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# ENHANCING ADAPTATION ACTION IN TURKEY PROJECT

TR2017 ESOP MI A3 04

## CLIMATE CHANGE ADAPTATION WORKS IN TURKEY

SEPTEMBER 2021



REPUBLIC OF TURKEY  
MINISTRY OF ENVIRONMENT  
AND URBANISATION



Environment and Climate Action  
Sector Operational Programme



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*This project is funded by the European Union and Republic of Turkey and implemented by the United Nations Development Programme. The beneficiary of the project is the Ministry of Environment and Urbanization. General Directorate of European Union and Foreign Relations is the Contracting Authority of this Project.*

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**Citation Information:** Enhancing Adaptation Action in Turkey, Climate Change Adaptation Works In Turkey [https://iklimeuyum.org/documents/Climate\\_Change\\_Adaptation\\_Works\\_In\\_Turkey.pdf](https://iklimeuyum.org/documents/Climate_Change_Adaptation_Works_In_Turkey.pdf)

United Nations Development Programme

Turkey



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### List of Abbreviations

English Full-Form	EN-abbr.	TR-ks.	Türkçe Açık Hali
European Union	EU	AB	Avrupa Birliği
Disaster and Emergency Management Agency	AFAD	AFAD	Afet ve Acil Durum Yönetimi Başkanlığı
French Development Agency	AFD	AFD	Fransız Kalkınma Ajansı
French Association for Disaster Prevention	AFPCN	AFPCN	Fransız Afet Riskini Azaltma Derneği
Land Use, Land Use Change and Forestry	LULUCF	AKAKDO	Arazi Kullanımı, Arazi Kullanım Değişikliği ve Ormancılık
Infrastructure Coordination Centre	AYKOME	AYKOME	Altyapı Koordinasyon Merkezi
Banking Regulation and Supervision Agency	BRSA	BDDK	Bankacılık Düzenleme ve Denetleme Kurulu
United Nations	UN	BM	Birleşmiş Milletler
United Nations Framework Convention on Climate Change	UNFCCC	BMİDÇS	Birleşmiş Milletler İklim Değişikliği Çerçeve Sözleşmesi
Information and Communication Technologies Authority	ICTA	BTK	Bilgi Teknolojileri ve İletişim Kurumu
General Directorate of Plant Production	BÜGEM	BÜGEM	Bitkisel Üretim Genel Müdürlüğü
Bosphorus University Lifelong Learning Centre	BÜYEM	BÜYÜM	Boğaziçi Üniversitesi Yaşam Boyu Eğitim Merkezi
C40 Cities Climate Leadership Group	C40	C40	Büyük Kentler İklim Liderlik Kurumu
Climate Action Network	CAN	CAN	Avrupa İklim Eylem Ağı
Geographic Information Systems	GIS	CBS	Coğrafi Bilgi Sistemleri
Cities Climate Finance Leadership Alliance	CCFLA	CCFLA	İklim Finansmanı Liderliği İttifakı
Carbon Disclosure Project	CDP	CDP	Karbon Saydamlık Projesi
Council of European Municipalities and Regions	CEMR	CEMR	Avrupa Belediyeler ve Bölgeler Konseyi
Cittaslow	Cittaslow	Cittaslow	Yavaş Şehirler
Covenant of Mayors	COM	COM	AB Belediye Başkanları Sözleşmesi
Conference of Parties	COP	COP	Taraflar Konferansı
Climate Policy Initiative	CPI	CPI	İklim Politikaları İnisiyatifi
Environmental Impact Assessment	EIA	ÇED	Çevresel Etki Değerlendirmesi
General Directorate of Combating Desertification and Erosion	GDCDE	ÇEMGM	Çölleşme ve Erozyonla Mücadele Genel Müdürlüğü
Ministry of Environment and Urbanization	MoEU	ÇŞB	Çevre ve Şehircilik Bakanlığı
Turkish Natural Catastrophe Insurance Pool	DASK	DASK	Doğal Afet Sigortaları Kurumu



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Foreign Economic Relations Board	DEİK	DEİK	Dış Ekonomik İlişkiler Kurulu
Nature Conservation Centre	DKM	DKM	Doğa Koruma Merkezi
General Directorate of Nature Conservation and National Parks	GDNCNP	DKMPM	Doğa Koruma ve Milli Parklar Genel Müdürlüğü
General Directorate of State Hydraulic Works	DSİ	DSİ	Devlet Su İşleri Genel Müdürlüğü
World Health Organization	WHO	DSÖ	Dünya Sağlık Örgütü
Third Generation Environmentalism	E3G	E3G	Üçüncü Nesil Çevrecilik (bir düşünce kuruluşu)
Ecosystem-Based Adaptation	EbA	EbA	Ekosistem Tabanlı Uyum
European Bank for Reconstruction and Development	EBRD	EBRD	Avrupa İmar ve Kalkınma Bankası
European Environment Agency	EEA	EEA	Avrupa Çevre Ajansı
European Energy Exchange	EEX	EEX	Avrupa Enerji Borsası
European Insurance and Occupational Pensions Authority	EIOPA	EIOPA	Avrupa Sigorta ve Mesleki Emeklilik Kurumu
Environmental Protection Agency	EPA	EPA	Çevre Koruma Ajansı
Ministry of Energy and Natural Resources	MoENR	ETKB	Enerji ve Tabii Kaynaklar Bakanlığı
European Union Emissions Trading System	EU ETS	EU ETS	Avrupa Birliği Emisyon Ticareti Sistemi
Food and Agriculture Organization of the United Nations	FAO	FAO	Birleşmiş Milletler Gıda ve Tarım Örgütü
International Network of Financial Centres for Sustainability	FC4S	FC4S	Uluslararası Sürdürülebilirlik için Finans Merkezleri Ağı
French Federation of Insurance Companies	FFSA	FFSA	Fransız Sigorta Birliği
Financial Stability Board	FSB	FSB	Finansal İstikrar Kurulu
German Insurance Association	GDV	GDV	Alman Sigorta Şirketleri Birliği-
Global Environment Facility	GEF	GEF	Küresel Çevre Fonu
Global Environment Facility Small Grants Programme	GEF/SGP	GEF/SGP	Küresel Çevre Fonu/Küçük Destek Programı
French Group of Mutual Insurance Companies	GEMA	GEMA	Fransız Mütüel Sigorta Şirketleri Birliği
G20 Green Finance Study Group	GFSG	GFSG	G20 Yeşil Finans Çalışma Grubu
German Corporation for International Cooperation	GIZ	GIZ	Alman Uluslararası İş Birliği Kurumu
Gross Domestic Product	GDP	GSYİH	Gayri Safi Yurtiçi Hasıla
Insurance Claim Monitoring and Surveillance Centre	HATMER	HATMER	Sigorta Hasar Takip Merkezi
Local Governments for Sustainability	ICLEI	ICLEI	Sürdürülebilir Kentler Birliği
International Cooperative and Mutual Insurance Federation	ICMIF	ICMIF	Uluslararası Kooperatif ve Karşılıklı Sigorta Federasyonu



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International Centre for Theoretical Physics	ICTP	ICTP	Uluslararası Teorik Fizik Merkezi
International Energy Agency	IEA	IEA	Uluslararası Enerji Ajansı
International Financing Institution	IFI	IFC	Uluslararası Finans Kuruluşu
International Federation of Pedestrians	IFP	IFP	Uluslararası Yaya Federasyonu
International Insurance Society	IIS	IIS	Uluslararası Sigorta Topluluğu
Intended Nationally Determined Contribution	INDC	INDC	Ulusal Katkı Niyet Beyanı
Instrument for Pre-Accession	IPA	IPA	Katılım Öncesi Yardım Aracı
Instrument for Pre-Accession Assistance for Rural Development	IPARD	IPARD	Kırsal Kalkınma Katılım Öncesi Yardım Aracı
Intergovernmental Panel on Climate Change	IPCC	IPCC	Hükümetlerarası İklim Değişikliği Paneli
Istanbul Policy Centre	IPM	IPM	İstanbul Politikalar Merkezi
International Platform on Sustainable Finance	IPSF	IPSF	Uluslararası Sürdürülebilir Finans Platformu
International Telecommunication Union - Telecommunication Development Sector	ITU-D	ITU-D	Uluslararası Telekomünikasyon Birliği – Telekomünikasyon Geliştirme Sektörü
International Union for Conservation of Nature	IUCN	IUCN	Uluslararası Doğa Koruma Birliği
Climate Change Action Plan	CCAP	İDEP	İklim Değişikliği Eylem Planı
National Climate Change Strategy	NCCS	İDES	Ulusal İklim Değişikliği Stratejisi
Climate Change and Air Management Coordination Board	CCAMCB	İDHYYK	İklim Değişikliği ve Hava Yönetimi Koordinasyon Kurulu
Global Balance Association	GBA	KDD	Küresel Denge Derneği
Integrated Urban Development Strategy and Action Plan	KENTGES	KENTGES	Bütünleşik Kentsel Gelişme Stratejisi ve Eylem Planı
Konya Plains Project	KPP	KOP	Konya Ovası Projesi
Local Government Management Agency	LGMA	LGMA	Yerel İdareler Yönetim Derneği
Marmara Urban Forum	MARUF	MARUF	Marmara Uluslararası Kent Forumu
Millennium Development Goals Fund	MDG-F	MDG-F	Binyıl Kalkınma Hedefleri Fonu
Ministry of National Education	MoNE	MEB	Millî Eğitim Bakanlığı
General Directorate of Meteorology	GDM	MGM	Meteoroloji Genel Müdürlüğü
Regulation on Making Spatial Plans	RMSP	MPYY	Mekânsal Planlar Yapım Yönetmeliği
Mobile Telecom Operators Association of Turkey	m-TOD	m-TOD	Mobil Telekomünikasyon Operatörleri Derneği
Network for Greening the Financial System	NGFS	NGFS	Finansal Sistemi Yeşillendirme Ağı



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Middle East Technical University	METU	ODTÜ	Orta Doğu Teknik Üniversitesi
Organization for Economic Co-operation and Development	OECD	OECD	Ekonomik İşbirliği ve Kalkınma Teşkilatı
General Directorate of Forestry	GDF	OGM	Orman Genel Müdürlüğü
Central Union of Forestry Cooperatives	ORKOOP	ORKOOP	Orman Kooperatifleri Merkez Birliği
Organized Industrial Zone	OIZ	OSB	Organize Sanayi Bölgesi
Common Agricultural Policy	CAP	OTP	Ortak Tarım Politikası
Specialized Commission	PSC	ÖİK	Özel İhtisas Komisyonu
Participant Vulnerability Analysis	PVA	PVA	Katılımcı Etkilenebilirlik Analizi
Official Gazette	OG	RG	Resmî Gazete
Health Insurance Information Centre	SAGME	SAGME	Sağlık Sigortası Bilgi Merkezi
Insurance Information Centre	IIC	SBM	Sigorta Bilgi Merkezi
Sustainable Banking Network	SBN	SBN	Sürdürülebilir Bankacılık Ağı
Subsidiary Body for Scientific and Technological Advice	SBSTA	SBSTA	Bilimsel ve Teknolojik Danışma Yardımcı Organı
Supervisory Control and Data Acquisition	SCADA	SCADA	Veri Tabanlı İzleme ve Kontrol Sistemi
Strategic Environmental Assessment	SEA	SÇD	Stratejik Çevresel Değerlendirme
Sustainable Development Solutions Network	SDSN	SDSN	Sürdürülebilir Çözümler Ağı
Sustainable Development Goals	SDG	SKA	Sürdürülebilir Kalkınma Amaçları
Business Council for Sustainable Development Turkey	BCSD	SKD	Türkiye Sürdürülebilir Kalkınma Derneği
Non-Governmental Organization	NGO	STK	Sivil Toplum Kuruluşu
General Directorate of Water Management	GDWM	SYGM	Su Yönetimi Genel Müdürlüğü
General Directorate of Agricultural Research and Policy	GDARP	TAGEM	Tarımsal Araştırmalar ve Politikalar Genel Müdürlüğü
Turkish Disaster Response Plan	TDRP	TAMP	Türkiye Afet Müdahale Planı
Agricultural Insurance Pool	TARSİM	TARSİM	Tarım Sigortaları Havuz Sistemi
Turkey's Disaster Management Strategy Document and Action Plan	TAYSB	TAYSB	Türkiye Afet Yönetimi Strateji Belgesi ve Eylem Planı
Banks Association of Turkey	BAT	TBB	Türkiye Bankalar Birliği
Grand National Assembly of Turkey	TGNA	TBMM	Türkiye Büyük Millet Meclisi
Turkish Competitive Telco Operators' Association	TELKODER	TELKODER	Serbest Telekomünikasyon İşletmecileri Derneği
Turkish Foundation for Combating Soil Erosion, for Reforestation and the Protection of Natural Habitats	TEMA	TEMA	Türkiye Erozyonla Mücadele, Ağaçlandırma ve Doğal Varlıkları Koruma Vakfı



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Clean Energy Foundation	CEF	TEMEV	Temiz Enerji Vakfı
Turkey Economic Policy Research Foundation (TEPAV)	TEPAV	TEPAV	Türkiye Ekonomi Politikaları Araştırma Vakfı
General Directorate of Agricultural Enterprises	TIGEM	TİGEM	Tarım İşletmeleri Genel Müdürlüğü
Agriculture and Rural Development Support Institute	ARDSI	TKDK	Tarım ve Kırsal Kalkınmayı Destekleme Kurumu
Turkish Union of Chambers of Engineers and Architects	TMMOB	TMMOB	Türk Mühendis ve Mimar Odaları Birliği
Ministry of Agriculture and Forestry	MoAF	TOB	Tarım ve Orman Bakanlığı
Union of Chambers and Commodity Exchanges of Turkey	TOBB	TOBB	Türkiye Odalar ve Borsalar Birliği
Housing Development Administration	TOKI	TOKİ	Toplu Konut İdaresi Başkanlığı
Traffic Insurance Information Centre	TRAMER	TRAMER	Trafik Sigortaları Bilgi Merkezi
General Directorate of Agricultural Reform	GDAR	TRGM	Tarım Reformu Genel Müdürlüğü
Insurance Association of Turkey	IAT	TSB	Türkiye Sigorta Birliği
Turkish Insurance Institute Foundation	TSEV	TSEV	Türk Sigorta Enstitüsü Vakfı
Industrial Development Bank of Turkey	TSKB	TSKB	Türkiye Sınai Kalkınma Bankası
Turkish Radio and Television Corporation	TRT	TRT	Türkiye Radyo ve Televizyon Kurumu
Turkish Enterprise and Business Confederation	TURKONFED	TURKONFED	Türk Girişim ve İş Dünyası Konfederasyonu
Scientific and Technological Research Council of Turkey	TUBITAK	TÜBİTAK	Türkiye Bilimsel ve Teknolojik Araştırma Kurumu
Turkish Marine Research Foundation	TMRF	TÜDAV	Türk Deniz Araştırmaları Vakfı
Turkish Statistical Institute	TURKSTAT	TÜİK	Türkiye İstatistik Kurumu
Health Institutes of Turkey	TUSEB	TÜSEB	Türkiye Sağlık Enstitüleri Başkanlığı
Turkish Industry and Business Association	TUSIAD	TÜSİAD	Türk Sanayicileri ve İş İnsanları Derneği
Ministry of Transport and Infrastructure	MoTI	UAB	Ulaştırma ve Altyapı Bakanlığı
United Cities and Local Governments	UCLG	UCLG	Birleşmiş Kentler ve Yerel Yönetimler Örgütü
National Rural Development Strategy	NRDS	UKKS	Ulusal Kırsal Kalkınma Stratejisi
Centre of Transportation Coordination	UKOME	UKOME	Ulaşım Koordinasyon Merkezi



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United Nations	UN	UN	Birleşmiş Milletler
United Nations Development Programme	UNDP	UNDP	Birleşmiş Milletler Kalkınma Programı
United Nations Environment Programme	UNEP	UNEP	Birleşmiş Milletler Çevre Programı
United Nations Environment Programme Finance Initiative	UNEP FI	UNEP FI	Birleşmiş Milletler Çevre Programı Finans Girişimi
United Nations Children's Fund	UNICEF	UNICEF	Birleşmiş Milletler Çocuklara Yardım Fonu
World Health Organization	WHO	WHO	Dünya Sağlık Örgütü
World Mayors Council on Climate Change	WMCCC	WMCCC	Belediye Başkanları İklim Değişikliği Konseyi
World Wildlife Fund	WWF	WWF	Dünya Doğal Hayatı Koruma Vakfı





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### List of Annexes

<b>Annex-1</b>	Multi-Parameter Analysis
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### EXECUTIVE SUMMARY

Since the latter half of the 20<sup>th</sup> century, climate change has been on the agenda as one of the most important problems faced by the world. Although measures are being implemented to reduce greenhouse gas emissions caused by the use of fossil fuels, which are the main cause of global warming, it has been scientifically proven that the impacts of climate change will continue to increase in the upcoming years. The adverse impacts of climate change have come further to the forefront with meteorological disasters occurring throughout the world. The sectoral, social and economic costs of such impacts that are already felt, and will be felt even strongly in the future, are increasing exponentially.

It is already observed that the extreme weather events, which are expected to increase as a result of climate change, have started to affect all natural processes as well as wildlife and human life by altering the hydrological cycle of the planet. Increasing temperatures are predicted to cause increased and more frequent precipitation and flooding in some regions, or reduced precipitation and drought in others. In either case, agricultural lands and products will go through changes, the water problem will exacerbate, trade balances will shift, affecting the global economy. Increasing natural events and disasters such as storms, hurricanes and cyclones in addition to the potable water problem, degraded ecosystems and rising sea levels will accelerate migration, introducing the issue of sharing natural resources to the agenda.

Climate change has become unavoidable and requires complementary policies and actions for emission reduction to ensure adaptation to its impacts, which clearly demonstrates that adapting to climate change is as important as reducing emissions. Indeed, activities for adapting to climate change have been increasing across the world day by day, as adaptation policies gain equal value as emission reduction policies under international agreements (Paris Agreement, Article 7) that have been renewed. Currently, as the impact of climate change becomes even more intense, the argument stands more forcefully out that global and national policies must pursue a balance between adaptation and mitigation policies, and such balance will be more effective through *bottom-up* approaches. As adaptation needs vary by local, regional and national circumstances, climate change adaptation has a strong link with local dynamics.

Adaptation may be described as the process of enhancing and implementing strategies and policies to combat and manage the impacts of climate change risks. Adaptation is the ability to keep up with the changing climate, and mitigating the adverse impacts of climate change while turning them into opportunities as necessary. Adapting is a continuous and dynamic process that can steer the decision-making processes in various sectors (agriculture, food, fishing, water, healthcare, tourism, disaster, insurance, infrastructure, ecosystem, energy, finance, urbanization, transportation, migration, etc.) in conjunction. As adaptation involves the integration of options, needs and measures at various management levels (national/local/regional), it requires continuous cooperation and coordination among all relevant stakeholders. From this perspective, successful adaptation policies are directly related to the development models of countries. Development models that neglect important sectors and areas such as urbanization, disaster, agriculture, tourism, ecosystems and water resources management, that are exposed to the impacts of climate change may lead to significant restrictions and bottlenecks in terms of climate change adaptation. In this context, development refers to carrying out economic, ecological and social development efforts in conjunction under the guidance of climate change adaptation policies.

The impacts of climate change have already started to be observed in **Turkey** with the increasing climate-related disasters such as increasing annual average temperatures, countrywide precipitation and seasonal changes, drought, heatwaves, floods, landslides, storms and forest fires.



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Many important sectors (agriculture, tourism, healthcare, finance, infrastructure, insurance, energy, transportation, industry, etc.) with climate-sensitive economies in Turkey prioritize emission reduction activities in their climate change response efforts. In addition to the increasing number of scientific studies related to determining the impacts of climate change, the need persists for impact analyses, vulnerability and risk calculations, climate modelling studies and human and financial resources at all levels (national/regional/local).

This Report was prepared under the “Enhancing Adaptation Action in Turkey Project” implemented by the Ministry of Environment and Urbanization through the United Nations Development Programme (UNDP) and co-financed by the European Union (EU) and Republic of Turkey. Serving as a comprehensive compilation of the efforts and studies on climate change adaptation in Turkey that have to date been undertaken by all relevant stakeholders, the Report analyses national key policies, including Turkey’s international obligations in this regard, and climate change adaptation efforts, some of which are highlighted as *good practices* to serve as a reference for future works. The report consists of three main parts.

Part One primarily analyses the legal framework, i.e. by and in compliance with which laws, and the institutional framework, i.e. which institutions exist and/or are involved, within which the adaptation activities are undertaken to strengthen capacities for climate risk management and make decision-making mechanisms more effective in adaptation action in Turkey. It reviews the primary and secondary legislation that supports or restricts the adaptation to climate change, and examines the powers and tasks, which are directly or indirectly related to climate change adaptation, of various ministries, and high-level committees and institutions at the central level within the institution building. It examines national development policy options in line with climate change adaptation and analyses the functionality of current climate change adaptation strategies. High-level political ownership items were examined separately and included in the report, by taking into account the policies that will require radical solutions with respect to climate change adaptation. As part of climate change adaptation, governance mechanisms are evaluated to identify the roles of local governments, scientific community, business community and civil society actors, and particularly the central government, in developing policies that focus on climate change adaptation in Turkey. The report particularly covers, in that context, scientific studies that include impact and vulnerability analyses, strategic plans in various sectoral areas, climate change adaptation projects within the frame of public services and particularly where municipal services intersect, awareness raising and capacity development activities, projects and works that respond to the mitigation and adaptation synergy.

Part Two describes the scientific research undertaken to determine the impacts of climate change in Turkey, detailing the institutions by which the scientific findings of such research and climate change projections are provided. This part, which contains evaluations on the qualifications of the research, refers to regional climate projections produced under various projects, and fields of application. It includes evaluations underlining the need to further support existing projects with scientific findings that demonstrate climate change risks and vulnerabilities. The evaluations clearly establish the significance of scientific observation, research and data for climate change adaptation, indicating that data production, collection, management and analysis studies are required for evidence-based decision-making for identifying vulnerabilities.

Part Three discusses the role of climate change adaptation in sectoral policies, covering 14 climate-dependent sectors with climate-sensitive economies namely agriculture, energy, cities, water resources, nature conservation, disaster risk management, finance, insurance, industry, healthcare, transportation, tourism, communication, and education. The subsections of each sector are analysed separately. For example, the infrastructure sector is addressed as a prominent subject for cities’ adaptation to climate change. The impacts of climate change in each sector are examined and policies,



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inclusive legislation, institution building, and strategic planning trends are analysed as supporting instruments for decision-making and application for adapting to such changes. Further analysed are the scientific basis required for vulnerability and risk analyses, existing sources used for financing adaptation as well as the gaps and barriers emerging in this framework.

The climate change vulnerability state of each sector is first established by primarily evaluating the global current situation regarding the sector, and the sectoral states are compared by examining the international and national policies, practices, experiences and certain applications that may be efficient for Turkey. Climate change impact assessments and climate change adaptation measures that are directly or indirectly addressed specifically for each sector are examined in terms of policies and practices. For example, answers are sought to questions such as 'Was the sector defined as a priority sector in the National Climate Change Adaptation Strategy and Action Plan? Was climate change adaptation clearly defined in healthcare sector strategies? Does the healthcare sector have a separate strategy for adapting to the impacts of climate change? Have impact, vulnerability and risk analyses been conducted specifically for the healthcare sector? If so, at which levels (national, regional, local)? Are there any direct adaptation measures specific to the subsections (e.g. relationship with infectious diseases) of the healthcare sector? If so, at which levels? Are current practices sustainable and resource efficient?'. Additionally, existing studies that demonstrate the areas in which the relevant stakeholders are more active in each sector as well as the cooperation and coordination relationships among stakeholders are presented in detail, creating an opportunity to assess the cross-sectoral integrated impacts in the present situation.

This part also sets forth the progress made by the central governments - particularly ministries - in charge of each sector in adapting to the impacts of climate change on a policy and practice basis. According to the report, it is projected that the key findings determined for the adaptation needs of each sector will support and guide the decision-making processes. In this part, the integration of existing key policies for climate change adaptation on a sectoral basis is analysed in terms of creating synergies. For example, the issue of combining the rural development policies and climate change adaptation policies of Turkey, which has complementary and cross-cutting strategic plans, is brought to the attention of decision makers by presenting international assessments as well. Although the current efforts of the sectors do not directly target climate change adaptation, various projects were basically implemented under the adaptation options providing a basis for enhancing adaptation action in Turkey. For example, some sectors (particularly the agriculture sector and water resources management) serve climate change adaptation through direct or indirect objectives which they set within the framework of their own policies.



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### 1. TURKEY'S CLIMATE CHANGE ADAPTATION POLICY

Even if all activities in the world that cause greenhouse gas emissions were instantly stopped, climate change will continue its effects for many more years, which is a determination that has been clearly concluded by the scientific community. This situation that causes and will continue to cause changes to all components of the climate system clearly demonstrates the importance of adapting to impacts. It is now inevitable that the temperatures that are expected to increase as a result of climate change will impact natural processes, ecosystems and life itself, changing life on earth for the worse.

It is predicted that increasing temperatures will cause heavier sudden precipitations or more frequent flooding in some regions, or reduced precipitation or changing precipitation regimes. In either case, agricultural lands and products will be changed, the water problem will grow, trade balances will shift which will impact all economies. Increased extreme meteorological events such as storms and hurricanes along with a potable water problem, damaged ecosystem and rising sea levels will accelerate migration, once again bringing into question the issue of fair sharing of natural resources. It is already apparent that many urban infrastructures have fallen short following the meteorological and hydrological events caused by climate change.

Adaptation activities in climate change response have started to become progressively important all over the world. With the Paris Agreement, adaptation policies have become as equally important as emission mitigation policies. In addition to governments' greenhouse gas emission mitigation goals, the adaptation policies which they must implement has also secured its position in the new global climate regime. Adaptation to climate change as well as its political, economic, commercial, social, vital, sociological, and cultural impacts emerges as a social problem with which all individuals and communities are closely concerned.

Climate change adaptation may be explained as the process of enhancing and implementing relevant strategies and policies in order to respond to and manage the impacts of climate change. Keeping up with the changing climate comes to mean mitigating the unfavourable impacts of climate change as well as turning such impacts into opportunities when required.

Adaptation is a dynamic process that implies guiding multiple stages of decision-making hand in hand. The process involves the integration of needs, options, costs, and risks at different managerial scales (national/local/regional) and different time spans by decision makers, which is why comprehensive and coordinated strategic approaches are required.

Climate change adaptation is one of the fundamental purposes of the regime established by the United Nations Framework Convention on Climate Change (UNFCCC). One of the most important innovations introduced by the Paris Agreement to climate regime involves strengthening the place of climate adaptation among policy priorities.



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### 1.1. International Obligations

- Turkey continues to meet its global and global-regional obligations concerning climate change adaptation within the meaning of the international conventions to which it is a party.
- The climate change adaptation policies of Turkey are developed in consideration of its obligations under the United Nations Framework Convention on Climate Change to which it is a party.

In terms of international obligations, Turkey continues to fulfil its international commitments as a party to the UNFCCC (2004) and the Kyoto Protocol (2009) and a signatory of the Paris Agreement (2016). In this framework, the current situation concerning strategies, policies and managerial means of implementation which also involve climate change adaptation are communicated to the UNFCCC Secretariat through National Communications, National Greenhouse Gas Inventory Reports and Biennial Reports.

At present, Turkey's Seventh National Communication on Climate Change has been submitted to the UNFCCC Secretariat as of 2018 and the preparations for the Eighth National Communication have been ongoing in coordination with the Ministry of Environment and Urbanization.

Turkey has submitted an "Intended Nationally Determined Contributions" (INDC) to the UNFCCC Secretariat as of September 2015<sup>1</sup>. The INDCs<sup>2</sup> presented before the acceptance of the Paris Agreement include all UNFCCC Parties'<sup>3</sup> policies and concrete (quantitative) goals concerning reducing greenhouse gas emissions which are supportive of the new climate regime and adapting to the impacts of climate change.

When closely examined, the INDCs of UNFCCC Parties involve not only quantified greenhouse gas emission reduction goals, but also concrete goals (adaptation planning against the impacts of climate change, policies for losses and damages, transitioning to climate-friendly technologies, financial policies, etc.) in prominent areas within the scope of the new global climate regime.

The current strategies that support national climate change policy in Turkey's INDC document do not include a "National Climate Change Adaptation Strategy and Action Plan". The sectors mentioned in the Communication that may be indirectly associated with adaptation are agriculture and forestry. The policies specified in the INDC for these sectors are directly cited below:

#### "Agriculture:

- *Fuel savings by land consolidation in agricultural areas*
- *Rehabilitation of grazing lands*
- *Controlling the use of fertilizers and implementing modern agricultural practices*
- *Supporting the minimum tillage methods*

#### Forestry:

- *Increasing sink areas and preventing land degradation*
- *Implementing Action Plan on Forestry Rehabilitation and National Afforestation Campaign*

UNFCCC Parties are obliged to prepare Biennial Reports containing data and managerial information on sink areas which cross-cut the greenhouse gas reductions of the UNFCCC signatory developed

<sup>1</sup> [Intended Nationally Determined Contribution of the Republic of Turkey](#), 30 September 2015.

<sup>2</sup> This term has been revised in the Paris Agreement as "Nationally Determined Contributions/NDCs" (Article 4, Paragraph 2).

<sup>3</sup> Party: State Parties to the United Nations Framework Convention on Climate Change and the EU.



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countries listed in ANNEX 1 and mitigation and adaptation. Turkey's First, Second and Third Biennial Reports were presented to the UNFCCC Secretariat at certain time periods; work for the Fourth Biennial Report is underway.

Nevertheless, a range of international and international/regional treaties to which Turkey is a party are directly and indirectly related to climate change adaptation. Today, the implementation of international treaties on nature conservation is considered in conjunction with the elements of climate change response; empowering changes are also taken on climate change response at the international level within the framework of such agreements. Such treaties to which Turkey is a party are the United Nations Convention to Combat Desertification, United Nations Convention on Biological Diversity, Convention on Wetlands of International Importance especially as Waterfowl Habitat, Convention on the Protection of the Black Sea against Pollution (Bucharest Convention), European Landscape Convention (Florence Convention), Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention), and Antarctic Treaty - Protocol on Environmental Protection to the Antarctic Treaty.

International agreements of which Turkey is a signatory that directly and indirectly concern climate change constitute the necessary legislative infrastructure under the domestic law. As required by the international treaties on climate change to which Turkey is a party, Turkish legislation is being developed by taking climate change response into consideration in its social, economic and environmental policies while new regulations are also on the agenda.

Furthermore, having the status of a candidate country to the European Union since 1999, Turkey has been involved in intensive efforts for a long time in order to adapt to EU climate change response policies under its international/regional obligations, renewing its legislative and institutional set-ups and developing its policies in this framework.





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### 1.2. Legal and institutional framework

- There are no legal codes in Turkey that address the issue of climate change as a whole.
- The effective legislation in sectoral areas contain numerous provisions that support climate change adaptation.
- In the institutional building of central government in Turkey, climate change adaptation is among the duties and powers of many public agencies.
- The relevant policy boards of the Presidency of the Republic of Turkey can take on a more active role in the coordination and implementation of climate change adaptation policies.
- Effective cooperation and coordination are required among the internal service units of relevant public agencies, in particular the Ministry of Environment and Urbanization, with regard to the determination and implementation of policies related to climate change adaptation.
- In the institutional building of the central government, there are many senior boards under the responsibility of the ministries relevant to climate change adaptation.
- Failure to adapt to climate change will bring along economic risks.
- The existing policy instruments (legislation, institution, planning) for the climate change adaptation action in Turkey are adequately strong but require improvement on some points.
- There is a strong connection between climate change adaptation, and social development and social rights.
- One of the most important problems is failure to establish a cooperative working dynamic among all relevant stakeholders of the climate change adaptation action.

In the national legislation, the subject of climate change is not regulated as a whole under a single legal code. In close examination, the relevant legislation and institutional regulations address climate change either considerably directly or indirectly. From the point of view of climate change adaptation, the primary legislation containing direct provisions is the Environmental Law and the Law on Soil Conservation and Land Use.<sup>4</sup> While the Energy Efficiency Law and the Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy directly address climate change, they contain provisions on emission reduction and indirectly refer to climate change adaptation. On the other hand, numerous laws concerning various sectoral areas that are in effect contain direct and indirect provisions supporting adaptation to climate change.<sup>5</sup>

In terms of organic laws, the term climate change is directly referenced in the provisions that regulate the duties and powers of the Ministry of Environment and Urbanization, Ministry of Agriculture and Forestry, Ministry of Industry and Technology, Ministry of Transport and Infrastructure, General Directorate of Meteorology, and Disaster and Emergency Management Agency.<sup>6</sup>

Beyond ensuring that the issue of climate change is considered as a fundamental policy, climate legislation, whether enacted under a single legal code or various laws, is only meaningful to the extent that it contains concrete goals and determined processes, defined roles and responsibilities, applicable and flexible mechanisms (Kocaman and Talu, 2019). If climate change response is subjected to the enactment of a legal code in Turkey - for which efforts are underway - the basis of the law must address mitigation and adaptation with equal weight. Regulating the principles, activities and goals related to mitigation and adaptation policies under a single legal code can stabilize and enhance implementation

<sup>4</sup> Details on the law are further addressed in the “Adaptation of the Agriculture Sector to Climate Change” part of the report.

<sup>5</sup> The extent to which the legislation for each sectoral/thematic field contributes to or restricts climate change adaptation is addressed in the relevant part of the report.

<sup>6</sup> Presidential Decree No. 1 provisions regulating the organization and duties of the Ministry of Environment and Urbanization, Ministry of Agriculture and Forestry, Ministry of Industry and Technology, and Ministry of Transport and Infrastructure and Presidential Decree No. 4 provisions regulating the organization and duties of the General Directorate of Meteorology.





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in climate change response in terms of bindingness and determination. Putting together the issue of climate change systematically under a single code can lead to considering climate change as an independent area that must be strategically considered and paid attention to in public policies, rather than being regarded as an issue among environmental problems. However, the priority must be the operability of the available legislation that provides a basis for adapting to climate change. There will be an increased conflict of powers in the event of failure to resolve the bottlenecks encountered in the current practices of many public entities whose fields of activity (sectoral and/or thematic fields) concern climate change adaptation.

In terms of legislative gaps, restrictions and problems; some laws and regulations may increase greenhouse gas emissions, reduce sink areas and/or inconvenience climate change adaptation. It is important to concentrate supportive and incentive instruments towards policies and practices/investments for climate change adaptation, particularly in the legislation involving financial matters and the regulations for various sectors. Under climate change adaptation, regulations must be formulated to eliminate the suffering particularly caused by meteorological disasters that are induced by climate change. The climate adaptation needs of the tourism, transport, infrastructure, energy, industry, health, insurance, and construction sectors must be addressed in the legislation, as well.

*Environmental Law and Climate Change Adaptation-* Environmental Law No. 2872 of 09/08/1983 aims to protect the environment in line with the principles for a sustainable environment and sustainable development. Climate change awareness is apparent when examining the minutes of General Assembly discussions for the Law No. 5491 of 26/04/2006 making comprehensive amendments to the Law. Furthermore, the amendment brought by the Law No. 7153 of 29/11/2018 and went into force upon its publication in the Official Gazette (OG) of 10/12/2018 contained assessments concerning the causes and results and impacts of climate change, which were captured in the TGNA minutes during the draft bill discussions. While the Law does not regulate the subject of climate change, the terms 'climate change' and 'carbon trading' are mentioned in the text. Article 3 of the Law lists general principles on environmental protection and improvement and prevention of pollution. Those among the principles that stand out in the context of climate change are as follows:

- The sustainable development principle shall be observed in terms of land and resource utilization
- Benefits of the economic activities to be undertaken and their impacts on natural resources shall be evaluated on a long-term basis within the frame of sustainable development principle
- It is obliged to use environment-friendly technologies reducing waste formation at its source and ensuring recycling of wastes in order for natural resources and energy to be used effectively in all kinds of activities
- For environmental protection and preventing and eliminating the environmental pollution; mandatory standards and taxes, charges, share, incentives of renewable energy resources and clean technologies, collecting emission fee and pollution compensation, market-specific mechanisms like carbon trading and economic instruments shall be used.

With the amendment introduced by Law No. 7153, reducing the use of plastic bags and packaging, implementing a depository scheme, recycling contribution fees, and receiving security for pollution prevention were included among the market-specific mechanisms and economic instruments to be used.

Article 9 "Environmental protection" provides that, in line with the sustainable development principle and with the aim of preventing the environmental pollution that may occur as a result of the satisfaction of the needs of urban and rural populations including residential, working and resting needs, environment plans in the country's physical space shall be prepared on regional and water basin



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basis to constitute a basis for master and implementation plans. These provisions are important for the spatial planning aspect of climate change adaptation.

Article 18 “Collection of environmental contribution, other revenues and budget funds” lists efforts to fight against desertification and climate change among the efforts for which a fund will be stipulated under the Ministerial Budget.

With the amendment introduced by Law No. 7153, it has been finalized by the provision added to Article 24 regarding authority in administrative fines that those who destroy biological diversity and violate the principles and procedures for conservation and use of wetlands shall be subjected to an administrative sanction by the Ministry of Agriculture and Forestry.

Another amendment introduced to the Environmental Law that is important in terms of climate change adaptation stipulates that: “Supplementary Article 1; the procedures and principles about the protection of soil, elimination and prevention of pollution are determined by the legislation; burning stubble, the demolition of meadows and fields and any activity that causes erosion are forbidden”.

Some of the regulations which were considered to have an important place in policy planning for climate change adaptation, prominent on the basis of the Environmental Law, and the enforcement for which the Ministry of Environment and Urbanization is responsible may be listed as follows: Regulation on the Implementation of the Environmental Protection Protocol in Antarctica<sup>7</sup>, Regulation on Conservation of Wetlands<sup>8</sup>, Regulation on Making Spatial Plans<sup>9</sup>, and Strategic Environmental Assessment (SEA) Regulation<sup>10</sup>.

*Policy Planning Instrument for Climate Adaptation: Strategic Environmental Assessment-* The implementation of such an important instrument in planning processes as the Strategic Environmental Assessment instrument was introduced in Turkey in accordance with the harmonization efforts for the EU Strategic Environmental Assessment (SEA) Directive (2001/42/EC). The main objective of the Strategic Environmental Assessment Regulation issued by the Ministry of Environment and Urbanization in 2017 is; “to regulate administrative and technical principles and procedures for the process of Environmental Impact Assessment implemented for the integration of environmental considerations into the preparation and approval of plans and programmes that are expected to have significant environmental impacts, in line with the sustainable development principle to ensure environmental protection”.

The planning processes and the strategic environmental assessment process for almost all sectors throughout the country are implemented concurrently. Accordingly, the plans (strategies, development programmes, management plans, regional plans, master plans, action plans, spatial plans, etc.) in preparation have begun to take the SEA scope into consideration.

In line with the scope of the SEA Regulation; it is essential to conduct, cause to conduct, and monitor a Strategic Environmental Assessment for the plans and programmes that constitute the policy frameworks of the waste management, fishery, energy, coastal management, spatial planning, coastal planning, rural development, regional development, energy, forestry, industry, waste management, water management, agriculture, telecommunications, culture and tourism, and transportation sectors in Turkey.

The need to include climate change adaptation policies in the strategies of almost each of the sectors and internalize impact adaptation factors to cross-cut the national sustainable development policies

<sup>7</sup> OG of 13.06.2020 issue 31154.

<sup>8</sup> OG of 04.04.2014 issue 28962.

<sup>9</sup> OG of 14.06.2014 issue 29030.

<sup>10</sup> OG of 08.05. 2017 issue 30032.



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(environmental/social/economic) renders the role of SEA in climate change adaptation particularly important.

The list of sectoral plans/programmes are defined in the Strategic Environmental Assessment Regulation and a “Strategic Environmental Assessment Report” must be prepared in the scope of all projects in the relevant areas.

The list of the plans and programmes to be implemented in strategic environmental assessment is provided in Table 1.

Table 1. List of Plans/Programmes to be Implemented in Strategic Environmental Assessment<sup>11</sup>

<b>List of Plans/Programmes to be Implemented in Strategic Environmental Assessment</b>	
Regional Development Administration Action Plans	National Basin Management Strategy
Regional Plans	Transport Master Plans
Integrated Coastal Zone Plans	Transportation and Communication Strategy
Environmental Plans	Tourism Strategy of Turkey
Planning Activities in Energy Sector	Industrial Strategy of Turkey
Basin-based Waste Management Plans	Tourism Coastal Structures Master Plan
Basin-based Wastewater Treatment Action Plans	Agricultural Master Plans
Basin Drought Management Plans	Operational Programmes
Basin Master Plans	River Basin Management Plans
Basin Flood Management Plans	Spatial Strategy Plans
Rural Development Programmes	Physical Plans in Culture and Tourism Conservation and Development Areas and Tourism Centres <sup>12</sup>
Basin Protection Action Plans <sup>13</sup>	

One of the criteria stipulated for consideration in the initial evaluations on the priority subjects to be included in the Strategic Environment Assessment scope determination report is that the strategy/plan, etc. that is addressed must also meet *sustainability* goals.<sup>14</sup> While it is not directly mentioned, this requirement is among the criteria sought for climate change adaptation. It is well known that the sustainable development goals cannot be achieved without paying sufficient attention to the climate crisis.

The Regulation also includes climate factors that are required to be in the SEA Report. The relevant provision is as follows: *...The likely significant effects as well as social and economic effects (which should include secondary, cumulative, synergistic, short, medium and long-term permanent and temporary, positive and negative effects) of the programme on biodiversity, population, human health,*

<sup>11</sup> SEA Regulation Annex-1 List.

<sup>12</sup> Plans of scale 1/100,000 and 1/50,000.

<sup>13</sup> Renewed as River Basin Management Plans.

<sup>14</sup> SEA Regulation, Information Required in the Scope Determination Report, Annex-3 List, Article 5.



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*fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage (including architectural and archaeological heritage), landscape and the interrelationship between the above factors”.*<sup>15</sup>

Another important point concerning the adaptation efforts of SEA in climate change adaptation in Turkey is that such assessments shall be conducted by taking *sensitive areas* into consideration. The requirement for this matter to comply with the legislation which must be referred to during the strategic/planning/programmatic works under the SEA Regulation is guided by the list of legislations in Annex-5 of the Regulation. Below is the legislation in force concerning the sensitive areas which must be protected in Turkey, directly cited from the Regulation:<sup>16</sup>

“1. Areas for which preservation is required in accordance with the national legislation:”<sup>17</sup>

- a) *“National Parks”, “Natural Parks”, “Natural Monuments” and “Natural Preservation Areas” which are determined pursuant to Article 3 of the National Parks Law No. 2873 of 9/8/1983,*
- b) *“Wildlife Preservation Zones, Wildlife Improvement Areas and Wild Animal Settlement Areas” which are determined by the Ministry of Environment and Forestry pursuant to Law No. 4915 of 1/7/2003 on Land Hunting,*
- c) *The areas which have been described as “Cultural Assets, “Natural Assets”, “Archaeological, Historical Sites” and “Preservation Areas” in sub-clauses 1, 2, 3 and 5 of paragraph (a) of the first clause of Article 3 of Law No. 2863 of 21/7/1983 on Cultural and Natural Heritage Conservation and which have been identified and registered pursuant to the related articles of the same Law,*
- ç) *Aquaculture Production and Breeding Areas within the scope of Law No. 1380 of 22/3/1971 on Aquaculture Products,*
- d) *The areas defined in Articles 17, 18, 19 and 20 of the By-law on Water Pollution Control published in the Official Gazette of 31/12/2004 issue 25687,*
- e) *Groundwater protection areas declared by the provisions of Law No. 167 of 16/12/1960 on Groundwaters and the Bylaw on the Protection of Groundwater Against Pollution and Deterioration published in the Official Gazette of 7/4/2012 issue 28257,*
- f) *The areas defined in the By-law on Ambient Air Quality Assessment and Management published in the Official Gazette of 6/6/2008 issue 26898,*
- g) *The areas specified and declared as “Special Environment Preservation Areas” by the Council of Ministers pursuant to Article 9 of Law No. 2872,*
- ğ) *The areas that are under protection in accordance with Law No. 2960 of 18/11/1983 on the Bosphorus,*
- h) *The areas considered as forests in accordance with Law No. 6831 of 31/8/1956 on Forestry,*
- ı) *The areas on which construction ban is imposed pursuant to the Law No. 3621 of 4/4/1990 on Coastal Protection,*
- i) *The areas specified in Law No. 3573 of 26/1/1939 on Amelioration of Olive Production and Grafting of Wild Olive Trees,*
- j) *The areas specified in Law No. 4342 of 25/2/1998 on Pastures,*

<sup>15</sup> SEA Regulation, Information Required in the SEA Report, Annex-4 List, Article 6.

<sup>16</sup> SEA Regulation, Sensitive Areas, Annex-5 List, paragraph 1-2.

<sup>17</sup> Any legislative changes shall constitute an integral part of the List in Annex-5.



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k) The areas specified in the Regulation on Preservation of Wetlands enforced upon its publication in the Official Gazette of 4/4/2014 issue 28962.

l) Protection of the agricultural lands with potential for agricultural production under the Law No. 5403 of 3/7/2005 on Soil Conservation and Land Use and the Law No. 3083 of 22/11/1984 on Land Reform Regarding Rearrangement of Land in Irrigated Areas.

### 2. Areas protected pursuant to international conventions to which our country is a party

a) Class I and II Conservation Areas specified in “Major Breeding Areas of Sea Turtles” which have been taken under protection pursuant to “Convention on the Conservation of European Wildlife and Natural Habitats” (BERN Convention), “Mediterranean Seal Habitat and Breeding Areas”,

b) The areas which have been taken under protection pursuant to “Convention for the Protection of the Mediterranean Sea Against Pollution” (Barcelona Convention)”,

1) The areas which have been determined as “Special Protection Area” in our country pursuant to the “Protocol on the Protection of Special Protection Areas in the Mediterranean”,

c) Cultural, natural and historical areas defined as the “Cultural Heritage” and “Natural Heritage” and taken under protection by the Ministry of Culture and Tourism pursuant to Articles 1 and 2 of the “Convention on the Protection of World Cultural and Natural Heritage”,

ç) The areas under protection pursuant to the “Convention on Wetlands of International Importance especially as Waterfowl Habitat” (RAMSAR Convention).

d) “European Landscape Convention”.

With reference to the fact that the areas which should be protected in Turkey listed in Annex-5 of the SEA Regulation are subject to the SEA, these areas are directly cited below:<sup>18</sup>

### “3. Areas which should be protected

a) Areas which have been determined in the Approved Environmental Plans as areas whose existing characteristics shall be protected and for which a building ban is applied (Areas Whose Natural Characteristics are Subject to Protection, Areas Whose Ecological Nature is Subject to Protection, and similar)

b) Agricultural Areas: The lands, of which the soil, topographic and climatic characteristics are appropriate for agricultural production, where agricultural production already takes place and which are suitable for agricultural production or which can be made suitable for agricultural production through land development, rehabilitation, reformation,

c) Wetlands: Areas which are natural or artificial, continuous or temporary, with stagnant or flowing water, fresh, brackish or salty water, with depths up to six meters in the tide recession period, having importance as a wetland habitat for living creatures especially for waterbirds, marsh, reed and turbary areas, and ecological wetlands from the shoreline to the land side of these areas,

ç) Lakes, rivers, and groundwater operation areas,

d) Habitat areas of species which are important for scientific research and/or endangered or might become endangered, or having endemic importance for our country; wetlands, mountains, marine and coastal ecosystems having important functions in the preservation of the natural state of their assets, which are likely to become exposed to hazards and which possess ecosystem integrity or provide a natural link between ecosystems; landscape protection areas, micro-climatic areas, ecosystems and caves; biosphere reserves, areas containing any one or more of sensitive regions

<sup>18</sup> SEA Regulation, Sensitive Areas, Annex-5 List, paragraph 3.





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*such as biotopes, bio-genetic reserve areas; and areas with unique geological and geomorphological formations.*

Almost all of the aforementioned areas subject to protection must be taken into consideration in ecosystem-based climate change adaptation work.

From an **institutional building** point of view, climate list is included in the roles and responsibilities of numerous ministries and affiliated entities. The multidimensional and multisectoral nature of climate change imputes roles and responsibilities to several ministries and various public entities in the activities to reduce emissions as well as in the area of impact adaptation.

The policy boards established outside of traditional ministries and public bodies stand out in the state government which was reorganized after transitioning to the **Turkish Presidential** system. As is known, Turkey has transitioned from a parliamentary regime to a Presidential one as of 2018. When taking a look at the powers and duties and functioning of the policy boards that were established within the frame of such a shift which brought along quite a radical change, it would not be wrong to say assert that such organizations have become important actors in public policymaking in Turkey. The boards working directly with the President were granted important powers and duties in the making of policies and strategies concerning their respective remits. The boards are chaired by the President, who appointed the board members. The responsibilities of numerous coordination and advisory committees within the body of ministries or other public institutions were transferred to Presidential policy boards. From this point of view, the related Presidential policy boards may be considered the address of the political will that is needed for climate change response policies to be executed with more effective coordination, as is the case in many areas.

While there are not any boards directly related to climate change among the policy boards, the Board of Local Government Policies<sup>19</sup> addresses urban resilience in responding to climate change. This higher board has/will have an important role in determining the policies which will be followed by ministries and provincial bodies, civil administrations and municipalities, and has a leading, fostering, and supervisory position in implementation.<sup>20</sup> Additionally, it may also be required for the Presidential Policy Boards of Health and Nutrition, Economy Policies, Social Policies, Security and Foreign Policies, and Science, Technology and Innovation to address policies that are relevant to climate change adaptation policies.

With its institutional legal entity, the **Ministry of Environment and Urbanization** is the “National Focal Point” to the UNFCCC Secretariat at the international level. Being directly responsible for national climate change response, the Ministry is in charge of national coordination on matters related to climate change. The climate change-related tasks of the Ministry of Environment and Urbanization were regulated in 2018 under Article 97 of the Presidential Decree No. 1; according to subparagraph (b) of Article 97, “...to undertake works and processes related to climate change” and subparagraph (l) “...to determine plans and policies for global climate change and taking measures related to this” are among the tasks of the Ministry. Almost all ministerial main service units have duties and powers related to climate change adaptation.

The General Directorate of Environment Management of the Ministry was directly tasked with climate change in Article 103 of the Presidential Decree No. 1. Subparagraph (m) which gives the task in question is as follows: “*Ensuring coordination with other institutions and organizations in order to undertake works related to determining plans, policies and strategies directed towards taking measures concerning global climate change and depletion of the ozone layer*”.

<sup>19</sup> The Board utilizes the duties and powers of the “Higher Board of Environment” which was abolished in 2018.

<sup>20</sup> This matter is further addressed in the “Cities and climate change adaptation” part of the report.



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The tasks of the Climate Change and Adaptation Department under the General Directorate of Environmental Management of the Ministry of Environment and Urbanization (MoEU) are as follows:

- Monitoring and coordinating local, national and international efforts for climate change response and protection of the ozone layer, drafting legislation on relevant matters,
- Ensuring national coordination and fulfilling its national focal point duties under international organizations and agreements for climate change response and protection of the ozone layer,
- Carrying out legislative and other works for EU Acquis harmonization in matters that fall under its remit,
- Drafting or having others draft the national reports that our country is obliged to prepare under international organizations and agreements,
- Ensuring the coordination of the Climate Change and Air Management Coordination Board (CCAMCB),
- Ensuring the national coordination of climate change response efforts at the local level (at the level of cities and geographical regions), organizing/having others organize capacity development activities and formulating legislations for the preparation and implementation of local climate change action plans,
- Monitoring and evaluating national and international developments concerning the control, recycling and disposal of the substances that cause the depletion of the ozone layer and of greenhouse gas emissions which constitute an alternative for such substances; carrying out and having others undertake efforts on determining and implementing relevant policies and strategies,
- National-level monitoring, controlling, and reporting the greenhouse gas emissions causing climate change,
- Carrying out works for market-based mechanisms and economic instruments, and particularly emissions trading system within the frame of climate change policies,
- Coordinating the works for monitoring and evaluating climate change adaptation policies,
- Carrying out works for public information and awareness-raising,
- Preparing and implementing national and international projects on matters in its remit.

It is the responsibility of the Climate Change and Adaptation Department of the Ministry to ensure the coordination of the monitoring and evaluation works for climate change adaptation policies. The fulfilment of all tasks listed above are ensured by four branches within the Presidency which are: i) Climate Change Policies and International Negotiations Branch, ii) Local Climate Change Policies Branch, iii) Greenhouse Gas Emissions Monitoring Branch, and iv) Protection of Ozone Layer and Management of Fluorinated Gases Branch.

In some other general directorates of the Ministry of Environment Urbanization, subunits were recently established for combating climate change, such as a Climate Change Branch under the Protection and Monitoring Department of the General Directorate for Conservation of Cultural Assets; and a Climate Change Branch under the General Directorate of Local Governments. If such units work in coordination with the activities undertaken by the Climate Change and Adaptation Department of the Ministry, their works can provide a basis for an effective network of coordination among all related general directorates of the Ministry. Otherwise, there may be a waste of time and duplicate actions in responding to climate change.

Other than the Ministry of Environment and Urbanization, those that carry internal service units directly concerned with climate change adaptation are the Ministry of Agriculture and Forestry and the Ministry of Interior. Climate change issues are generally handled by environmental subunits within other related ministries. For example, works on the relationship between climate change and health are being undertaken at the Environmental Health Department of the General Directorate of Public Health.



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Higher Boards, Higher Institutions- There are higher boards steering the policies under the responsibility of related ministries that directly or indirectly address climate change adaptation policies of Turkey. The only board that is directly concerned with this subject is the Climate Change and Air Management Coordination Board (CCAMCB), coordinated by the Ministry of Environment and Urbanization. Having important tasks in the formulation of climate change-related policies, the board was established upon Circular No. 2001/2 of the Prime Ministry in 2001 under the name of Climate Change Coordination Board and was later renamed as the Climate Change and Air Management Coordination Board (CCAMCB) after its reorganization in 2013 upon Circular No. 2103/11 of the Prime Ministry. Among the board members are various ministries and the Union of Chambers and Commodity Exchanges of Turkey (TOBB), Turkish Industry and Business Association (TUSIAD), and Independent Industry and Business Association (MUSIAD). Seven permanent working groups that respond to all relevant policy responses (mitigation, adaptation, financing, technology, etc.) related to combating climate change and ensure horizontal coordination among institutions were established under the CCAMCB. The groups, which are listed below, include a working group under the CCAMCB that is directly concerned with climate change response:

1. Climate Change Impacts and Adaptation Working Group
2. Greenhouse Gas Emission Reduction Working Group
3. Greenhouse Gas Emission Inventory Working Group
4. Finance Working Group
5. Technology Development and Transfer Working Group
6. Training, Awareness and Capacity Building Working Group
7. Air Management Working Group.

The members of CCAMCB's Climate Change Impacts and Adaptation Working Group are relevant ministries and their relevant service units and TOBB, TUSIAD and MUSIAD. According to the guidelines regulating the working principles and procedures of the CCAMCB, it is among the duties and powers of the chairman to invite public entities, academic institutions, non-governmental organizations, trade associations and/or private sector representatives to meetings as an observer without any voting rights, in order to receive technical assistance and consultancy.

Other higher boards and similar formations whose policies and sectoral fields are directly or indirectly concerned with climate change adaptation issues are listed below.

- Disaster and Emergency Board
- Agricultural Drought Management Coordination Board
- Agricultural Support and Steering Board (Regional)
- Central Basin Management Board
- National Biodiversity Coordination Board
- Agricultural Drought Management Coordination Board
- Turkish Water Institute (SUEN) Steering Committee
- National Wetlands Commission
- Board for Conservation of Environment and Natural Assets
- Water Management Coordination Board
- High Technics Board
- UN Convention to Combat Desertification (UNCCD) National Coordination Unit
- Science, Technology and Innovation Policies Board
- Turkish Academy of Sciences Council





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In addition to higher boards, there are also higher institutions with a public entity status, scientific and administrative autonomy, and autonomous budgets in certain sectoral areas concerning climate change. Such institutions, which are the Turkish Natural Catastrophe Insurance Pool, Information and Communication Technologies Authority, Agriculture and Rural Development Support Institute, and Public Health Institution, operate under the responsibility of the Presidency or as 'affiliated' or 'associated' organizations of Ministries.

Various institutes/centres within the Turkish public administration structure conduct scientific research at universities or independently on climate change adaptation.<sup>21</sup>

Climate change adaptation works of central bodies at the level of provincial organizations are undertaken primarily by the provincial directorates of the Ministry of Environment and Urbanization within the framework of the local duties of relevant general directorates of the Ministry. The situation is similar for local (provincial, regional) organizations of other relevant ministries, as well. The local/regional boards related to climate change adaptation may be listed as follows: Provincial Water Management Boards, Provincial Soil Conservation Boards, Provincial Wetlands Commissions, Regional Development Boards within Development Agencies, and Regional Boards for Conservation of Cultural Assets.

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<sup>21</sup> The works of such institutes are discussed in various parts of the report concerning their respective sectoral areas.



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### 1.3. Policies and strategic planning

- It is important to structure development policies in Turkey by taking climate change impacts and adaptation into consideration.
- Lack of strong cooperation and coordination among stakeholders and a monitoring-evaluation mechanism makes it difficult to transform the existing climate change adaptation strategies into adaptation actions.
- Climate change adaptation strategies do not adequately reflect the mitigation and adaptation synergy and economic, social and environmental co-benefits.
- It must be taken into account that an enhanced adaptation policy in Turkey will provide the national economy with added value.

The success of adaptation policies is directly related to national development models. Development models that are prepared without taking into account such important sectors and areas as urbanization, disaster, agriculture, tourism, management of ecosystems and water resources that are exposed to climate change impacts may cause severe constraints and bottlenecks in terms of climate change adaptation. Here, development refers to co-practising economic, ecological and social development work under the guidance of climate change adaptation policies and adapting to the impacts of climate change is a matter of development.

Climate change response was first addressed in the planning of development policies in Turkey in 2000. The Eighth Five-Year Development Plan Private Specialization Commission Report on Climate Change<sup>22</sup>, a Private Specialization Commission (PSC) Report for the Eighth Five-Year Development Plan (2001-2005) which was the development plan for that period, is the first document on national climate change policy preparations. All policy approaches (mitigation, adaptation, technology transfer, financing) addressed at the global level in climate change response in the document were considered comprehensively in line with the conditions in Turkey. The PSC Report stressed that building decision mechanisms for the integration of the climate change policies in Turkey with national development strategies and plans in the broadest sense should be a prerequisite so that practices for Turkey's anti-climate action could be undertaken through the encouraging and constructive principles and policies to be included in development plans as well as legal, institutional, financial, planning tools and methods.

The first steps towards integrating climate change adaptation policies with Turkey's development goals at various levels (national, local/regional) were taken through this report. The report underlined five basic needs that are still relevant and must be taken into account by the decision makers on adaptation in Turkey, which are;

- i) Impact and vulnerability assessments, climate modelling and predictions based on the importance of scientific research on climate change adaptation,
- ii) Addressing economic analyses that involve climate change impacts, climate change adaptation, and counter strategies and adaptation policies in terms of sectoral policies,
- iii) Establishing extensive mechanisms for participation and information, knowledge exchange, and consultation,
- iv) Promoting the collection and distribution of scientific data, research, development, and knowledge generation,

<sup>22</sup> [Eighth Five-Year Development Plan Private Specialization Commission Report on Climate Change](#), Prime Ministry SPO: 2532. PSC: 548, Ankara, 2000.



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- v) Enhancing the data collection and monitoring mechanism to steer national policies, and determining appropriate methods for monitoring and data collection.<sup>23</sup>

In the process of the Ninth Development Plan (2007-2013), climate change policies were not examined as the subject of a private specialized commission as with the previous development plan. One of the important objectives of the plan was to prepare a national climate strategy and action plan that establishes policies and measures for greenhouse gas emission reduction with the participation of relevant parties and by taking into consideration the facts of the country. During the period covering the plan, the “National Climate Change Strategy/NCCS” which was adopted by the Higher Planning Council in 2010 and involved strategic steps in various sectors and thematic fields in responding to climate change were prepared, as well as its supporting policy documents “Climate Change National Action Plan/CCAP” and “Turkey’s Climate Change Adaptation Strategy and Action Plan”.<sup>24</sup>

At the time of the Ninth Development Plan, impacts of climate change were researched by the Turkish Grand National Assembly (TGNA) within the frame of supervisory activities. In the 23<sup>rd</sup> Legislative Term (2<sup>nd</sup> Legislative Year) of the TGNA, a Parliamentary Inquiry Commission focusing on the impacts of climate change particularly on water resources was established. Within this framework, the Report issued by the “*Parliamentary Inquiry Committee on the Sustainable Management of Water Resources and the Impacts of Global Warming*” set up in 2008 included a comparison of the current situation concerning climate change with the observed and anticipated changes in terms of both Turkey’s climate and global climatic conditions and addressed the potential impacts of global warming particularly on Turkey’s water resources<sup>25</sup>. The Report also touched upon the national and international efforts towards combating the factors that cause global warming and laid down the individual, institutional, and legal steps that are required in this context.<sup>26</sup> The Report was opened to a plenary discussion at the General Assembly Unions of 07.10.2008, 14.10.2008, and 15.10.2008<sup>27</sup>. Some of the important decisions that still remain on the agenda of decision makers regarding adapting to the impacts of climate change on water resources are as follows;<sup>28</sup>

- Drought measurements must be performed and modelled and the necessary measures taken in a timely manner. To that end, meteorological natural phenomena such as drought and flood must be included in the scope of disasters and disaster management plans must be formulated for the sectors which they impact.
- Monitoring and estimation of the changes in climatic parameters form the basis of climate change work. As data with a certain intensity needs to be obtained for this purpose, it is of great importance to develop and regularly operate an observation network in which meteorological and hydrological observations will be made.
- Meteorological parameters such as precipitation, snowfall, temperature, vaporization, etc. are monitored by the General Directorate of Meteorology, and flow by the General Directorate of State Hydraulic Works.<sup>29</sup> In order to undertake such works, a national database must be

<sup>23</sup> In the Report, the then-State Planning Organization of the Prime Ministry and TURKSTAT were recommended as the responsible and leading organizations for the works in this field.

<sup>24</sup> The climate change strategies are further examined in Chapter 3 of this Report.

<sup>25</sup> “TGNA Reports No. (10/1, 4, 5, 9, 10, 11, 13, 14, 15, 16, 17) of the Parliamentary Inquiry Commission Established for the Sustainable Management of Water Resources and the Impacts of Global Warming”, 23<sup>rd</sup> Term, 2<sup>nd</sup> Legislative Year, Page No. 138, April 2008, Ankara.

<sup>26</sup> <https://www.tbmm.gov.tr/sirasayi/donem23/yil01/ss138.pdf>

<sup>27</sup> <https://www.tbmm.gov.tr/tutanaklar/TUTANAK/TGNA/d23/c028/tbmm23028002.pdf> (Minutes of the TGNA General Assembly Plenary Discussion upon the Commission Report)

<sup>28</sup> “Role of TGNA in Climate Change Policy”, Global Balance Association, Turkish Association of Legislation, Consumer and Climate Protection Association, Ankara, February 2016 (The report was prepared within the framework of the “Strengthen the Role of Turkish Parliament for the Improvement of National Climate Change Policy Project” financed by the UK Prosperity Fund).

<sup>29</sup> These activities were previously monitored by the DSI and the Former General Directorate of Electric Works and Studies (EIEI).



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established by gathering the data collection system under a single roof and a research centre must be established for climate change and drought.

A specialized commission or working group directly related to climate change was not established for the preparations for the Tenth Development Plan (2014-2018). The Tenth Development Plan aiming for the inclusion of disaster risks in macro-economic, sectoral, and spatial planning processes, listed the objectives for “Environment and Disaster Management” under the title of “Livable Places, Sustainable Environment” as follows; i) Maintaining climate change response and adaptation efforts, ii) Enhancing awareness and the resilience of settlements against disaster, iii) Taking disaster risks into account in land use planning processes, iv) Prioritizing the improvement of critical infrastructures, and v) Establishing a disaster information management system.

Turkey began to integrate the United Nations Sustainable Development Goals with its development plans during the implementation process of the Tenth Development Plan. The Plan included important objectives concerning the sustainable use and effective management of water resources (SDG 6) which will have maximum exposure to the impacts of climate change.

The Tenth Development Plan is important for being the plan in which the *green growth* concept was used for the first time in government policies. Green growth, the global importance of which is mentioned in paragraphs 62, 900, 1032 and 1041, is also addressed under climate change policies in such sectoral areas as energy, industry, agriculture, transportation, construction, services, and urbanization. The plan refers to green growth as an area of R & D that has high economic potential and new employment opportunities. Starting another development rhetoric in Turkey, such a policy choice/initiative is an extremely important step that also indicates the country’s potentially low-carbon development dynamics in climate change response. Demonstrating the transformation in economic policies, these steps also remain at the core of the development of climate change adaptation policies.

From this point of view, the issue of which opportunities will arise from investing in a low-carbon and resilient future in line with the development policies has been recently getting attention and a connection is trying to be established between climate risk management capacity and macro policies.

The Eleventh Development Plan (2019-2023)<sup>30</sup> adopted the United Nations (UN) Sustainable Development Goals for 2030 as a base priority. Although Turkey does not have a green growth strategy available as of yet, green growth needs are foreseen by many elements of SDGs. Addressing economic growth and the climate agenda concomitantly in Turkey was accelerated with the start of the implementation of the Eleventh Development Plan and the integration of renewable energy and energy efficiency, as well as the macro economic benefits of shifting the investments and funding sources for infrastructures towards low-carbon solutions, were brought into discussion.

The Eleventh Development Plan contains a series of objectives that are directly or indirectly related to adapting to the impacts of climate change in agriculture, food security, agricultural development, disaster risk management, efficient water utilization, protection and sustainable use of biodiversity and natural resources, forestry, and tourism and various thematic fields. The objectives are detailed below (with their respective paragraph no.):

*“406.5. In order to prevent water losses due to evaporation by taking into account the effects of climate change, work will be undertaken to establish underground water basins and dams.*

*410.6. Action plans will be prepared to combat invasive species and agricultural pathogens in connection with climate change.*

<sup>30</sup> The Eleventh Development Plan was prepared in coordination with the Strategy and Budget Office of the Presidency, adopted by the TGNA on 18 July 2019, and brought into force upon its publication in the Official Gazette of 23 July 2019 issue 30840-bis.



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411.6. *Product pattern change scenarios in agriculture will be established in order to adapt to climate change.*

426.6. *Studies to identify the effects of climate change on tourism sector will be conducted.*

714.2. *Planning, implementation and capacity building activities including national and regional adaptation strategies to increase the capacity to adapt to the negative impacts of climate change will be undertaken.*

714.3. *In order to adapt to climate change and to take the necessary measures, regional and city-scale needs will be identified and solution proposals will be determined, and Climate Change Action Plans will be prepared for 7 Regions, particularly for the Black Sea Region.*

723. *Disaster hazard and risk maps will be prepared, taking into account scenarios regarding the impacts of climate change throughout the country.”*

Adaptation in the 2020 Presidential Annual Programme- Pursuant to Presidential Decree No. 1 on Organisation of Presidential Office, it is the task of the Ministry of Treasury and Finance to prepare jointly with the Strategy and Budget Department by acquiring the opinions of the Policy Board within the body of the Presidency and relevant public administrations the development plan, Presidential Programme, medium-term programme, medium-term financial plan, Presidential annual programme, sectoral plan and programmes within the framework of fundamental targets, principles and objectives set out by the President.

The Medium-Term Programme, which covers the years 2019-2021, mainly addressed and set targets related to further mitigation policies for responding to climate change. The “Developments in the Global Economy” chapter of the 2020 Presidential Annual Programme<sup>31</sup>, which is one of the annual programmes under the Medium Term Programme, states that “*unless solution-oriented steps are taken, it is an important risk that the problems arising from climate change which is of particular concern to the future of the global economy will transform into greater problems in the future*”. Important findings of the programme related to climate change adaptation are indicated below.

- Changes in our country’s climatic conditions and precipitation regime deeply affect the supply and demand equilibrium and consumer prices in agricultural product markets.
- Coastal areas where tourism activities are concentrated are under pressure due to human-related utilization and the unfavourable conditions caused by global climate change.
- One of the key elements that directly or indirectly affect sustainable development goals, which are shaped on the axis of such components as climate change and energy efficiency, is logistics and transportation services.
- The fundamental purpose is to ensure the access of all individuals and particularly those with low income to adequate, liveable, resilient, safe, inclusive, economically affordable, sustainable, climate-resilient housing with basic infrastructure services.
- It is required to enhance Turkey’s climate change adaptation capacity, as Turkey is among the countries that will be affected most from climate change due to its geographical location.
- Disaster hazard and risk maps will be prepared, taking into account scenarios regarding the impacts of climate change throughout the country.

<sup>31</sup> Published in Official Gazette (OG) of 4 November 2019 issue 30938-bis.



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While the measures<sup>32</sup> established for various sectoral areas are important and constructive steps in terms of climate change adaptation action, the institutions that assume responsibilities seemingly fail to pay adequate attention to the multi-stakeholder nature of adaptation. Responsible/cooperating institutions are mainly the actors of public administration.

Taking a look at current policies as a whole, significant progress has been made for adaptation in development policy planning in Turkey. Figure 1 demonstrates the important steps related to adaptation in development plans.



Figure 1. Adaptation Timetable for Development Policies

Cost of Failure to Adapt to Climate Change- IPCC remarks that according to the results of all published research, the losses caused by climate change will have a major cost that will increase over time.

As one of the management tools in the implementation of the Paris Agreement, the Global Commission on Adaptation was established in 2018 to enhance social and economic systems against climate change impacts. Working in cooperation with the World Resource Institute and the Global Centre on Adaptation, the Commission strives towards ensuring that countries keep adaptation economy on their national agenda and address it within the scope of their socio-economic policies. A current report prepared by the Commission states that countries must plan the financial resources required for adaptation investments in coordination with their national financial systems, by taking into consideration the economic costs of lack of measures (Roston, 2019).

Completed in 2017 in cooperation with the Earth Association, WWF Turkey and E3G (Third Generation Environmentalism, a British think-tank), the “Cost of Inertia” sub-component of the “Low Carbon Development Pathways and Priorities for Turkey” Project, which is a study on the burdens and financial risks of failure to achieve the anticipated goals in climate change response and Turkey’s late transition to low carbon that will be brought onto Turkish economy, proposes that policies that prioritize climate change adaptation in numerous sectors are required in Turkey and analyses the agricultural, energy, and health sectors in this framework.

From the perspective of **strategies and action plans**, the strategies that are currently being implemented for adapting to the impacts of climate change are known to have a past of nearly twenty years in Turkey.

<sup>32</sup> The measures have been discussed in the relevant sectoral parts of the report.





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The National Climate Change Strategy/NCCS (2010-2020), which is the first official policy document on climate change response, was prepared in an effective working process with the involvement of public institutions, private sector representatives, non-governmental organizations, and universities and adopted by the Former Higher Planning Council of the Prime Ministry in May 2010.<sup>33</sup> The fact that the Strategy was prepared after Turkey became a Kyoto Protocol signatory in 2009 is particularly important in terms of the motivation for studies. The Strategy is one of the objectives of the Ninth Development Plan as well as a policy recommendation by the “OECD Environmental Performance Reviews: Turkey 2008” Report. Although the Ninth Development Plan objectives mainly highlighted the policies and measures for reducing greenhouse gas emissions, the impact of climate change on Turkey, the country’s vulnerability situation, and subjects related to adaptation received extensive coverage in the NCCS.

Climate adaptation was studied as one of the main objectives of the NCCS; another remarkable objective was to establish a holistic information management system in order to enhance the flow and exchange of knowledge in national climate change work, which is still required by decision makers. It was also emphasized by the NCCS that mitigation and adaptation are synergistic strategies in the agriculture sector and that mitigation technologies enhanced the resilience of farmers against climate change. Therefore, the NCCS signified that mitigation and adaptation needed to be planned concomitantly particularly in the agriculture sector, as the synergy to be created with efficient agricultural planning and implementation as well as mitigation and adaptation measures would be effective in increasing production and reducing poverty.

The Climate Change Action Plan (2011-2023) (CCAP) prepared in line with the objectives of the National Climate Change Strategy and the Ninth Development Plan identified five basic vulnerable areas for climate change adaptation, which are water resources; ecosystem services, biodiversity and forestry; agriculture sector and food security; natural disaster risk management; human health. A total of nearly 200 actions related to such vulnerable areas, targeting 2023 at the latest were included in the CCAP.

Nationwide areas of vulnerability in five fundamental topics were determined and critically comprehensive objectives and actions were identified in such areas in the “National Climate Change Adaptation Strategy and Action Plan (2011-2023)” which is the first policy document on enhancing Turkey’s adaptation capacity to climate change.

The areas are i) water resources management, ii) agriculture sector and food security, iii) ecosystem services, biodiversity and forestry, iv) natural disaster risk management and v) human health. The Strategy determined i) capacity building and awareness, ii) technology, research and development, financial policies and mechanisms, governance, coordination, monitoring and evaluation, and gender equality to be cross-cutting subjects.

The Strategy also recommended carrying out integrated cost-benefit analyses that take into consideration sectoral adaptation-mitigation synergy, since mitigating the unfavourable results of climate change, i.e., greenhouse gas emissions mitigation and adaptation strategies may be closely related and mutually complementary. From this point of view, the Strategy lays emphasis on researching the harms and adaptation costs of adaptation-mitigation measures as well as their common benefits. Additionally, it is seen that adequate connections between urbanization and climate change adaptation were not established in the Strategy.

The “Strategic Steps to Adapt to Climate Change in Seyhan River Basin” study was conducted as a local policy implementation in the preparation stage of the “National Climate Change Adaptation Strategy and Action Plan”. The study established a strategic framework for climate change adaptation in Seyhan

<sup>33</sup> Decision No. 2010/8 of the Former Higher Planning Council of 3 May 2010.



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River Basin and determined priority roadmap factors under five intertwining headings, i.e., water resources management; agricultural production and food security; ecosystem services, biodiversity and forestry; natural disaster risk management; and human health as strategic steps within the scope of vulnerability assessments.<sup>34</sup>

The Strategic Plan of Ministry of Environment and Urbanization (2019-2023) identified protecting the environment and natural resources, ensuring sustainable environmental management, combating climate change, and enhancing the national adaptation capacity as a primary objective and determined five performance indicators related to climate change adaptation.

Numerous strategies, policy papers and action plans (national and local/regional/basin levels) for various sectors and thematic fields concerning climate change adaptation have been prepared by relevant ministries, covering their respective areas of work. While legal and institutional regulations were implemented and concrete steps taken towards achieving the objectives set out in such policy papers, restrictions concerning adapting to climate change still remain in various sectoral fields.<sup>35</sup> The policy papers on climate change adaptation that are available for relevant sectors and thematic fields are listed in Table 2. The table includes policy papers that are at the national level and does not address those at local, regional and urban levels (provincial action plans on drought, provincial wetlands plans, provincial food security plans, integrated coastal area management plans, urban transport master plans, urban green infrastructure strategies and action plans, etc.). The institutional strategic plans of ministries were not included in the table, as well.

Table 2. Sectoral Policy Papers on Climate Change Adaptation in Turkey<sup>36</sup>

<b>Agriculture</b>	
National Drought Management Strategy Paper and Action Plan (2017-2023)	River Flood Control Action Plan (2017)
Action Plan for Industrial Forestation Activities (2013-2023)	National Action Plan for Combating Soil Erosion (2013-2017)
National Strategy and Action Plan on Combating Desertification (2015-2023) <sup>37</sup>	National Action Plan on Afforestation and Erosion Control Campaign (2008-2012)
Strategic Plan for Organic Farming (2018-2022)	National Agricultural Development Strategy (2014-2020)
Agricultural Research Master Plan (2011-2015)	National Agricultural Drought Strategy and Action Plan (2013-2017) <sup>38</sup>
National Report on Land Degradation Neutrality for Turkey (2016-2019)	
<b>Agricultural Development</b>	
National Strategy for Agricultural Development (2014-2020)	National Agricultural Development Plan
National Strategy for Regional Development (2014-2023 / 214-2018)	
<b>Disaster</b>	

<sup>34</sup> "Strategic Steps to Adapt to Climate Change in Seyhan River Basin", Dr. Nuran Talu, Hande Özü, UN Joint Programme for Enhancing the Capacity of Turkey to Adapt to Climate Change, T.R. Ministry of Environment and Urbanization, General Directorate of Environmental Management, Department of Climate, Ankara, November 2011.

<sup>35</sup> The policy papers are further evaluated in the relevant sectoral parts of the report.

<sup>36</sup> The policy papers are further addressed in their respective sectoral chapters of the report.

<sup>37</sup> Turkey's National Action Programme on Combating Desertification, which is the preliminary document that involves the studies planned within the framework of combating desertification/land degradation in Turkey, was published in 2005.

<sup>38</sup> The initial National Agricultural Drought Strategy and Action Plan covers 2008 - 2012.





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Disaster Management Strategy Paper and Action Plan for Turkey (2020-)	Roadmap Documentation for Climate Change and Related Disasters (2014)
<b>Water Resources Management<sup>39</sup></b>	
National Water Plan (2019-2023)	Action Plan on Potable, Utility, and Industrial Water Procurement (2008-2012)
National Basin Management Strategy and Action Plans (2014-2023)	Dam Basins Green Belt Action Plan (2013-2017).
Flood Action Plan (2014- 2018)	Upper Basin Flood Control Action Plan (2013-2017)
<b>Urban</b>	
National Smart Cities Strategy and Action Plan (2019-2020)	Integrated Urban Development Strategy and Action Plan (2010-2023)
Wastewater Treatment Action Plan (2017-2023)	
<b>Ecology</b>	
National Biodiversity Strategy and Action Plan (2007-)	National Strategy of Turkey for Protected Areas and Climate Change (2010-2012)
National Forestry Programme (2004-2023)	Action Plan on Lakes and Wetlands (2017-2023)
National Wetlands Strategy and Action Plan	
<b>Tourism</b>	
2023 Tourism Strategy of Turkey	National Strategy for Combating Desertification (2015-2023)
<b>Health</b>	
National Programme and Action Plan for Mitigating Negative Effects of Climate Change on Health (2015-)	

In some cases, strategies and action plans were prepared for region-specific climate change adaptation, an example of which is the “Climate Change Adaptation Strategy and Action Plan for Dağca-Karaburun Special Protected Areas” prepared by the Ministry of Environment and Urbanization in 2017.

**Climate Change Adaptation Planning at Regional Level-** The impacts of climate change are varying at regional and local levels. In that sense, impact analyses, regional modelling and planning that address climate change impacts not only at the urban level but also at the regional level are required.

Policies in priority sectoral and thematic fields have long been planned and implemented at the regional level in Turkey. Within the scope of regional development policies, there are special development projects such as Southeast Anatolia Project, East Anatolia Project, East Black Sea Project,

<sup>39</sup> Plans such as the River Basin Management Plan (2018-) and management plans planned individually for various river basins, Sectoral Water Allocation Plans that induce direct implementation in water resources management were not included in Table 2.



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and Konya Plains Project<sup>40</sup> and institutional buildings<sup>41</sup> (regional development administrations) developed for specific regions. The Southeast Anatolia Project (GAP) stands out with its potential to change the regional climate due to the changes caused by its occupied area to surface characteristics, and activities in water and land use. On the other hand, the Konya Plains Project (KPP) is an important regional development project for the Konya Closed Basin which involves such risks as groundwater withdrawal, drought, and desertification. In order to adapt to climate change at regional and local levels, it seems beneficial to evaluate such projects in conjunction with the local administrative structure which they cover.

When evaluating regional structures and trends, the “National Strategy for Regional Development 2014-2023” prepared by the Former Ministry of Development states under the “Natural Structures, Environment and Climate Change” heading that, *“the environmental indicators of Turkey have improved by the measures taken to enhance emission control, renewable energy utilization and energy efficiency, enable waste management, further extend and enhance the quality of potable water, sewer and similar services, improve the fight against desertification and erosion, expand protected areas including forests and marine protected areas, and preserve biodiversity”*.

The policy measures for regional action planning for climate change in Turkey included in the 2020 Presidential Annual Programme is given in Table 3.

Table 3. Policy Measures in the 2020 Presidential Annual Programme

Policy/Measure	Responsible/Cooperating Institutions	Activities and Projects To Be Undertaken
Measure 714.3. In order to adapt to climate change and to take the necessary measures, regional and city-scale needs will be identified and solution proposals will be determined, and Climate Change Action Plans will be prepared for 7 Regions, particularly for the Black Sea Region.	Ministry of Environment and Urbanization, Climate Change and Air Management Coordination Board (CCAMCB)	Climate change action plans will continue to be prepared for the seven geographical regions in Turkey.

The preparation of climate change action plans was first started in the Black Sea Region among the 7 geographical regions. In this framework, the Black Sea Climate Change Action Plan was outlined by the Ministry of Environment and Urbanization in July 2019, as follows:

- Spatial Strategy Plan and spatial plans of all scales will be prepared by taking into consideration the climate change parameters.
- Starting with Samsun, Ordu, Giresun, Trabzon, Rize and Artvin provinces, the buildings located near streambeds will be identified and relocated to appropriate areas.

<sup>40</sup> Southeast Anatolia Project Regional Development Administration which used to be under the former Ministry, and the East Anatolia Project, East Black Sea Project and Konya Plains Project Regional Development Administrations which used to be under the former Ministry of Development were placed under the Ministry of Industry and Technology pursuant to Decree-Law No. 703 of 02.07.2018.

<sup>41</sup> Decree-Law No. 642 of 3/6/2011 on the Organization and Functions of the Regional Development Administrations for Southeast Anatolia Project, East Black Sea Project and Konya Plains Project.



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- The buildings located in high-risk landslide sites will be identified and relocated to appropriate areas.
- Identification studies will be conducted for the removal of older bridges that are under the responsibility of local governments and that have completed their economic life or with inadequate cross-section width in line with a prioritization framework.
- Capacities and numbers of culverts and bridges near the Black Sea Coastal Road that block rainfall from running into the sea will be increased.
- Water lines and tunnels to channel sudden floods to the sea will be constructed at certain points of the Black Sea Coastal Road and risky road infrastructures.
- The frequency of inspections will be increased in facilities operating in the region to keep the natural structure of streambeds. The frequency of inspections will be increased to prevent taking materials from or spilling excavation wastes into streambeds in an uncontrolled fashion and ensuring that the water flow direction in the streambed is not changed.
- Waste management and zero waste practices will be expanded in the region to prevent wastes from further burdening streambeds.
- Site selection for public buildings in the spatial plans will be made in a way that they will be the least affected by extreme weather events.
- Regular and periodical training will be provided to local authorities on flood and overflows.
- Separate sewer systems will be established for rainwater and wastewater.
- Disaster risk analyses of critical infrastructure facilities such as drinking water, wastewater, and waste storage will be conducted.
- Data coordination will be ensured to establish early warning systems for the safety of life and property in locations at risk for a natural disaster.
- The use of energy-efficient, climate and eco-friendly local building materials will be fostered and disseminated in the region. It will be ensured that the use of climatically-sound building materials in local architecture is disseminated.
- Building swales and rain gardens and carrying out road construction using permeable materials throughout the region will be encouraged.
- Regular training will be provided to local authorities on climate change and its impacts.

The regionally organized *Development Agencies* in Turkey stand out as structures that can support activities serving climate change adaptation. The task of ensuring nationwide coordination of the development agencies organized under the former Ministry of Development was initially assigned to the General Directorate of Development Agencies, established under the Ministry of Industry and Technology upon Presidential Decree No. 1, in 2018. Furthermore, Law No. 5449 on the Establishment, Coordination and Functions of Development Agencies was renamed as the Law on Development Agency Services and several articles thereof were repealed pursuant to Decree-Law No. 703 of 02.07.2018.

Within the framework of “developing, implementing, and determining the principles and procedures for the implementation of integrated or thematic support programmes and projects for regional development” which used to be among the tasks of Development Agencies prior to the legislative change in 2018, Development Agencies supported and carried out activities, projects etc. on this matter as part of their approach to regional climate change in Turkey. An important study among the limited number of studies that were conducted on the role and activities of development agencies on climate change response in Turkey systematically analysed the works and support provided by the agencies on a regional basis and established how climate change was addressed under the existing development approach (Tansel and Öğüt, 2019). The research conducted a numerical analysis for direct/indirect Development Agency activities related to climate change from among all regional development activities undertaken between 2010 and 2017, examining the changing of such activities



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by year and their distribution by different activity types. Outcomes of the research determined that the activities undertaken by Development Agencies on twelve main subjects (the topics: sustainability, energy, infrastructure, waste-recycling, buildings-land use, transport, awareness, climate change, environmental consciousness, eco-tourism, and other) which were determined by means of project support for climate change response, project calls, activities, and publications tended to decrease in number over the years, that support and call had a very low share in the direct activities for climate change, and that the activities of Development Agencies that were related to climate change took form according to the differences in interregional development. While the rate of support and activities that were directly related to the topic of 'climate change' was very low in overall climate change activities, the activities on the topic of 'energy' received most of the support in all regions regardless of their development levels.

The "Capacity Building for Climate Change Mitigation and Adaptation in the Turkish Thrace Region" project supported by the European Union IPA grant funds was implemented in cooperation with Tekirdağ Namık Kemal University and Tekirdağ Metropolitan Municipality between 2017-2019. The implementation area of the project is the TR21 Turkish Thrace Region covering Tekirdağ-Edirne-Kirklareli provinces that border the Meriç-Ergene Basin and Marmara Basins. The main purpose of the project is to research the impacts of climate change and ensure the sustainable utilization of regional land and water resources and minimization of drought and flood risks and damages in order for all sectors and particularly the agriculture sector to economically sustain production against the anticipated unfavourable effects of climate change in the Turkish Thrace Region. Determining that numerous economic sectors in the Turkish Thrace Region will be affected by climate change to the extent of their climate sensitivity or dependency; the project estimated that all sectors in the area of study will be affected negatively by such risks as increased extreme weather events, political instability, and increased costs in products and services. Having addressed the regional integrity factors in climate change adaptation action in the Turkish Thrace Region extensively, the project stands out as a good practice example of regional climate change adaptation planning in Turkey.<sup>42</sup>

*Integrated Coastal Zones Approach and climate change adaptation-* Today's approaches towards the management of coastal zones are going through a managerial and instrumental change, as such areas remain at the intersection of international, national and regional policies and strategies and are subject to sectoral strategies. The Integrated Coastal Zone Management and Planning approach in the planning practices of Turkey has been affected by such changes and reformed over time. In Turkey, integrated coastal zone planning studies are conducted under the responsibility of central governments. According to the 'Regulation on Making Spatial Plans' which was published in Official Gazette of 14.06.2014 issue 29030, an integrated coastal zone plan is not included in the phasing of spatial planning, prepared with a strategic approach that is specific to coasts and areas of interaction, and guides development plans. Prepared within the framework of determining spatial development strategies in coastal areas and ensuring sectoral adaptation, integrated coastal zone plans are high-level plans and provide input for all planning activities and practices including environmental plans, and coastal master and implementation plans. Integrated coastal zone management and plans are undertaken by the General Directorate of Spatial Planning under the responsibility of the Ministry of Environment and Urbanization (MoEU) within the framework of the duty and power described in Article 102 of Presidential Decree No. 1. In terms of international obligations, coastal zone management is addressed within the scope of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean of which Turkey is a signatory. In consideration of the impacts and problems caused by climate change in coastal zones, this planning

<sup>42</sup> Project details are further addressed in the annexes to the report.



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tool that covers several coastal provinces should be taken into account during regional climate change adaptation planning (Gülbitti and Özüduru, 2020).

*Rural Development Policies and climate change adaptation-* In some countries around the world, adaptation is included in key policies that directly guide their macro economies. For example, decision makers in Latin America incorporated climate change adaptation into rural development policies. Rural development policies have been implemented in Turkey for a long while -particularly to mitigate regional inequalities- and climate change impacts are discussed, albeit indirectly, in recent studies/projects. The regionality of rural development is particularly important in terms of Turkey's regional climate adaptation planning, allowing for Turkey's rural development policies and practices to provide a base for regional climate change adaptation actions.

Under the Eleventh Development Plan objective (p.707), rural development aids will be programmed with a focus on farmers and environment, arrangements will be made to eliminate the existing multi-heads in providing aids, and complementarity and effectiveness will be ensured in implementation. For this purpose, Table 4 shows the 'climate-friendly' policy measure specified in the 2020 Presidential Annual Programme.

Table 4. Policy Measures in the 2020 Presidential Annual Programme

Policy/Measure	Responsible/Cooperating Institutions	Activities and Projects To Be Undertaken
Measure 708.2. Environmental supports and incentives will be increased in order to improve the quality of life in rural areas and to make the rural areas protected, lived and produced.	Ministry of Agriculture and Forestry, Ministry of Environment and Urbanization	-Aids will continue to ensure the prevention of agricultural pollution caused by and increase the environmental performance of enterprises, and work will be initiated to establish new support models.  -Available support mechanisms will be enhanced to promote the storage and use of animal-based fertilizers and climate-friendly agricultural practices.

Strategies, plans, and action plans<sup>43</sup> for rural development are in practice in Turkey. The first National Development Strategy was implemented in 2007.<sup>44</sup> In the Strategy, the key objective of IPA II for Agriculture and Rural Development Sector was to prepare Turkey for the future implementation of the EU Common Agricultural Policy (CAP); in this framework, the Instrument for Pre-Accession Assistance (IPA)<sup>45</sup> aims to render Turkey's efforts in policy areas related to rural development sustainable as well as ensuring compliance with the *acquis* in the fields of food security, veterinary, plant health policy, and fishery. The IPARD (Instrument for Pre-Accession Assistance for Rural Development) Programme component of IPA directly focuses on the abovementioned subjects.

<sup>43</sup> Rural Development Action Plan (2014-2018)

<sup>44</sup> National Rural Development Strategy/NRDS I (2007-2013), adopted in 2006 pursuant to the Decision of the State Planning Organization of the Prime Ministry, Higher Planning Council (HPC Decision No. 2006/1 of 25/1/2006). The Rural Development Plan (2010-2013) was also prepared during that process, pursuant to which meta data studies were carried out for certain selected rural indicators in coordination with TURKSTAT. CEM-National Rural Development Strategy II, pp. 67-68.

<sup>45</sup> A financial instrument established by the EU to support candidate (Turkey) and potential candidate countries.





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The National Rural Development Strategy/NRDS II<sup>46</sup> is implemented under the responsibility of the Ministry of Agriculture and Forestry. The tasks of the Agriculture and Rural Development Support Institution (ARDSI), which was established to undertake activities for the implementation of rural development programmes and is also an ‘associated’ organization of the Ministry of Agriculture and Forestry, are regulated in Presidential Decree No. 1.<sup>47</sup>

Describing agriculture and rural development as the key sector in Turkey in socio-economic terms, NRDS II refers to three important matters which are; i) need for investment to raise the sector to the EU level, ii) lower productivity and lower income levels in comparison to other sectors, causing migration from rural areas to urban centres and iii) the challenges before the socio-economic development of rural regions. NRDS II determines “*protecting the rural environment and natural resources within the frame of climate change adaptation and green growth principles*” as a subgoal of the main goal of Turkey’s rural development policy which is “*to improve and ensure the sustainability of job and living conditions of the rural community in its territory, in harmony with urban areas, to approximate the minimum quality of life in rural regions to the national average*”.

### “NRDS II- Strategic Goal-2: Improving Rural Environment and Protecting Natural Resources

Taking into consideration the impacts of climate change, rural areas contain strategic natural resources, i.e., water, food, energy, and clean environment that will become increasingly important in the future. On the other hand, efforts towards making maximum use of natural resources in the short term and turning such resources into economic value as part of the production activities in rural areas lead to the destruction of natural environment and rapid depletion of resources. Problems such as desertification, drought, erosion, forest fires, floods, landslides, and

For example, NRDS II discusses forestation –areas that are suitable for forestation are decreasing with every passing year due to climate change, which requires longer periods for forests to reach their potential as natural carbon storage and mature– and the protection of forests within the scope of the IPARD Programme which is the implementing programme of the strategy. The key implementing instruments of NRDS II constitute the IPARD-II Programme (2014-2020) which has been renewed. Extensive activities supporting adaptation preparations for the implementation and management of the EU Common Agricultural Policy, Rural Development Policy, and related policies as well as the formulation of policies within this scope have been implemented in Turkey within the framework of IPARD II and in the coordination of ARDSI and GDAR since the first National Rural Development Strategy.<sup>48</sup>

The IPARD Programme, which is implemented with the aim of financing Turkey’s adaptation preparation for the EU acquis under the relevant chapters<sup>49</sup> (directly relevant: Chapter 11. Agriculture and Rural Development; other: Chapter 12. Food Safety, Veterinary and Phytosanitary Policy, Chapter 13. Fisheries, Chapter 22. Regional Policy and Coordination of Structural Instruments, Chapter 27. Environment and Climate Change), is considered to be a model implementation for all financial support programmes undertaken in this aspect. Co-financed by the European Union and the Republic of Turkey, the programme comprises support provided mostly in the form of grants and partially as credit. All along, the existing approach in Turkey has been based on accomplishing the services and investments incumbent upon the public (public administration) in ensuring rural development using the sources procured from the central government budget. Budget expenditures for rural areas are managed by

<sup>46</sup> [National Rural Development Strategy \(2014-2020\)](#), adopted pursuant to Decision No. 2014/45 of 31 December 2014 of the Higher Planning Council. The strategy paper entered into force upon its publication in Official Gazette of 21/02/2015 issue 29274.

<sup>47</sup> Presidential Decree No. 1 (Official Gazette of 10.07.2018 issue 30474).

<sup>48</sup> IPARD I was implemented in 42 provinces between 2007-2013, in the same timeframe as the first National Rural Development Strategy.

<sup>49</sup> The chapters within the framework of Turkey’s EU accession negotiations.



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the central government organization (Ministry of Agriculture and Forestry and affiliated entities) which carries out public services in rural areas through provincial organizations.

*“On the other hand, it has become essential to develop innovative service delivery models that take into account basic trends such as advancement of information technologies, the transformation of the role of the public in conventional service delivery, changes in service demands and types, the new demographic structure of rural areas, and climate change adaptation measures. Such a need is vital for maintaining the continuity and quality of services. However, to this end, central government institutions responsible for service delivery must resort to appropriate institutionalization for innovative service delivery, develop innovative practices that take into consideration the local government structures, and strengthen cooperation and partnership networks with other actors of local development, including local governments and NGOs”.*<sup>50</sup>

Currently, ARDSI has been continuing its practices in line with the guidance of the National Rural Development Strategy covering 2014-2020 (same period as IPARD II), targeting 81 provinces. The National Rural Development Strategy (NRDS II) addresses climate change either directly or indirectly in the planned sub-sectors (livestock breeding-dairying, fisheries-aquaculture, renewable energy) to respond to the rural development which has been planned in the rural parts of Turkey.

The IPARD support is implemented under the multiannual “Rural Development Plan” covering 2014-2020. Co-financing by the European Union and the Republic of Turkey has been continuing in this framework and only low-interest agricultural credits (subsidized credits) are available for investments, including for biosafety and renewable energy, that facilitate the financing of investments supported through IPARD.

The competitiveness of food processing enterprises is affected negatively by high energy costs. Therefore, utilization of renewable energy must be fostered in new enterprises as well as in existing enterprises renewing their facilities and restructuring their operations.

Measures were identified in seven categories as part of IPARD 2014-2020, which is compatible with the types of actions planned for the Agriculture and Rural Development Sector. Each of the measures, together with the corresponding share from EU contributions, are listed below:

- 1) Investments for the physical assets of agricultural enterprises, %42
- 2) Investments for physical assets in the processing and marketing of agricultural and fisheries products, %22
- 3) Agriculture-Environment, Climate Change, and Organic Farming, %2
- 4) Implementation of Local Development Strategies - LEADER<sup>51</sup> Approach, %3
- 5) Rural Infrastructure Investments, %10
- 6) Diversification of farming activities and enterprise development, %19
- 7) Technical assistance, %2

It is predicted that some of these measures that support the implementation of national rural development strategy and policies will complement the national climate change adaptation policies, as well.

<sup>50</sup> Direct quote, National Rural Development Strategy (2014-2020), Ministry of Agriculture and Forestry, pp: 33., Ankara, February 2015.

<sup>51</sup> LEADER Programme is an European Union initiative to support rural development projects initiated at the local level in order to revitalise rural areas and create jobs (LEADER: Liaison Entre Actions de Développement de l'Économie Rurale).





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The measure titled “Agriculture-Environment, Climate Change, and Organic Farming” addresses climate change adaptation in relation to soil degradation, protection of highly valuable agricultural biodiversity, rural water utilization problems (excessive use of water resources, best practices on the controlled use of water resources in irrigation, excessive use of groundwaters, etc.), preventing the destruction of agricultural lands (key risks have been identified as erosion caused by wind and precipitation, and decreasing water resources, etc.), fertilizers, pesticides and preventing the excessive use of pesticides in agriculture, the need to integrate organic agriculture into agricultural development policies and tourism and healthcare sectors, the problem of stubble burning which is an existing method in agriculture that cannot be prevented with inspections, and utilization of farm animal-based fertilizers as an energy resource.

The programme aims to increase the number of enterprises investing in renewable energy generation in line with the programme measure titled “Diversification of Farming Activities and Enterprise Development”, which is more related to emission reduction in responding to climate change. Accordingly, with a 55-65% governmental support, some metropolises (including Ankara, Diyarbakır, Erzurum, Bursa, Konya, Aydın, Van, Samsun, Şanlıurfa, Trabzon, Balıkesir, Hatay, Denizli, Mersin, Manisa, Ordu, Mardin, Kahramanmaraş, Malatya) made a call for applications with a budget of 42 to 54 million Euros<sup>52</sup> for investments in this area (ARDSI, 2020). The scope of the investments includes any renewable energy activity for the purpose of electricity and heat generation (except for hydropower; photovoltaic solar energy systems, concentrating solar energy systems, wind energy systems, micro-cogeneration for biomass, electricity and/or heat generation, etc.). The final beneficiaries are specified as farmers or farming households diversifying their activities in or outside of the farm, natural persons in rural areas, and private legal entities in rural areas.

Another important measure concerning climate change in the programme is the “Implementation of Local Development Strategies - LEADER Approach” which means taking into consideration the specific culture, identity and geography, historical identity, local and traditional products and socio-economic challenges of agriculture and rural development activities at the local level and producing solutions accordingly. This approach encourages formulating innovative solutions to rural problems, undertaking an important task to meet the needs of rural communities.

In the framework of this approach, pilot projects focusing on the local community and ensuring climate change adaptation through *bottom-up* strategies are supported by the LEADER Programme of the EU. In the early 2000s, LEADER also provided support to the climate change adaptation-oriented projects (enhancing resilience and adaptation in land management planning, establishing flood risk management plans; promoting the planting of conventional species, restoring peatlands/wetlands, improving degraded agricultural soil to enhance the humus content and carbon retention potential of the soil, projects serving at the local level such as revitalizing rural areas and creating jobs) of the rural development policies of EU member states. On the other hand, it stated that as of 2017, the EU Member States have failed to achieve the anticipated benefit from the LEADER Programme with regard to adaptation and that the focal point of the project was mainly to reduce emissions (EEA, 2019).

With the support of UNDP Country Office, activities for smallholder and off-farm enterprise investments and rural infrastructure investments were carried out through the “Ardahan, Kars, Artvin Development Project” to reduce rural poverty in these relatively less developed provinces of Turkey. Within the scope of these activities implemented by the Ministry of Agriculture and Forestry, the efficiency of irrigation pumps in villages in the region was increased by means of practices that take the impacts of climate change on water resources into account to ensure integrated resource productivity in agriculture and agro-industry.

<sup>52</sup> There are ARDSI Provincial Coordinatorships in these 42 provinces.



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**Adaptation needs of Turkey-** Among the needs that are required to achieve the goals of all strategy papers (including those for sectoral fields) described above with regard to climate change adaptation, providing Turkey, classified a developing country, with international finance and technology support is an important issue expressed by decision makers as a policy approach. Reserving the necessity of drastic solutions (such as giving weight to adaptation in economic policies, social development and social rights, transparency in adaptation management) for Turkey's climate change adaptation needs, it is important to focus on the following subjects to improve the present situation and overcome the adaptation barriers that are encountered:

- 1- Addressing adaptation and mitigation policies concomitantly
- 2- The need to monitor and evaluate adaptation action processes
- 3- The need to manage domestic and local knowledge for climate change adaptation
- 4- The need for cooperation and coordination with stakeholders

**Cooperating Stakeholders in Climate Change Adaptation in Turkey:** The prominent works of the stakeholders supporting the improvement of climate change adaptation policies in Turkey are compiled below.

Although Turkey is still in the early stages of developing low carbon or green growth policies, the "Green Growth in Turkey: Challenges and Opportunities" report which examined green growth in Turkey was prepared in 2013 with the support of World Bank and upon request by the Former Ministry of Development. This semi-official report drew attention to certain opportunities to ensure the human development-oriented integration of environmental sustainability and related social and economic matters with the national agenda for economic growth and competitiveness.

A pilot project titled "Pilot Climate Change Adaptation Market Study: Turkey" was implemented by the European Bank for Reconstruction and Development (EBRD) and the International Financing Institution (IFI) in 2013 to shed light on Turkey's adaptation economy. The project aimed to increase the awareness of private sector on the impacts of climate change, determine the role of the Turkish business community in keeping up with the new circumstances created by climate change, enhancing the risk management capacity, and informing Turkish companies about future commitments.

The "Mapping Climate Change Policies Actors in Turkey" (2014) study conducted by Sabancı University, IPC in 2014 called into question the state and non-state actors in the development of climate policies of Turkey, their works, and their relationships (Şahin, 2014). The study also called attention to a multilateral policymaking process in the field of climate change in Turkey. Nevertheless, the actor-mapping indicates that climate policies are largely determined by the government and relevant bureaucracy and that the relationships that actors from the private sector, civil society and academia have among themselves as well as with the public sector are restricted.

In terms of adapting to climate change, the report titled "Low Carbon Development Pathways and Priorities for Turkey: Climate-Friendly Development in Turkey: A Macro Level Evaluation" which was prepared in 2015 by Sabancı University Istanbul Policy Center Stiftung Mercator Initiative in cooperation with WWF-Turkey emphasized that Turkey's role in and sway on the new climate change regime would be defined by the adaptation and mitigation policies it will implement at the national and local levels, as well as by the emission reduction target it will declare and in this context, a holistic approach to mitigation and adaptation policies was called for.

The EU-funded "Technical Assistance for Developed Analytical Basis for Formulating Strategies and Actions towards Low Carbon Development" Project, of which the Ministry of Environment and Urbanization is a beneficiary, was implemented between 2017-2020. With its main focus on responding to emission reduction, the project-built policy and legal frameworks for low carbon development in Turkey and made inferences that pointed at low-carbon transition in various economic



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sectors. While addressing key climate policies, the study did not discuss climate change adaptation policies and actions within the scope of a low carbon development mechanism.

The EU climate projects of which the Ministry of Environment and Urbanization is a beneficiary mostly comprise grant components to support stakeholders, with İklimİN Project a prominent example. In a period of nearly three years, EU grants were used by various projects from different regions in Turkey, all of which were implemented in cooperation with various stakeholders and some of which involved climate change adaptation issues.

The “Local to National Climate Network” project, which is still being implemented by the Clean Energy Foundation (CEF) and the Global Balance Association (GBA) and supported through the “Grant Scheme for Partnerships and Networks” under the EU Civil Society Support Programme, aims to increase the effectiveness of local NGOs and City Councils in fighting climate change, enhance the cooperation between municipalities and NGOs at the local level, and build an inventory in various fields of climate change.

Being one of the recent work to enhance stakeholder dialogue and cooperation in combating climate change in Turkey, the project titled “Turkey 2050 Calculator: Facilitating Climate Policy Dialogue Through Adaptation of an EU Low Carbon Pathway Tool”<sup>53</sup> was implemented between April 2019-June 2020 with the cooperation of Turkey Economic Policy Research Foundation (TEPAV), South-East Europe Climate Change Network (SEE Change Network), and Climate Action Network Europe (CAN-Europe) (TEPAV, 2019). The main purpose of the project, which was supported within the framework of the Fifth Phase of Turkey-EU Civil Society Dialogue Grant Scheme, is to empower and deepen the impact of NGOs in Turkey on energy and climate policy dialogue and decision-making process by building coalitions with EU and West Balkan counterparts to strengthen expertise and skills for policy engagement. The project brings together NGOs from Turkey, EU and West Balkans to exchange knowledge and expertise linked to the EU energy and climate policies, goals, processes and impacts. Furthermore, the project also aims to raise awareness amongst all groups in society on the practical steps that can be taken in implementation of the Paris Agreement and EU targets by using the “participatory scenario building” tool, *2050 Carbon Calculator*. The knowledge and expertise acquired throughout the study contributed to supporting the dialogue amongst Turkey and EU non-governmental organizations as well as laying the foundations of a potential future ‘Turkey 2050 Carbon Calculator’. While the project does not directly concern climate change adaptation, it has an indirect relevance in the framework of formulating low carbon development policies in integration with mitigation and adaptation policies in Turkey.

The research “Women’s Solutions to Climate Change in Turkey” which was published by the Global Balance Association in 2018 approached climate change response from a gender equality perspective (Talu, 2018). Asserting that climate change had varying impacts on women and men, the research emphasized the sectoral/thematic fields in which women must become an active actor in climate change and built a policy framework to guide decision makers and other stakeholders for the first time in Turkey.<sup>54</sup>

For a long while, the Turkish Industry and Business Association (TUSIAD) has been examining climate change policies from the perspective of economic policies. With reference to the acknowledgement that the sensitivity of the business community against the risks brought on by climate change has reached a significant level in Turkey, TUSIAD is in favour of an economic transformation that is centred around the climate crisis. The “New Climate Regime Through the Lens of Economic Indicators Report” recently prepared by TUSIAD has been shared with the public as of September 2020.

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<sup>53</sup> Short title of the project is “Turkey 2050 Calculator: Facilitating Climate Policy Dialogue”.

<sup>54</sup> Further information about the research is provided in the annexes to the report.



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In the event “Investing in a Low Carbon and Resilient Future: Opportunities for Turkey” held in January 2019 under the leadership of SHURA Energy Transition Centre, the low carbon future of Turkey was evaluated based on the “Investing in Climate, Investing in Growth” Report by OECD (SHURA, 2019). Although such evaluations mainly focus on energy transition, an adaptation economy has come into existence through paying further attention to the sectors with climate-sensitive economies.

The “Green Climate, Green Economy Project” implemented in 2017 in cooperation with the Green Thought Association, Sabancı University IPC, and Green European Foundation discussed the good practices that were being implemented in the European Union countries with regard to mitigation and adaptation in the fields of urbanization, land use and energy within the framework of the circumstances in Turkey, pointing out potential green economy policies and opportunities that may be considered by decision makers based on such examples.

The “Co-benefits of Climate Action: Assessing Turkey’s Climate Pledge” Report was prepared in 2016 in cooperation with the Climate Action Network Europe (CAN Europe) and the New Climate Institute.



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### 2. SCIENTIFIC FRAMEWORK

- Recently, the number of scientific works concerning climate change in Turkey has been increasing as well as the need to conduct impact analyses on the sectoral dimension.
- The number of projects for high-resolution climate projection works in Turkey must be increased, which must be led by the academic community.
- Climate models need to be studied at the regional level.
- There is a need to develop various methods, tools, and guides on downscaling for global climate model outputs, for which public incentives must be provided.
- There is a problem of data sharing among public institutions and academic community, which is why a National Climate Adaptation Platform in which data can be collected and which is accessible by all stakeholders is required. Such a platform will enhance the functionality of decision-making processes.
- University research centres that conduct studies on climate change adaptation must become widespread throughout the country.



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### 2.1. Climate projections and modelling

Modelling works is an important scientific effort to accurately pinpoint potential climate changes and their impacts. Climate models are the primary tools available to create future climate projections for the next century in accordance with climate predictions and to research the climate system response using various radiative challenges and emission scenarios, and their results may be considered as seasonal and long-term averages (20 to 30 years). Being one of the most important component of climate change work in climate modelling, emission scenarios reflect expert judgements and evaluations concerning future emissions that are based on scientific works on socio-economic, environmental, and technological trends demonstrated in integrated evaluation models. The findings on how the favourable and unfavourable effects of climate impact social and economic life demonstrate the place and importance of climate in human life (Ministry of Agriculture and Forestry, 2013).

According to IPCC reports prepared by assessing the outcomes of climate models and observation data, it is a known fact that the average temperature on Earth has been increasing, snow and ice cover has been decreasing, and sea level has been rising.

*Determining Adaptation Policies Against Uncertainties-* As numerous scientific aspects, causes, and effects of past and present climate change are very well known today, there are sufficiently reliable and important knowledge on climate change adaptation available for decision makers. However, it must be kept in mind that the observed and projected data on climate change and its impacts are always associated with uncertainties. For instance, according to an emission scenario, a scientific prediction for global average temperature may report an estimated ideal of 3°C increase within an uncertainty interval of 2 to 4.5°C (EEA, 2017). The uncertainty interval indicates the impossibility of estimating exactly what will happen while demonstrating the existence of scientific evidence that future warming will probably be within a certain interval and the adequacy of relevant and abundant knowledge on climate change adaptation (and mitigation) for decision makers. Some sources of uncertainty may be reduced in principle with more research, and some cannot. The sources of uncertainty in climatology are primarily caused by the following:

- *Faulty observation tools (such as rain gauges) and/or **measurement inaccuracies** due to data processing (for example, algorithms for estimating surface temperature based on satellite data).*
- **Collection errors** due to incomplete temporal and/or transient data scope. In studies, clustered results are obtained by combining the measurements taken from a limited number of locations (such as meteorological observation stations), in a limited time span and at different points. Such clusters lead to uncertainties especially when the measurement network is sparse and an indicator demonstrates large deviations through area and/or time.
- Lack of meteorological observation stations at high altitudes and failure by measurements to adequately represent mountainous areas are lacking in terms of correcting the systematic errors of climate models.
- **Natural variability** due to unforeseen natural processes in the climate system (*internal climate variability; such as atmosphere and ocean variability*). It is known that natural variability impacts environmental and social systems (e.g. ecosystem dynamics) that affect the climate system (e.g. future volcanic eruptions) and/or that are climate-sensitive.
- *Model (climate and climate impact models) limitations caused by the locational and temporal resolution of models: (i) misunderstanding of the original components of the Earth system (e.g. dynamic icecap processes) or their interactions or feedback (e.g. climate-carbon cycle feedback) and/or the environmental or social system considered (e.g. demographic development in regions with a risk of flood), and (ii) simplifications in physical and thermodynamic processes lead to such problems as not knowing the exact numerical parameters that are used and the processes in the*





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*climate system*. One of the parameters defining the key uncertainty of global climate models is the climate sensitivity parameter, which represents the change in the yearly global average surface temperature when the representative concentration pathway (RCP) is doubled (transient climate response) or after a doubling of the atmospheric carbon dioxide concentration is doubled when RCP is at equilibrium (equilibrium climate sensitivity).

- **Future emission curves** (of greenhouse gases and aerosols) determine the dimensions and rates of future climate change. Future emission levels are based on demographic, economic, and technological growth as well as the successful implementation of international agreements (particularly under UNFCCC) for climate change mitigation.
- *The future development of non-climate (socio-economic, demographic, technological, and environmental factors) factors* determine how a specific change in the climate affects the environment and the society.
- *Future changes in social choices and political priorities* determine the importance attributed to a specific climate change impact (e.g. a local or regional loss of biodiversity).

Explanations of climatologic uncertainties have been summarized above. Results of climate models will require the correction of systematic errors (bias correction) before being used in future studies. Such explanations also indicate how the decision makers must behave under these circumstances. As is known, the common feature between science and policymaking is the lack of absolute knowledge, which is why decision makers must act by acknowledging that uncertainty management is an integral part of risk management.

If decision makers expect logical developments in their decisions, they must be conscious of the degree of uncertainty related to certain data sources; yet existing uncertainties must not prevent decision-making. In accordance with the “precautionary principle” (Article 3.3.) which is one of the four key principles<sup>55</sup> of the UNFCCC, State Parties have made a commitment not to neglect taking preliminary measures in climate response during the continuance of scientific processes.

The precautionary principle, which is essentially a political principle rather than a philosophical one, has been included in various international agreements (such as the United Nations Convention to Combat Desertification, United Nations Convention on Biological Diversity, United Nations Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean) to which Turkey is a signatory, that are directly related to climate change adaptation policies.

The precautionary principle is known to legally appear in the national policy commitments of some countries (Federal Government of Germany, Environmental Policy, 1976).

The message of the precautionary principle is that “*measures should be taken where there are threats of harm, even when the scientific evidence that is available is lacking to respond to the existence of a potential hazard*”. Therefore, the precautionary principle is based on hazard identification and scientific uncertainty.

There is a clear requirement to take policy and implementation measures against global climate change, whose existing and potential risks have been scientifically proven, from this day forth by taking into consideration the uncertainties that are scientifically explained above.

The importance of climate change uncertainties and their impacts on a specific adaptation decision is naturally based on some factors, which are; i) time horizon and irreversibility of the decision taken, ii) relative importance of climate factors for the decision, and iii) costs of maintaining/continuing the decision in the face of uncertain developments. For instance, focusing on the ‘zero/low regret’ and

<sup>55</sup> Four key principles under the UNFCCC: 1- Equity 2- Common but differentiated responsibilities 3- Precaution 4- The right, and obligation, to promote sustainable development





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'win-win' adaptation strategies that address climate change adaptation is mostly, if not always, considered to be precautionary when uncertainties are abundant among other social objectives. This way, the additional costs required to adapt to climate change may decrease, presenting the decision makers with an opportunity to evaluate their adaptation policies in terms of economic policies.



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### 2.2. National climate change projections

With the Fourth Assessment Report (AR4) presented by the IPCC in 2007, scientific studies on climate change were increased in at institutional and academic levels in Turkey as well as the world. In accordance with the scientific studies and different climate models and scenarios that are required to determine the impacts of climate change in Turkey, regional climate projections at different resolutions were produced through the projects implemented by the General Directorate of Meteorology (GDM) and the General Directorate of Water Management (GDWM) of the Ministry of Agriculture and Forestry. Both projects made use of three global models and two RCP climate scenarios from the CMIP5 (Coupled Model Intercomparison Project Phase 5) archive which constitutes the basis for the Fifth Assessment Report (AR5) of the IPCC. The global climate models selected under the project were downscaled by using the RegCM4.3 regional climate model developed by the ICTP (International Centre for Theoretical Physics) and climate projections for up to the year 2100 were generated for Turkey. The changes that were predicted according to future projections were based on the reference period of 1971-2000.

The RCP4.5 and RCP8.5 scenarios of the HadGEM2-ES, MPI-ESM-MR and GFDL-ESM2M global models were used with the “Climate Change Projections for Turkey” Project which was completed by the GDM in 2015. Regional climate projections were obtained by downscaling the entire domain from global resolution to 50 km and then from 50 km to 20 km for the three models that were selected under the project. The “Impact of Climate Change on Water Resources Project” completed by the GDWM in 2016 also used the RCP4.5 and RCP8.5 scenarios of the HadHEM2-ES, MPI-ESM-MR and CNRM-CM5.1 global models. Again, regional climate projections were produced the three global models selected under the project by downscaling the outer domain from a global model resolution to 50 km, and the inner domain from 50 km to 10 km at a higher resolution.

Climate indexes representing extreme situations were also calculated as part of both projects. Under the study that was conducted by the GDWM, hydrological projections for 25 basins in Turkey were also produced, after which hydro-geological and hydrological studies were conducted.

These studies conducted by the GDM and the GDWM provided basic data for all stakeholders who were preparing plans for future measures for adaptation and mitigation. In this context, Master’s Thesis and Doctoral Dissertations as well as the drought management plans that have been and are still conducted by institutions in the context of climate change adaptation, the projects assessing the impacts of climate change on snowmelt and flows, and the results of such climate projections were used. These data should be used as a foundation to enhance the accuracy and success of the future planning works of stakeholders. On the other hand, increasing resolutions, i.e., downscaling, is an important step to establish a high-resolution data set for the different scenarios of future global climate models in and around Turkey, which will allow for the data to be used as a basis for the planning of both local and sectoral adaptation and mitigation activities. Utilization of this data by sectors will also increase the accuracy and success of sectoral activities, as well (Demircan, no date).

The institutions that continue to provide scientific findings of climate and climate change projections collect, produce, and distribute such data through their existing communication infrastructure in line with the national needs and international obligations for meteorological observation and measurement data. The data are used to conduct monthly, seasonal, and annual climate analyses and shared with national and international institutions, organizations, and the public. Within the scope of the activities undertaken in Turkey to provide a scientific basis for climate change in Turkey, such institutions as the GDM, DSI, GDWM, etc. play a special role in establishing an early warning system to inform the public about climatic events. Analyses for estimations for farmers, agricultural frost warnings, irrigation information systems, and drought are conducted; a number of sectors including agriculture, health, energy, water resources are informed on the negative effects in advance through



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seasonal estimation studies. Additionally, GDM has been providing capacity development training to the meteorology and climate services of developing countries.

New projects are required for high-resolution climate projections in Turkey. It is particularly important that other regional climate models work for Turkey, as well. Climatologic results that are obtained must be announced not only to scientists or public agencies but also to each stakeholder and individual who are interested in the subject and shared on the national climate change adaptation platform which will be practical, appeal to everyone, and suitable for continuous innovation. Relevant stakeholders require developing methodologies, tools, and guidelines and receiving training on using downscaling techniques for “Global Climate Reanalysis Data Sets” and global climate model outputs, for which public incentives are also required.



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### 2.3. Work by stakeholders

The General Directorate of Meteorology, an affiliated entity of the Ministry of Agriculture and Forestry, was founded with the intent of establishing and operating meteorology stations, carrying out and evaluating observations, making weather forecasts and providing meteorological information assistance for various sectors. The organization and duties and powers of the General Directorate was regulated by Articles 261 to 282 of the Presidential Decree No. 4, while very few provisions remained in the Law No. 3254 of 08/01/1986 on Meteorology Services which is the former organizational law. Among the tasks of the General Directorate are “to conduct studies and examinations to determine the climate characteristics of Turkey and to archive and publish the knowledge obtained”.

The General Directorate had a direct role to play on climate change, along with the Department of Research which was established as a main service unit with Article 9/B added to the Law pursuant to the Decree Law No. 657 in 2011 and which presently serves in the existing structure as a service unit. The Department of Research is tasked with conducting research and development studies on meteorological natural disasters, hydro-meteorology, marine and agricultural meteorology, climate, climate change, and other matters related to meteorology and carrying out meteorological works for environmental activities. Works of the units that serve under the Department are directly related to climate change adaptation. The tasks of the Climatology Branch, which is one of the units, are as follows:

- To conduct or cause to conduct monitoring, research, and modelling studies on climate and climate change,
- To analyse climate parameters and conduct a climatic classification for Turkey,
- To create climate projections by using models and to support adaptation and damage mitigation works against the unfavourable impacts of climate change,
- To conduct analyses and research on the ozone and ultraviolet radiation.

The Meteorological Disasters Branch is tasked with providing estimations and early warnings to reduce damages caused by disasters, contributing to disaster preparedness and disaster management, and conducting disaster analysis, research, and development studies. The annual Evaluation Report for Meteorological Disasters is prepared by this branch.

The tasks of the Agricultural Meteorology Branch include drought analyses, plant climate requirements, and modelling works.

Among the tasks of the Hydro-Meteorology Branch are studies on sudden flooding and early warning.

The projects under the Horizon 2020 Programme, which supports the multinational research and development projects of the European Union, are predominantly scientific studies compared to other technical assistance projects. Industrial enterprises, SMEs, SME associations, universities, research institutes, research centres, public agencies (central and regional/local), non-governmental organizations, international organizations, and individual researchers may benefit from the Programme. Climate change response projects take an important place in the portfolio of Horizon2020, which has been supporting scientific and specific themed projects in climate adaptation as well as mitigation (e.g. the 2018 application project titled “Horizon2020/Adaptive Tree Breeding Strategies and Tools for Forest Production Systems Resilient to Climate Change and Natural Disturbances”), and the number of project calls in this area seems to further increase. The Horizon2020 Programme calls for 2020 address both the subjects of adaptation and adaptation-mitigation combined. The priority topics of the call titled “Building A Low-carbon, Climate Resilient Future” are as follows; i) decarbonization, ii) climate change adaptation, iii) climate change impacts and climate services, iv) the relationship between climate change, biodiversity, and ecosystem services, v)



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cryosphere, vi) knowledge gaps on climate change, and vii) earth observation (EC Europa & Horizon2020).

The priority topics of the Horizon2020 calls titled “Green Economy in the Context of Sustainable Development Goals” are; i) Circular Economy: Connecting economic and environmental gains, ii) innovating cities, iii) sustainable supply of raw materials (non-energy and non-agricultural raw materials), iv) developing nature-based solutions, disaster risk mitigation, and natural capital accounting.

The PRIMA2020 Programme, which is a sub-programme of Horizon2020, supports joint international projects on the themes of water, agriculture, food, agro-food value chain in the Mediterranean. The following main themes were determined in the 2020 call of the Programme; i) Water Management (low cost, lean solutions for enhancing irrigation efficiency of smallholder farmers), ii) Agricultural Systems (re-design the agro-livelihood systems to ensure resilience), and iii) Agro-Food Value Chain (new optimization models of the agro food supply chain system to ensure fair price for consumers and reasonable profit share for farmers).

Under the Horizon2020 Programme, Turkey has newly begun to take part in some projects that are directly relevant to climate change adaptation, among which there is a recent project that is being implemented in Izmir since early 2019. The scientific team of the project titled “Urban Green UP” are academicians from Ege University and Izmir High Technology Institute. Under the multi-country project (Turkey, United Kingdom, and Spain<sup>56</sup>) the aim is to produce, implement, and conduct a 2-year monitoring on landscaping projects that formulate *Nature-Based Solutions* in demo areas determined in the cities of Izmir, Liverpool, and Vallidolit. The steps towards establishing a ‘Climate Sensitive Agricultural Education and Research Institute’ in Sasalı, which is a demo area in Izmir under the Green UP project, have been taken as of May 2020 (Sivil Sayfalar, 2020).

*Higher Education Sector’s Adaptation to Climate Change*- Climate change is an extremely important, even the most important area of responsibility for universities. This situation shows that higher education institutions require a change in this area in order to become more sustainable, which is a subject that has recently been addressed further at the international level. Supranational climate networks such as the International Universities Climate Alliance, Global Alliance of Universities on Climate, and Australasian Campuses Towards Sustainability have been urging for change in the management of the higher education sector as well as the sector itself. In 2019, the three universities wrote a letter signed by over 7,000 higher and further educational institutions, calling for a multitude of research, education and social assistance investments in the field of climate change in higher education and the reduction of emissions. Accordingly, it was recommended to make more sources available to produce action-oriented climate change research and skills and diversify the curriculum in universities. The call also included asking all universities to commit to become carbon neutral within the 2030-2050 timeframe.

Although only a limited number of universities have emission reduction and climate change adaptation plans, initiatives such as the Times Higher Education Impact Index reveal that there is a growing interest towards global climate action in the higher educational community (Burbridge, 2017). University campuses are being restructured as energy production and consumption areas. For instance, Strathmore University in Kenya and RMIT University in Australia are institutions that can produce their own renewable energies (Rickards and Pietsch, 2020).

Although a significant portion of the recent activities in the **universities in Turkey** does not reflect the expected scientific research potentials, the subjects on climate change impacts that are studied by the

<sup>56</sup> Project coordinatorship is in Spain.



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academic community are becoming increasingly satisfactory for the target groups in terms of awareness and capacity development. Although not directly relevant to adaptation, some universities are known to implement “carbon negative” activities at their campuses and increase their work on this subject. A hybrid (wind and solar energy system) renewable energy system was built in the Bitlis Eren University Campus, R & D activities are being conducted in the Kilyos Campus of Bosphorus University on generating, and storing, energy from a wind energy plant and other renewable energy sources serving as an alternative to wind (solar, wave, biogas, and geothermal), and research that targets transitioning from petrol-based economy to bio-economy by taking algae as raw material has been conducted in the of ‘Microalgae Biotechnologies Research and Development’ department of the Kilyos Campus.

Climatology is studied in three main units which are the Faculty of Aeronautics and Astronautics, Meteorological Engineering Department, ITU Eurasia Institute of Earth Sciences, and ITU Climate Change Application and Research Centre under Istanbul Technical University (ITU).

“International Symposiums on Atmospheric Sciences” are held annually by ITU Meteorological Engineering Department. The main theme of the 2019 Symposium (ATMOS2019) was “Interactions Between Climate Change and Sectors”.

ITU Eurasia Institute of Earth Sciences has long been carrying out numerous regular scientific research on impact assessments for climate change. In order to develop the climatology and meteorology in Turkey, the institute strives to ensure that the research on various subjects in various regions is brought to the agenda and provides an insight for the future through holding continuous training programmes and symposiums.

There is also recent scientific research available on various regions throughout the country, conducted by ITU Eurasia Institute of Earth Sciences with the support of TUBITAK programmes in the process of identification of climate change impacts, vulnerability assessments, and adaptation at the traditional TURQUA Symposiums (Quaternary Symposiums of Turkey) that have been continuing for 30 years. ITU Eurasia Institute of Earth Sciences brings scientists and experts from various universities in Turkey, building the nation-wide capacity on climatology through such activities in a broad spectrum extending from geomorphology, archaeometry, palaeoanthropology to prehistory, geology, and climatology under the framework of quaternary sciences.

*ITU Climate Change Application and Research Centre* was operationalized in 2019<sup>57</sup>. The Centre aims to conduct various works on numerous subjects for responding to climate change, including i) conducting national and international scientific research and studies and developing projects, ii) conducting national and international, interdisciplinary, theoretical and/or practical research on all fields such as agriculture, forests, water and energy resources and economic, social and cultural impacts, that fall within the scope of climate change, iii) following up on and creating a database for the studies conducted on climate change and its impacts in our country and in the world, ensuring sustainability in the data and research, iv) joining forces with institutions that are in charge of climate change and its impacts through collaborative protocols, v) enhancing Turkey’s potential for, presenting, and publishing practical research, and vi) determining the future impacts of climate change/variability on life and various sectors.

The Centre is involved in important areas of activity such as; i) conducting research on the mutual interaction between climate and agriculture, forestry, health, environment, water resources, economy, tourism, social, and other areas, creating a database, carrying out data analyses, producing solutions, and monitoring climate change, ii) ensuring future climate change modelling by using various

<sup>57</sup> <https://www.resmigazete.gov.tr/eskiler/2019/05/20190517-8.htm>



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scenarios, implementing and having others implement the changes in the model on estimations about global and regional climate change, continuously applying the models that have been developed on the data, updating the modelling results, and conducting research for the development of models, and iii) researching the potential impacts of climate change on various sectors.

As is evident from its name, *Selçuk University Research and Application Centre on Agriculture and Climate Change*<sup>58</sup> directly focuses on the agriculture sector, which is rather significant in terms of the development of agricultural activities in the basin (Konya Closed Basin) as well as identifying the potential areas of the agricultural sector that will adapt to climate change. Hence, the Centre is a first in the university community in terms of enhancing and promoting local research at the regional/aerial level.

With regard to the varying impacts of climate change according to regional characteristics and addressing problems and solutions at the regional level, the Centre is a good model for other universities that plan to establish research units on climate change in the future. The aim of the Centre is to research the climate change impacts on agricultural activities that cause important problems for the present and the future, proposing solutions to the problems encountered in implementation, and creating awareness by building joint cooperation efforts for the benefit of all beneficiaries and offering trainings to producers and scientific circles. In this framework, the Centre is responsible for building the infrastructure to conduct all types of laboratory and land works on the impacts of climate change on agriculture and carrying out climate change work related to horticultural plants, plant protection, food engineering, landscape architecture, field crops, agricultural economy, agricultural machinery and technological engineering, agricultural structures and irrigation, earth sciences and plant nutrition, and zotechnical disciplines. The Centre has a broad range of areas of activity, some of which are listed below:

- To conduct national and international theoretical and practical research projects for agriculture and climate change;
- To formulate protective soil tillage techniques to mitigate the impacts of global climate change and maintain the existing production, ensure the use of precision agriculture practices in production, develop suitable machinery and equipment for current needs, improve the use of biofuel due to its carbon dioxide emission reducing effects;
- To develop adaptation strategies for all changes that affect productivity and quality starting from the revival and blooming periods for climate change-dependent horticulture, improve the physiological state and storage duration of crops after harvest;
- To develop policies on the agriculture sector's adaptation to climate change and mitigating the negative impacts of climate change, undertake the publication work required for farmers, who are the most affected by this situation, to gain awareness, and conduct economic analyses for climate change impacts;
- To review the potential impacts of the predicted climatic changes on food security, develop aligned strategies to ensure food security, and establish sectoral collaborations on secure food by taking into consideration the changes in the food chain;
- To improve the existing management of basins by selecting the most appropriate irrigation systems in agricultural areas where ground and surface waters are gradually decreasing, and conduct optimization works by using new technologies in animal shelters and greenhouses that are affected by climate change;

<sup>58</sup> Selçuk University Regulation for Research and Application Centre on Agriculture and Climate Change, Official Gazette of 7 June 2019 issue 30794.





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- For the purpose of examining the effects of climate change on the physical, chemical, and biological characteristics of soil; to provide a suitable environment for quality plant breeding by taking into consideration the unfavourable impacts of the greenhouse gas emissions in laboratory, greenhouse, and agricultural atmospheres increase due to global warming which have been increasing due to global warming, maintain the organic matter of soil during such works, improve the moisture regime and plant nutrition status, and take measures to prevent land and water pollutions emerging as a result of various activities.

Bosphorus University Centre for Climate Change and Policy was established in 2014. The Centre in which researchers from various disciplines such as physics, environmental sciences, economy, geography, and tourism work has been carrying out interdisciplinary research on the impacts of climate change and policies and supporting studies for the implementation of such research in East Mediterranean and neighbouring regions such as the Middle East and Central Asia as well as the geographical region in which we live.

Sabancı University-Istanbul Policy Centre (IPC) is a direct unit working on climate change in Sabancı University. A climatology report titled “Climate Change and Drought” was published by IPC (Şahin and Kurnaz, 2014). The report, which contributed to the scientific research processes for climate change impacts, listed recommendations for particularly decision makers for policymaking purposes by taking into consideration the relation of drought to climate change and the multidisciplinary nature of such a problem. The research provided an important message that drought was a problem that requires policy management and to avoid addressing drought as a problem that is independent of climate change and against which finding realistic solutions would become more challenging in the opposite case. In that respect, the IPC report recommended that public administrators address the phenomenon of drought in conjunction with, and even as a part of, climate change.

Capacity Development Need of Academia- Having failed to disseminate throughout the country, climate change response activities of the universities in Turkey are concentrated in a few certain universities and the provinces in which such universities are located. The projects, which have been recently hosted by the universities in Istanbul, are implemented in other provinces. While providing short-term benefits, this may also hinder capacity development in terms of climate response in many universities across the country, and local actors from establishing joint efforts.

Gathering and Sharing Knowledge- While problems related to the scientific aspect of climate change impacts are encountered in the data collection works undertaken in Turkey, the failure to gather the available knowledge serves as the most significant bottleneck that challenges decision making processes. In this respect, it is important to share the existing and prospective knowledge and data within a joint system.

The knowledge acquired from the research and activities that have to date been undertaken on climate change impacts and adaptation may be considered as important advances towards establishing an extensive database in Turkey.

The fact that the subject covers different specialties causes the dispersion of powers and responsibilities in public administration amongst numerous institutions, disorganized production of knowledge, and available data to be in different formats and at different standards which has long required making the data and knowledge available to users by gathering and storing them within a system. As one of the key factors of achieving the goal of *adapting to the impacts of climate change in cross-cutting subjects* which is found in the National Adaptation Strategy and Action Plan (2011), this subject has also been an important goal in enhancing decision-making processes.

It was also aimed in the strategy to determine water resource, food security, soil and land use vulnerabilities caused by climate change, and revise the existing database and knowledge systems,



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which would support the monitoring and evaluation processes of the relevant ministries and institutions (DSI, GDM, GDARP, TIGEM etc.) related to the goal of formulating adaptation options, by considering climate change impacts and the present systems were developed within means.

The need for a continuous cooperation and coordination between the institutions producing and/or using data and knowledge and end users is central to climate change adaptation efforts. It is required to amass various subjects (flora and fauna, agriculture data, water management and land surveys, data on flood/overflow for prevention of natural disasters, socio-economic data by sectors, socio-ecological assessments, impacts on healthcare sector, urban resilience, etc.) through a systematic and holistic approach to climate change impacts.



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## 3. SECTORAL POLICIES AND CLIMATE CHANGE ADAPTATION

- Cross-sectoral integrated impacts are not taken into consideration in climate change adaptation works in Turkey and risk assessments cannot be conducted in this regard.
- Sector studies that serve as an interface for other sectors concerning climate change adaptation should be gathered.
- It is important to conduct integrated cost-benefit analyses, taking into consideration the mitigation and adaptation synergy in all relevant sectors, for climate change adaptation actions.

The essential purpose of a national climate change adaptation strategy is to further integrate adaptation actions into the key sectors in Turkey, enhancing resilience and preparedness against present and future climatic influences. Whether they are directly dependent on climate or their economies are sensitive to climate change, some sectors (particularly agriculture sector and water management) serve climate change adaptation by setting direct or indirect objectives in line with their main policy framework in terms of vulnerability. EU Member States (e.g. Malta, Romania) take special national and regional measures for adaptation in line with climate change impact and vulnerability assessments, while some even have a special, sector specific adaptation strategy. For example, a special adaptation strategy was drafted for the agriculture policies of Slovenia. Although none of the sectors in Turkey has a direct adaptation strategy, the agriculture sector has established a policy, taken measures, and been formulating options for the mainstreaming of climate change impacts into national agriculture policies in Turkey.

Taking into consideration that different policies are mutually complementary, the adaptation strategy fundamentally brings along various accelerator opportunities for all sectors to adapt to climate change. For example, an adaptation strategy in conjunction with an agriculture sector strategy is important for adapting to climate change in the agriculture sector in Turkey. In that respect, policies on water resources management (including floods) and/or environmental protection in the fields of biodiversity not only support the adaptation actions in the agriculture sector, but also further complement the sector specific strategy and the national adaptation strategy.

In the context of climate change adaptation, the decision makers in Turkey may have three basic options in addressing sectoral policies; the first of which is integrating adaptation into the individual strategy of each sector, the second of which is internalizing 'adaptation' as a cross-cutting factor of national development policies (i.e., sustainable development economy, green economy policies, low carbon development economy policies, circular economy, rural development economy, etc.), and the third of which is having an individual adaptation strategy for each sector.

When comparing Turkey's climate change response efforts with the EU approaches in the EU 2020 Progress Report, it is indicated that a long term and holistic national strategy that is aligned with the EU has yet to be developed and that the topic of climate change action has been poorly integrated into other sectoral policies.<sup>59</sup>

The business community especially needs to play an active role in climate change adaptation solutions. In cooperation with the public sector, sectoral actors can make use of commercial opportunities in certain service areas (healthcare, waste and water management, sanitation, housing, or energy sectors, etc.) in order to enhance resilience against climate change impacts.

<sup>59</sup> Turkey 2020 Report, European Commission, 2020 Communication on EU Enlargement Policy (COM/2020/660 final), Brussels, 06.10.2020.



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These issues were clarified while examining the present situation with regard to the link between sectors and climate change adaptation. Accordingly, the options, needs, and measures concerning the policies and instruments required by decision makers were examined separately for each sector.



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### 3.1. Agriculture sector and climate change adaptation

- In Turkey, sectoral climate change adaptation policies and practices are mainly concentrated in the agriculture sector.
- The existing institutional structure in Turkey is strong and sufficient in terms of the agriculture sector's adaptation to climate change.
- The most dynamic sector to support the functionality of the decision-making processes in proactive adaptation actions in Turkey is the agriculture sector.
- The sector has made progress in various fields of climate change adaptation, which is an important added value for Turkey to achieve its sustainable development goals.
- There is a direct link between climate change adaptation action and food expenses, which is also related to the topics of income level and social rights.
- In Turkey, organic farming is important for climate change adaptation but requires a systematic approach in policies and practices.
- Agriculture and rural development policies are the priority sectoral policies for a climate change adaptation on a regional and basin basis.

The “State of Climate Services 2019” report presented by the World Meteorological Organization at the 25<sup>th</sup> UNFCCC Conference of the Parties (COP25, November 2019, Madrid) focused primarily on agriculture and food security to ensure climate change adaptation on a global scale, emphasizing that the progress in fighting global hunger had been reversed. This situation shows that the interaction between climate change and agriculture is an unignorable fact; in fact, it would be accurate to predict that a significant portion of future potential risks in agricultural production will be a result of climate change caused by global warming.

#### 3.1.1. Sectoral impact of climate change

In addition to being a source of climate change, the agriculture sector is also one of the most affected sectors by climate change. The impacts of climate change on agricultural activities are particularly important due to the relationship between production and nutrition. Generally, all agricultural crops require soil, water, sunlight, and warmth to grow and climate is a dynamic component affecting all of the aforementioned components and therefore the risk it poses against the agriculture sector is very high due to the uncertainty in its nature. The changing of all meteorological parameters including the global average temperature and precipitation according to future estimations has already started to affect the type and place of agricultural production in the world. The general framework of the impact of climate change on agriculture and agricultural enterprises is provided in Table 5 (Ministry of Agriculture and Forestry, 2019).

Table 5. Impacts of climate change on agriculture and agricultural enterprises

Impacts of Climate Change on Agriculture	Impacts of Climate Change on Agricultural Enterprises
<ul style="list-style-type: none"> <li>• Deteriorating water and soil quality</li> <li>• Degrading ecosystem and decreasing biodiversity</li> <li>• Shifting ecological fields</li> <li>• Reduced agricultural production and quality</li> <li>• Increased pests and diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Sowing and planting problems</li> <li>• Harvesting and threshing problems</li> <li>• Tillage problems</li> <li>• Fertilization problems</li> <li>• Pesticide application problems</li> <li>• Cultural problems (hoeing, pruning, etc.)</li> <li>• Productivity problems</li> </ul>



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<b>Impacts of Climate Change on Agriculture</b>	<b>Impacts of Climate Change on Agricultural Enterprises</b>
<ul style="list-style-type: none"> <li>• Fertilization and pesticide application problems</li> <li>• Sustainable food security problems</li> </ul>	<ul style="list-style-type: none"> <li>• Quality problems</li> <li>• Water/irrigation water supply problems</li> <li>• Plant diversity problems</li> <li>• Enhanced plant growth due to increasing CO<sub>2</sub> concentrations</li> </ul>

After the 4<sup>th</sup> Industrial Revolution<sup>60</sup>, agriculture has become increasingly quality and productive. The agriculture industry will seemingly grow more important than ever in the next few decades, with technological developments playing an inevitable part in the future position of the agriculture sector. Smart agriculture systems with an advanced technology have already been implemented in some developed countries. Technology, which has an increasing presence in the agriculture sector, is becoming an integrated part of the sector. With the help of progressive technologies that facilitate the work of producers by increasing agricultural yield, earnings and quality, smart agricultural practices that are climate friendly are becoming widespread throughout the world.

Through high technology agricultural techniques and technologies, farmers/producers have the opportunity to acquire detailed information about such variables as soil acidity and temperature in addition to their respective regional topography and resources, access future weather and climate predictions, control natural elements such as moisture and temperature through digital sensors, and prevent the excessive use of resources such as water and electricity, allowing R & D and software development efforts to become more prominent. The interaction between climate change and agriculture has become a non-negligible fact and multi-disciplinary R & D studies that will be developed alongside the decisions to be taken and regulations and amendments to be made have become greatly important. Works that bring forward agricultural adaptation, capacity development, and awareness are continued through the Climate Smart Agriculture approach and the projects that are implemented by the UN in Central Asia and African countries.

This transformation in the agriculture system, which is defined as the rise of industrial agriculture since the mid-20<sup>th</sup> century and also referred to as the Green Revolution or Food Revolution, has become an agricultural form of production that increases grain yield in global agriculture, and enables production through hybrid plants grown as a result of planting genetically modified seeds. Supported by global food companies, this process has had a more intensive area of application in developing countries. On the bright side, this trend, which saved millions of people from hunger, has helped the development of productive grain types, improved irrigation opportunities, modernized protection techniques, and facilitated the provision of input such as hybrid seeds, GMO seeds, artificial fertilizers, herbicides, and pesticides to farmers.

As a result of the climatic changes caused by global warming, agriculture is predicted to become a technology sector in the future and be guided by the countries that possess such technologies. Therefore, policies on Industry 4.0, smart agriculture technologies, and innovative approaches (use of renewable energy sources in agriculture, etc.) should be formulated, quickly integrated into agricultural and food security practices and disseminated under climate change adaptation.

**In Turkey**, use of water in agriculture and drought are the leading problem areas in mainstreaming climate change into national agriculture policies. An important step of gaining/increasing the allocation and utilization efficiency of water resources as an economic value is to ensure adaptation against the

<sup>60</sup> Industry 4.0 Revolution: A 21<sup>st</sup> century manufacturing revolution in which smart products are manufactured in smart factories using cyber physical systems.



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impacts of climate change. In consideration of the fact that 75% of the overall water that is available in Turkey is used in agricultural irrigation and a significant portion of the water is lost on the way due to uncontrolled surface irrigation at the rate of 88.5% in agriculture; the rationalist management of the agriculture sector and water resources are clearly at the top of the agenda for climate change adaptation (Kodal and Ahi, 2018). In terms of the vulnerabilities of the sector, the water crisis triggered by climate change is known as the most important threat risk. Therefore, most studies conducted in Turkey under the agriculture sector's adaptation to climate change concern the protection of water resources, supporting and ensuring the common use of modern irrigation techniques for water-saving, establishing early warning systems for floods, and developing drought-resilient species.

### 3.1.2 Sectoral adaptation to climate change

While the impacts of climate change on agricultural productivity, hydrological balances, input sources, and a series of other agricultural system components are still felt today, its future impacts are estimated through modelling efforts and a number of applications, such as for the protection of agrobiodiversity for food security in the sector and sustainable management of sustainable soil using technologies that reduce carbon emissions to prevent land degradation, is exercised across the world based on the outputs of the modelling works (Zaimoğlu, 2019).

In an evaluation conducted in 2013 by the World Bank concerning Turkey's green growth policies, it was predicted that the environmental protection policies, which were addressed in the ongoing structural change in the agriculture sector, could lead to "climate-smart triple wins", which are i) mitigation through carbon retention, ii) better climate resilience, and iii) higher competitiveness and employment.

The fact that agricultural products (industrial plants) are considered as alternative renewable energy sources further enhances the sector's role in fighting against climate change in Turkey. One of the overall objectives is making the energy, which is obtained from unused agricultural wastes, available for the use of the industrial facilities in that regions and particularly the food industry and SMEs. In this way, it is predicted that modern bioenergy technologies and energy efficiency measures will be developed in the industrial agriculture sector in Turkey.

Due to agricultural activities being dependent on the natural and meteorological conditions, the agriculture sector is among the primary sectors that are the most vulnerable against and will be directly affected by climate change **in Turkey**. As the agriculture sector is one that provides food in addition to delivering raw materials to affiliated industries and creating employment, the impacts of climate change on agriculture may produce important social and economic consequences. While climate change prevention is prominent in terms of land use within the context of agricultural soils that serve as sinks, regulation of agricultural activities as well as the measures to be taken against risks, and opportunities become crucial in terms of adapting to climate change.

It is important to pay attention to the following with regard to climate change adaptation action in the agriculture sector in Turkey:

***Importance of soil organic carbon-*** Soil organic carbon is an extremely important and effective indicator in terms of balancing land destruction, sustainable use of the country's soils, and mitigating and/or eliminating the unfavourable impacts caused by climate change. Determining the types of use and mapping the locations of the lands in which national soil organic carbon stocks are low, adequate, or high is also required to formulate national land use policies. In the context of determining the present organic carbon stocks of Turkey's soils, a "Carbon Budget Map", prepared by GDARP by using the organic carbon values of mostly agricultural lands and brought into use by FAO, is available for Turkey's Soils.





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In consideration of the fact that soils with the largest carbon pool in terrestrial ecosystems have a significant carbon fixation potential in scientific and practical terms, the research to be conducted on soil organic carbon can mitigate the unfavourable impacts on climate change and facilitate climate change adaptation. In this framework, it is basically recommended to apply agricultural techniques that will not ruin soil organic matters and soil organisms in climate change response (including mitigation and adaptation) in the agriculture sector.

Prolonged dry periods and irregular climatic conditions may lead to short-term coping strategies such as deforestation and excessive grazing. Inappropriate agricultural practices and excessive grazing reduces the organic carbon contained in the ground and air, causing carbon reduction. Reduced organic matter renders the land more vulnerable against black carbon and erosion caused by heavy precipitation that increases with climate change. It also has negative effects on land productivity, biodiversity, and various physical, chemical, and biological characteristics of soil that affect ecologic functions. Changes in the ground cover may also lead to changes in local climatic conditions due to varying surface reflectivity and water transpiration.

Importance of pasture areas- Pasture areas are hot spots in terms of national carbon retention, food security, and erosion protection in which rehabilitative works need to be expanded (Doğanay and Akça, 2018).

Adaptation & mitigation synergy in energy production from agricultural wastes- In this day and age, agricultural wastes (plant wastes + animal wastes) can be converted into solid, liquid and gas fuel through different technologies and appropriate processes. There are millions of biogas facilities in the world that use conventional or modern technologies to produce energy from agricultural wastes. According to research, biomass has the largest share at 73% in **global renewable energy consumption**. In USA, nearly 1 billion kWh electricity is generated by 265 biomass facilities based on agricultural wastes. These figures demonstrate the raw material value of agricultural wastes, which are important sources of biomass (World Food Programme, 2018). Liquid biofuels (bioethanol, biodiesel) that are directly produced with plant-based raw materials are used in Turkey, as well, where there are also facilities, albeit few, that convert agricultural wastes into energy. There are modern facilities in Adana, Urfa, and Aydın where cotton straws and corn stalks are burnt, facilities that use rice husks, animal wastes, sunflower stalks in the Marmara Region, facilities that use oil residues in the Aegean Region, and facilities that use sunflower stalks in the Turkish Thrace Region. However, the existing facilities are not sufficient to use the agricultural waste potential of the country.

As an example of agricultural wastes in Turkey that have not yet been sufficiently recycled, although hazelnut shells are used in bakeries and houses as fuel in the Black Sea Region, green hazelnut shells are collected and left to rot in fields, leaving their energy content unutilized. Another opportunity pointed out in biogas production, which is an important step in the disposal of waste harming the soil by burning stubble, is the organic fertilizer with a residual value that remains after fermentation; agricultural reutilization of the fertilizers generated as waste from processes is particularly important in terms of agricultural sustainability and climate-smart agricultural practices.

Connection of stubble burning with climate change adaptation- The most ecologically unsuitable agricultural practice in the agriculture sector in Turkey is stubble burning<sup>61</sup>. As a habit of agricultural workers to prepare better seed beds and remove weeds, pests, etc. in order to prepare for aftercrops, stubble burning is an extremely improper and scientifically harmful method in terms of modern agricultural techniques as well as ensuring the agriculture sector's adaptation to changing climatic conditions. The most fundamental damage caused by stubble burning is the destruction of the organic matter in soil by burning, which is a loss that is usually impossible to compensate.

<sup>61</sup> Stubble: Agricultural waste, i.e., roots and stalks of the crops harvested as a result of agricultural production.



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The organic matter in soil constitutes the source of a portion of the nutrients required for plant growth in addition to absorbing and retaining rainwater in the soil, and preventing it from being carried away by erosion by ensuring the aggregation of soil. Stubble burning kills the microorganisms on the surface of the soil, as a result of which the biological quality of the topsoil deteriorates, soil moisture cannot be protected, agricultural biodiversity is damaged, and the loss of soil organic carbon and nitrogen that foster plant growth increases. Furthermore, stubble fires cause air pollution and forest fire.

In accordance with the provisions of the Forest Law (1956)<sup>62</sup> and the Environmental Law (1983)<sup>63</sup>, measures to prevent stubble burning are taken by a number of local institutions<sup>64</sup>, particularly provincial administrative authorities, and provincial organizations of the Ministry of Agriculture and Forestry (Provincial Directorates of Agriculture, Regional Directorates of Forestry/Forestry Operations Area Directorates/Precincts) and the Ministry of Environment and Urbanization (Provincial Departments of Environment and Urbanization). Additionally, governorships in many provinces do not apply the rule stipulating that “controlled burning stubble can be allowed under the responsibility of the Governorships and in the scope of the action plan prepared by the governorship”, strictly disallowing any kind of stubble burning including those that are controlled.<sup>65</sup> However, although imposed with increased force every year, all of these measures, inspections, and penal sanctions fail to suffice in practical terms; farmers cannot deal with agricultural wastes, so they usually burn the residual wastes in the field since they must sow seeds in the new harvesting period after gleaning the wastes of the former period. Studies on the subject are continued under the responsibility of the General Directorate of Agricultural Research and Policy (GDARP) of Ministry of Agriculture and Forestry, through the research conducted in some research institutes on alternative and sustainable solutions for stubble burning.<sup>66</sup> These studies, which are conducted within the framework of soil and water resources management, signify moving away from conventional soil tillage methods and using agricultural mechanization and information technologies. One of the key objectives of innovative soil tillage methods is to prepare good seed beds by processing the stubble that remains from the previous crops. It is predicted that problems related to excessive tillage will also be eliminated by using sowing machines on stubble, as well.

*Industrial agriculture and climate change adaptation*- While industrial agriculture continues to grow rapidly in the fields of grain crops, livestock breeding, and fishery, there have been discussions (e.g. discussions on various nutritional health problems, commodification of food which creates non-nutritional areas of use, particularly biofuel) on whether this process indeed increases agricultural production.

From the perspective of environmental protection and climate change response, these discussions focus on these artificial agricultural inputs, which have led to ecological problems in themselves, bringing significant costs for producers as well as the environment. Therefore, in light of the uniform

<sup>62</sup> Law No. 6831 on Forests (OG of 08.09.1956 issue 9402).

<sup>63</sup> Environmental Law No. 2872: (OG of 11.08.1983 issue 18132)

- Supplementary Article 1, subparagraph “c”- Burning stubble, the demolition of meadows and fields and any activity that causes erosion are forbidden. However, on the lands where the second production is cultivated, controlled burning stubble can be allowed under the responsibility of the Governorships and in the scope of action plan prepared by the governorship (Amendment: 26/4/2006 - art. 5491/1).

- Article 20, subparagraph “I”- Those who burn stubble contrary to Clause (c) of Supplementary Article 1 of this Law are fined 20 TL per decare. The fine shall be multiplied to five in case of burning stubble near forests or wetlands and inhabited quarters.

<sup>64</sup> Municipalities (those responsible for ensuring the response of fire authority units to extinguish stubble fire within adjacent areas), Presidencies of Agricultural Chambers, Provincial Gendarmerie Commands, Provincial Security Directorates, provincial organizations of the General Directorate of Highways, Provincial Directorates of National Education, and neighbourhood masters.

<sup>65</sup> Governorship of Sakarya, Circular on Prevention of Stubble Fires (Circular No. 2019/3).

<sup>66</sup> Şanlıurfa Instance: The project “The Investigation of the Applicability of Direct Sowing into Stubble as an Alternative to Conventional Soil Tillage System” carried out by GAP Directorate of Agricultural Research Institute and supported by GDARP and Harran University, Agricultural Machinery Department under the Faculty of Agriculture, began in 2017 and has been continuing.



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predictability of modern industrial agriculture, such problems that were initially unpredictable have brought along new threats created by industrial agriculture at their respective scales.

***Regenerative agriculture and climate change adaptation:*** Soil destruction is both a cause and a result of climate change. Increased carbon emission into the atmosphere causes soil destruction and biodiversity loss, while intensive agricultural production increases greenhouse gas emissions. As soil is also an important and reliable sink for carbon, the carbon retained by the soil is lost as a result of intensive agricultural activities and errors in soil management. This situation is a significant risk for the soils of Turkey.

Within the framework of the efforts by the General Directorate of Combating Desertification of Ministry of Agriculture and Forestry, it is specified that soil lands in Turkey face the risk of erosion and desertification in Central, East, and Southeast Anatolia Regions<sup>67</sup>. In Turkey's case, the mismanagement of soil and terrestrial ecosystems lead to a chain of problems including the impoverishment and loss of water retention qualities of soil, loss of biodiversity, desertification, and ultimately hunger. New techniques, such as regenerative agriculture, integrating soil and agriculture in responding to climate change have started to become a current issue in Turkey.

The methods of applying regenerative agriculture techniques in Turkey are discussed through some projects. For instance, the "Green Economy Policies for Climate" report, prepared in 2017 in coordination with the Green Thought Association, Sabancı University Istanbul Policy Centre (IPM) and Green European Foundation, indicates that the existing agriculture and food system slows down climate change response, as it does in the rest of the world. This situation makes it difficult for the agriculture and food sector to adapt to climate change, leading to the degradation of soil and eradication of the livelihoods of small farmers. This report emphasizes that the methods (such as carbon sequestration<sup>68</sup>) for protecting the natural carbon cycle of soil organic matter through regenerative agricultural practices is a symbiotic<sup>69</sup> tool that can be used for climate change adaptation, also highlighting that the applicability of regenerative agriculture is low cost. Accordingly, the land use planning works included in the provisions of soil conservation and land use laws is important in terms of soil management, which has five basic factors; i) carrying out soil analyses, ii) controlling mineral fertilizer applications, iii) enhancing the carbon retention capacity of the soil through compost applications, iv) increasing no-till agricultural practices, v) reusing agricultural wastes with high carbon content in the soil.

***Ensuring adaptation to climate change in agriculture through resilient seeds-*** The traditions of eco-friendly production, which have long been abandoned in Turkey, are beginning to revive for fighting climate change in rural areas. Hybrid seeds, which are heavily used in agricultural production in Turkey, are preferred, or forcibly preferred, in terms of market demands and the productivity of crops from primary planting, with the influence of related policies and legal and institutional regulations. Very few of the village-specific species, which were named after their region and/or form as part of historical Turkish traditions, reach large markets due to production efficiency; they disappear in the system, become obsolete or fall out of favour.

It is necessary to use, develop, and diversify seeds that are resilient to prolonged drought, soil salinity, or sudden and heavy precipitation caused by climate change. Therefore, it has become increasingly important to recover the memories concerning the seeds, agriculture techniques, means of product storage/conservation, etc. that were inherited from generation to generation.

<sup>67</sup> Definition of desertification in Article 1 of the United Nations Convention to Combat Desertification: land degradation, or soil erosion, in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.

<sup>68</sup> A method used to introduce permanent organic matter into the soil or to increase the existing matters.

<sup>69</sup> Symbiosis: a living relationship in which two living creatures co-exist as a single organism, providing mutual assistance.



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Native seeds, which are generally produced and sold in local markets by smallholders, has a fundamentally vital value in protecting agricultural gene pools and ensuring food security due to their adaptability to changing climatic conditions, low water needs, and ability to provide seeds for the next planting year.

There is a greater need for works such as taking inventory of Turkey's native seed legacy and creating a database; intergenerational knowledge gap should be focused on in order to do so. While policies and practices related to the impacts of climate change on the agriculture sector are studied, the need for studies/research on such characteristics of native seeds and species as being resilient to drought and diseases, and adaptability to increasing global temperatures still remains. In order to achieve this, local communities and civil formations, individuals, universities/research institutes, local seed companies, organized non-governmental organizations, and local governments (governorships and municipalities) must work in cooperation so that an opportunity may arise to prevent the country's dependence on foreign sources in agriculture. The Ministry of Agriculture and Forestry has an increasing number of projects and applications in this field; the 'Native Seed Project', initiated in 2017 and implemented in cooperation with the organizations and institutions of the Ministry of Agriculture and Forestry, and the Mobilization for Seeds from Grandfather to Grandson have been continuing in the charge of First Lady Emine Erdoğan, wife of President Recep Tayyip Erdoğan.

In **legislative** terms, there are numerous legislations (primary and secondary legislation) on the sector, most of which are considered to be directly or indirectly associated with combating climate change (including mitigation and adaptation responses), that constitute a legal framework for Turkey's agriculture policy. Such legislation may be listed as follows: Agriculture Law No. 5488,<sup>70</sup> Law No. 5403 on Soil Conservation and Land Use,<sup>71</sup> Law No. 95262 on Organic Farming,<sup>72</sup> Meadows Law No. 4342,<sup>73</sup> Law No. 5996 on Veterinary Services, Plant Health, Food and Fodder,<sup>74</sup> Law No. 5553 on Seeds,<sup>75</sup> Regulation on Good Agricultural Practices in Turkey,<sup>76</sup> Agricultural Reform Law No. 6511 For Land Arrangements in Irrigation Areas,<sup>77</sup> Law on Aids to be Provided to Farmers Affected by Natural Disasters,<sup>78</sup> Regulation on Agricultural Basins,<sup>79</sup> Law No. 3573 on Olive Improvement and Grafting of Wild Species,<sup>80</sup> Decree of the Council of Ministers on Supporting Producers who prefer Environmentally-Based Agricultural Land Protection Project (ÇATAK),<sup>81</sup> Communiqué No. 2016/9 on implementation of Council of Ministers Decree on Supporting of Producers who prefer Environmentally-Based Agricultural Land Protection Program (ÇATAK),<sup>82</sup> etc.

The purpose of **Law No. 5488 of 18/04/2006 on Agriculture** is to determine the policies and introduce the legislation required to improve and support the agriculture sector and rural areas in line with development plans and strategies. The Law on Agriculture includes references to matters that are

<sup>70</sup>Agriculture Law No. 5488, OG of 25/04/2006 issue 26149.

<sup>71</sup> Law No. 5403 on Soil Conservation and Land Use, OG of 19/07/2005 issue. Some articles were introduced in 2014 (OG of 15/05/2014 issue 29001).

<sup>72</sup> Law No. 95262 on Organic Farming, OG of 03/12/2004 issue 25659.

<sup>73</sup> Meadows Law No. 4342, OG of 31/07/1998 issue 23419.

<sup>74</sup> Law No. 5996 on Veterinary Services, Plant Health, Food and Fodder, OG of 03/06/2010 issue 27610.

<sup>75</sup> Law No. 5553 on Seeds, OG of 08/11/2016 issue 26340.

<sup>76</sup> Regulation on Good Agricultural Practices in Turkey, OG of 07/12/2010 issue 27778. Regulation was updated in 2014.

<sup>77</sup> Agricultural Reform Law No. 6511 For Land Arrangements in Irrigation Areas, OG of 01/12/1984 issue 18592. Most recently updated in 2017.

<sup>78</sup> Law on Aids to be Provided to Farmers Affected by Natural Disasters, OG of 20/06/1977 issue 2090.

<sup>79</sup> Regulation on Agricultural Basins, OG of 7.9.2010 issue 27695.

<sup>80</sup> Law No. 3573 on Olive Improvement and Grafting of Wild Species, OG of 07/02/1939 issue 4126.

<sup>81</sup> Decree of the Council of Ministers on Supporting Producers who prefer Environmentally Based Agricultural Land Protection Project (ÇATAK), OG of 14/11/2008 issue. Most recently updated in 2017 (OG of 17/08/2017 issue 30157).

<sup>82</sup> Communiqué No. 2016/9 on implementation of Council of Ministers Decree on Supporting of Producers who prefer Environmentally Based Agricultural Land Protection Program (ÇATAK), OG of 31/03/2016 issue 29670.



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closely relevant to climate change, such as environmental protection, improvement of soil and water resources, conservation of biodiversity and ecosystems, and natural disaster response and mentions the provisions on sustainability in agricultural production and development through a holistic approach, human health, and environmental consciousness among agriculture policy principles. Among the priorities of agriculture policies under the Law on Agriculture are the following, which may be considered as part of climate change adaptation.

- Developing risk management mechanisms for natural disasters
- Making a land use plan
- Improvement and rational utilization of soil and water resources.

The Law refers to the “aids for the protection of agricultural lands programme for environmental purposes” within the scope of agricultural support tools. Accordingly, it is stipulated to provide aids under the protection of agricultural lands programme for environmental purposes in order to encourage farmers, who undertake tillage farming practices in agricultural lands that are exposed to erosion and adverse environmental impacts, to use their lands for natural plant covers, pastures, organic farming, and afforestation. Additionally, environment is among the priority and favourable topics in agricultural support practices.

The Law also contains legislation on the protection of biodiversity, genetic resources, and ecosystem and ensuring biosafety. It is also stipulated by the Law to determine agricultural basins in order to concentrate, support, organize, specialize, and undertake integrated agricultural production in areas that are suitable for its respective ecology. The provisions of the Law that are related to rural development indicate the implementation of the principles regarding improvement of agricultural and non-agricultural employment, increasing and diversification of incomes, taking measures to increase the educational and entrepreneurial levels of women and the young population in rural areas; and engagement, bottom-up approach, local capacity development and institutionalization in projects and activities. Some of the regulations issued under the Law are; i) Regulation on Agricultural Basins (2010), ii) Regulation on Agricultural Production Registration System (2014), iii) Regulation on Good Agricultural Practices (2010), and iv) Protection and Sustainable Use of Aquatic Genetic Resources (2012).

The Ministry of Agriculture and Forestry is mainly responsible for the implementation of the Agriculture Law. The Agricultural Support and Steering Board addressed in the Law was abolished, and it was stated in the Presidential Circular No.3 that its duties would be fulfilled by the Ministry of Agriculture and Forestry and the Ministry of Treasury and Finance.

It is particularly important to implement the Law on Agriculture, which basically regulates the agriculture sector based on policies, principles, and supports, by using a climate change adaptation approach.

**Law No. 5403 of 03/07/2005 on Soil Conservation and Land Use** determines the basic principles for soil conservation, development, balanced and efficient use and management and the principles and procedures to ensure the classification and planned use of agricultural lands in line with the principle of sustainable development with an environmental priority. The Law stipulates to determine appropriate forms of land use based on water potential and soil databases and maps, by taking into consideration the abilities and other characteristics of the land, which provides a basis for national and regional plans and data for other physical planning through land use plans; and that land use plans will include agricultural lands, pasture lands, forest lands, areas determined by special laws, settlement areas, social and economic infrastructure facilities, and other forms of land use.

Additionally, the Law on Soil Conservation and Land Use also regulates the preparation of soil conservation projects to prevent natural soil losses through agricultural land use plans and projects.





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Article 15 of the Law regulates the identification and conservation of erosion sensitive areas. The Article makes direct reference to climate change by its provision stipulating that by cooperating with relevant public entities and non-governmental organizations, the necessary measures must be taken in areas that become subject to desertification and soil degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities (Kocaman and Talu, 2019).

The Law contains a regulation on determining the plains with a high agricultural production potential and in which there are rapid occurrences of soil loss and land degradation resulting from various reasons such as erosion, pollution, misapplication, or misuse as great plain conservation areas, which is a new type of conservation area. The number of plains that have been designated as great plain conservation areas and likened to “agricultural protected areas” is 257.

**Meadows Law No. 4342 of 25/02/1998** regulates the identification, limitation, and allocation of meadows, summer quarters, winter quarters, pastures and permanent grasslands and their proper use, their maintenance and rehabilitation to increase and sustain their productivity, inspection of their use, their protection, and changing their purpose of use when required.

The Regulation of 2012 on Grazing of Animals in Forests and Meadows, Summer Pastures and Winter Quarters Located within Forests and the Regulation of 1998 on Meadows were issued based on the Law.

The task of ensuring the protection of, protecting, and taking the necessary measures for permanent grasslands, meadows, summer and winter quarters is performed by the Directorate General of Crop Production of Ministry of Agriculture and Forestry.

**Law No. 3573 of 26/01/1939 on Olive Improvement and Grafting of Wild Species** aims to improve the olive sector through the protection and maintenance of olive groves, striving to prevent any intervention in olive groves other than olive cultivation activities. Another law which must be addressed within the scope of protecting biodiversity with regard to adaptation to the impacts of climate change is the Law No. 5553 of 31/10/2006 on Seeds, whose purpose is to enhance productivity and quality in plant production, ensure seed quality, and regulate the production and trade of seeds.

The Law on Seeds involves legislation concerning the registration of the species and genetic resources of reproduction materials of field crops, vineyard and orchard plants, and forest and other plants, and regulations on the production, certification, trade, and market surveillance of seeds. The Ministry of Agriculture and Forestry is mainly responsible for the implementation of the Law.

In consideration of the growing interest in organic agricultural products and native grain species used in bakery products, efforts for the research, protection, improvement, and dissemination of wheat and barley seeds and particularly drought resilient native species should be supported. In this framework, the Regulation on Plant Varieties Registration, Production and Marketing, which regulates the reproduction, marketing, retention and sustainable use of seeds in order to prevent the genetic erosion of native species of field crops, vineyard and orchard plants and other plants in our country was introduced in 2018.

In terms of **institution building**, the **Ministry of Agriculture and Forestry** stands out in the determination and implementation of climate change response policies in Turkish agriculture. The organization and duties and powers of the Ministry are regulated in Articles 410 to 440 of the Presidential Decree No. 1.



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The Ministry was established by combining the Ministries of Food, Agriculture and Livestock and Forestry and Water Affairs.<sup>83</sup> Among the topics in the Ministry's remit, which were formerly under the charge of the Ministry of Food, Agriculture and Livestock are: i) crop and animal production and aquaculture, ii) development of the agriculture sector, iii) food production, security, and safety, iv) rural development, v) protection of soil, water resources and biodiversity, and vi) regulation of agricultural markets. The tasks of the Ministry of Agriculture and Forestry that formerly belonged to the Ministry of Forestry and Water Affairs are; i) Protection, development, cultivation of forests, ii) combating desertification and erosion, afforestation; meadow rehabilitation for forests, iii) environmental protection, identification of protected areas; protection of national parks, natural parks, natural monuments, nature conservation areas, wetlands; protection, management, improvement of biodiversity, hunting animals and wildlife, iv) protection and sustainable use of water resources, and v) monitoring of meteorological events.

Most main service units<sup>84</sup>, affiliated entities, research institutes/centres, higher councils and institutions, and provincial organizations<sup>85</sup> of the Ministry are concerned with and have tasks and powers related to climate change adaptation.

While numerous units in the institution building of the GDM are concerned with climate change, the "Department of Climate and Agricultural Meteorology" is directly relevant to the agriculture sector.<sup>86</sup> The tasks of the Department of Climate and Agricultural Meteorology are listed below:

- Conduct or cause to conduct agro-meteorological research and development studies and agrometeorological applications for the agriculture sector
- Conduct research and analysis on drought, conduct or cause to conduct studies on the effects of meteorological factors on plant growth
- Conducting research and analyses for the use of remote sensory and numerical prediction products in agriculture
- Monitoring, investigating, reporting the climate and climate change by using climate records and observations and sharing such records with the national and international public, carrying out studies concerning Turkey's climate and climate classifications
- Conduct or cause to conduct climate change modelling works; providing scientific assistance to climate change adaptation or mitigation works undertaken against the adverse impacts of climate change by public entities by producing data and products for climate change projections
- Engage in technical cooperation with international organizations on issues in its remit
- Conduct and publish scientific studies on the subjects in its remit; collaborate and participate in studies with relevant public institutions, organizations and universities
- Investigate the weather and climatic events that negatively affect human, plant and animal health and develop or cause the development of climatic and meteorological early warning systems in order for necessary measures to be taken.

<sup>83</sup> Decree Law No. 639 of 03/06/2011 and Decree Law No. 645 of 29/06/2011 regulating the organization of the said ministries were repealed.

<sup>84</sup> Main Service Units of the Ministry of Agriculture and Forestry: General Directorate for Nature Conservation and National Parks, General Directorate for Water Management, General Directorate of Combating Desertification and Erosion, General Directorate of Plant Production, General Directorate of Agricultural Reform, General Directorate of Agricultural Research and Policy, General Directorate of Agricultural Insurance Pool Management Company, and General Directorate of Central Union of Turkish Agricultural Credit Cooperatives.

<sup>85</sup> To reach the provincial organizations, research institutes, regional directorates, provincial and district directorates under the Ministry: <https://www.tarimorman.gov.tr/Sayfalar/Detay.aspx?SayfaId=13>.

<sup>86</sup> Presidential Decree, No. 67 (OG of 18 September 2020 issue 31248).





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The tasks of the main service units (as well as their affiliated internal and local institutionalization) of the Ministry of Agriculture and Forestry whose activities are directly or indirectly related to climate change adaptation are discussed in detail below.

The tasks of the General Directorate of Agricultural Reform that are related to climate change may be summarized as follows:

- Environmental and land improvement.
- Improving quality of life and local rural development capacity in rural areas.
- Efficiency in agricultural irrigation.
- Protecting soil resources.
- Duties assigned pursuant to the Law on Soil Conservation and Land Use.
- Services related to global climate change, agri-environment, drought, desertification, other agricultural disasters and agriculture insurance; assistance to farmers harmed by natural disasters

Law No. 2090 of 20/06/1977 on the Assistance to Farmers Who Have Suffered Losses Due to Natural Disasters stipulates to establish a Department of Disasters within the body of the Ministry to perform the tasks designated by this Law to the Ministry of Agriculture and Forestry. The said Department is the Department of Agricultural Insurance and Natural Disasters of the General Directorate of Agricultural Reform.

**General Directorate of Agricultural Reform (TRGEM)** is the main responsible institution in the implementation of the Law on Soil Conservation and Land Use. Within the framework of its tasks and powers, TRGEM has been carrying out its works related to evaluating the sectoral impacts of climate change and reducing greenhouse gases caused by the agriculture sector by means of its various units.

In this context, the prominent tasks of GDAR, *Department of Agri-Environment and Conservation of Natural Resources* related to climate change impacts on the sector are specified below;

- i) to prepare, cause to prepare, implement, and provide the necessary support to plans, programmes, national and international projects related to biodiversity in agricultural ecosystems, climate change, sustainable use of natural resources, environment and climate friendly agricultural practices,
- ii) to undertake and cause to undertake works on agricultural drought and desertification caused by global climate change,
- iii) to undertake works on the efficient use of animal and agricultural wastes in energy through biomass methods, and
- iv) to make calculations for agricultural greenhouse gas emissions and sinks, and to prepare the National Greenhouse Gas Inventory.

Furthermore, other units of GDAR that are concerned with climate change such as the Department of Agricultural Insurance and Natural Disasters, Department of Soil Conservation and Land Use and the Department of Irrigation Systems and Agricultural Infrastructure Services also have tasks that are associated with the impacts of climate change on the agriculture sector.

The prominent tasks of GDAR, *Department of Agricultural Insurance and Natural Disasters* related to climate change impacts on the sector are specified below;

- i) to make plans and ensure the submissions of proposals for the approval of the President regarding the premium assistance to be provided according to agricultural products, risks, regions, and enterprise scales,
- ii) to perform the tasks assigned to the Ministry pursuant to the Agricultural Insurance Law,



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- iii) to ensure that the total premium assistance, which will be covered by the Government based on the standard state-funded agricultural insurance policies to be issued by insurance companies for the risks that are secured in the pool database pursuant to the Presidential Decree, is transferred to the agricultural insurance pool account by taking into consideration other registrations at the Ministry's 'Farmer Registration System' and at the Ministry,
- iv) to ensure that draft decrees are submitted to the President of the Republic for approval relating to subsidizing the extra damage support committed by the state to the agricultural insurance pool for the likely extra damage in accordance with the risk sharing and reinsurance plan as approved by the management of agricultural insurance pool and the subsidy for extra damage is transferred to the agricultural insurance pool account; supervise the smooth payment of damage compensation,
- v) to participate in the works and applications regarding agricultural insurance,
- vi) within the framework of the Law No. 2090 of 20/06/1977 on the Assistance to Farmers Who Have Suffered Losses Due to Natural Disasters, to ensure the allocation of appropriations under disaster regulations in order to provide the aids specified in the Law to all farmers whose agricultural assets have been damaged,
- vii) to monitor credit paybacks of farmers who have suffered from disasters, whose status will be evaluated under Law No. 2090 and to whom credit was provided; to ensure the postponement of credit debts of the farmers who have used credit under Law No. 2090 and suffered another disaster in one year.

The prominent tasks of GDAR, *Department of Soil Conservation and Land Use* related to climate change impacts on the sector are specified below;

- i) to ensure that the soil database is improved, updated, and the bases required for agricultural land use plans are established,
- ii) to prepare risk maps regarding soil and erosion and to operate in cooperation with other relevant public institutions and non-governmental organizations in this regard,
- iii) to determine the working principles and procedures of Soil Conservation Boards (in accordance with Law No. 5403 on Soil Conservation and Land Use),
- iv) to conduct and cause to conduct land and soil surveys, classification, and mapping procedures,
- v) to control and approve all soil maps prepared across the country and create a national soil and land database and to prepare or cause to prepare land use plans,
- vi) to perform or cause to perform the procedures for determining plains with a high agricultural production potential,
- vii) to make or cause to make land use plans for farming purposes and/or soil conservation projects,
- viii) to conduct or cause to conduct analyses for soil and irrigation waters, and
- ix) to perform the procedures for off-farm use of agricultural lands in the application areas covered by Law No. 3083, by taking into consideration the cases of necessity and objectives of the Law.

The prominent tasks of GDAR, *Department of Irrigation Systems and Agricultural Infrastructure Services* related to climate change impacts on the sector are specified below;

- i) to determine the Ministerial policies and strategies for agricultural irrigation and infrastructure services,



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ii) to undertake, cause to undertake, and support the works intended for promoting water-saving on-farm modern irrigation systems,

iii) to take measures to ensure the sustainability of agriculture by cooperating with water user organizations and to undertake or cause to undertake works to increase productivity in irrigation, and

iv) to perform or cause to perform the services for the conservation and improvement of soil and water resources, water supply in rural areas, and removal of used waters in areas that are declared as application areas pursuant to Law No. 3083.

The tasks of the **General Directorate of Combating Desertification and Erosion** includes works related to combating desertification and erosion, avalanche, landslide and flood control, integrated basin rehabilitation, and water basins for the purposes of soil conservation and improvement of natural resources. The works undertaken for the transformation and improvement of soil organic carbon stocks in Turkey are carried out under the leadership of the General Directorate of Combating Desertification and Erosion of Ministry of Agriculture and Forestry. The implementation and coordination responsibilities of the United Nations Convention to Combat Desertification, to which Turkey is a signatory, are assumed by the General Directorate of Combating Desertification and Erosion (GDCDE). The Convention, which establishes the state of desertification on a global scale, aims to mitigate the impacts of drought, contribute to sustainable development in countries affected by desertification, enhance cooperation in combating desertification, and disseminate good practices. In that regard, it is required to improve productivity and ensure the sustainable management of land and water resources, and implement long-term strategies to improve the living conditions of local communities, in particular, in affected areas. Desertification which results from climate change and human activities reduces the resilience of degraded lands and the productivity of soils, thus affecting the flora and fauna, causing shortages by reducing food production, and leading to other economic and environmental problems, migration, conflicts, and social disasters.

Among the tasks of the **General Directorate of Plant Production** that are related to climate change may be summarized as follows:

- Coordination to achieve new modes of production by considering human health and the ecological balance, and to prevent possible pollution.
- Rehabilitation and maintenance of pastures, meadows, summer and winter quarters.
- Services related to the activities and operation of agricultural basins.

The tasks of the **General Directorate of Nature Conservation and National Parks** include the determination of national parks, nature parks, natural monuments, nature conservation areas and wetlands and the protection, development and management of those registered by the Ministry of Environment and Urbanization; studies related to the protection and development of areas concerning wildlife, forest water resources, streams, lakes, ponds and wetlands and sensitive areas, and areas and plant and animal species protected by international conventions; registration and announcement of nature parks, natural monuments and nature protection areas, wetlands and other similar protected areas in forests and places subject to forest regimes.

The tasks of the **General Directorate of Water Management** include the determination of policies regarding the protection, improvement and use of water resources; river basin management by basins in order to ensure the preservation and enhancement of the ecologic and chemical qualities of the aquatic environment; and flood management.

The General Directorate of Water Management also has a task that is directly related to climate change which is *“To undertake works on the impacts of climate change on water resources”*. The Climate Change Adaptation Branch of the *Department of Flood and Drought Management* of the General



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Directorate is in charge of carrying out works on the impacts of climate change on water resources, floods, drought and the measures to be taken in this regard.

**General Directorate of Agricultural Enterprises (TİGEM)**, which is an affiliated entity of the Ministry of Agriculture and Forestry, is in charge of operating 15 state farms (319,870 ha land) engaging with agriculture in Turkey. The key responsibilities of the farms are seed production and livestock breeding to meet the farmers' rehabilitated seed and genetic material needs. TİGEM supports the dissemination of knowledge on sustainable lands and water management amongst farmers.

Numerous projects on the impacts of climate change on the sector are implemented within the duties and powers of the **General Directorate of Agricultural Research and Policy (GDARP)**. The GDARP unit that is directly concerned with climate change is the Department for Research on Soil and Water Resources, which is officially in charge of preparing, having others prepare, monitoring, and evaluating research projects on climate change, desertification, erosion, and soil and water pollution.

The Department for Research on Soil and Water Resources also prepares research projects on the efficient and sustainable use and classification of and creating a database for soil and water resources in Turkey and on-site retention of soil moisture, which are directly related to the sectoral climate change impacts.

GDARP departments carry over 30 permanent working groups that conduct and monitor research in various fields.<sup>87</sup> The tasks of the Working Group for Research on Climate Change and Agricultural Ecology of the Department for Research on Soil and Water Resources are specified in Table 6:

Table 6. Internal organization of GDARP for adaptation-1

Department	Working Group	Tasks
Department for Research on Soil and Water Resources	Working Group for Research on Climate Change and Agricultural Ecology	<p>a) To determine the possible changes to be caused by climate change in soil and water resources, to undertake and coordinate the development of appropriate climate-friendly techniques and adaptation strategies for agricultural production, to prepare, cause to prepare and implement national and international research projects, to monitor ongoing projects and evaluate finalized projects,</p> <p>b) To examine the impacts of drought and climate change on agriculture and ensure their determination by climate and plant development models,</p> <p>c) To ensure the measurement and monitoring activities to determine the share of agriculture in the greenhouse gas budget, to undertake and coordinate the works to contribute to the development of strategies and practices to reduce greenhouse gas emissions caused by agriculture,</p> <p>ç) To ensure the development of measures and early warning models for the protection and monitoring of</p>

<sup>87</sup> Source: Task Guidelines for Working Groups of General Directorate of Agricultural Research and Policy (The Guidelines were based on Articles 508 and 509 of Presidential Decree No. 1 on Presidential Organization published in the Official Gazette of 10.07.2018 issue 30474).



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Department	Working Group	Tasks
		<p>soil moisture in order to reduce the risks in agricultural production in arid and semi-arid regions,</p> <p>d) To ensure the development of water harvest methods that are suitable for agricultural ecologic regions,</p> <p>e) To undertake and cause to undertake works on determining, monitoring and improving land degradation and determining and monitoring methods of combating erosion and desertification in agricultural lands.</p>

The responsibilities of some working groups under other departments of GDARP concerning indirect response to climate change are shown in

Table 7:

Table 7. Internal organization of GDARP for adaptation - 2

Department	Working Group	Tasks
Department for Research on Plant Health	Working Group for Research on Weeds	“To coordinate the research on the examination of the changes in weeds caused by climate change and the development of response strategies based on climate change with the relevant department,”
Department for Research on Livestock and Aquaculture Products	Working Group for Research on Large Livestock	“In coordination with the relevant department, to prepare and cause to prepare, support, monitor and evaluate R & D projects on global climate change and its possible impacts on large livestock; to carry out the necessary actions to share the outcomes with the implementing organizations,”
	Working Group for Research on Small Livestock	“In coordination with the relevant department, to prepare and cause to prepare, support, monitor and evaluate R & D projects on global climate change and its possible impacts on small livestock; to carry out the necessary actions to share the outcomes with the implementing organizations,”
	Working Group for Research on Poultry and Other Small Pets	“In coordination with the relevant department, to prepare and cause to prepare, support, monitor and evaluate R & D projects on global climate change



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Department	Working Group	Tasks
		and its possible impacts on poultry, bees, silkworms, rabbits and other small pets; to carry out the necessary actions to share the outcomes with the implementing organizations,”
	Working Group for Research on Fishery and Aquaculture Products	“To cooperate with relevant departments on issues involving the relationships between global climate change and aquacultural production,”
	Working Group for Research on Animal Genetic Sources	“To conduct and cause to conduct research on the adaptation of native animal breeds to marginal environmental conditions and possible global climate change and carry the results into effect with the coordination of the relevant department.”

Furthermore, almost all working groups are responsible for developing new varieties that can adapt to changing climatic and environmental conditions and ensuring the adoption and implementation of approaches that will shorten the rehabilitation period.

GDARP has many interactive projects on *agriculture & climate* change adaptation that are undertaken jointly with the “Working Group for Climate Change and Agricultural Ecology” together with their institutes in various regions of Turkey. As of February 2019, there are 50 ongoing, 8 finalized, and 11 proposed projects that are directly related to climate change and 3 projects that are funded by the EU and other sources (i.e., the Special Provincial Administration<sup>88</sup>).<sup>89</sup> The projects are implemented with institutes/centres and occasionally as joint studies conducted with other general directorates of the Ministry of Agriculture and Forestry. In this regard, GDARP has an intra-institutional business protocol on the R & D projects executed between the General Directorate of Combating Desertification and Erosion and the General Directorate of Forestry.

GDARP’s ‘Research Projects for Agricultural Machinery and Technologies’ also directly/indirectly covers the subject of adapting to climate change. As of February 2019, there are 16 ongoing, 11 newly proposed, 5 finalized projects on the agenda of research institutes in this framework, in addition to three projects that are supported by the EU and other sources (i.e., the Special Provincial Administration).<sup>90</sup>

Among these, some hybrid projects addressing emission reduction in conjunction with climate change adaptation are especially important. For example, the project titled ‘Drying of Chandler Walnut Variety Using Solar Energy-Biomass Hybrid System in Tekirdağ Province’, which has been implemented by the

<sup>88</sup> Pursuant to the law no. 6360, special provincial administrations and unions for providing services to villages in 30 provinces where metropolitan municipalities are located were abolished. Special provincial administrations and village service unions continue their activities in 51 provinces.

<sup>89</sup> Project Overviews for Climate Change and Agricultural Ecology Working Group, Ministry of Agriculture and Forestry, General Directorate of Agricultural Research and Policy, 2019 Project Evaluation Meetings Document, pp: 1-63, Antalya, 4-8 February 2019.

<sup>90</sup> Project Overviews for Research on Agricultural Machinery and Technologies, Ministry of Agriculture and Forestry, General Directorate of Agricultural Research and Policy, 2019 Project Evaluation Meetings Document, pp: 64-98, Antalya, 4-8 February 2019.





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Ministry of Agriculture and Forestry's Viticulture Research Institute in Tekirdağ, is planned to last for two years (January 2020 - December 2021). Another example of mitigation and adaptation hybrid projects is the 'Pilot Project for Solar Cell Irrigation Channel' implemented by the GAP Agricultural Research Institute (Şanlıurfa) between 2016-2018). The hybrid project for mitigation and adaptation titled the 'Designing and Determining the Performance of a Solar Energy Dryer for Drying Antep Pistachio', also implemented by the GAP Agricultural Research Institute (Şanlıurfa), is supported by the Department of Agricultural Machinery of Çukurova University Faculty of Agriculture and will last for two years between 2020-2022.

The research institutes/centres of the Ministry of Agriculture and Forestry that operate across the country are further discussed below in terms of climate change adaptation.

### Agricultural Research Institutes and Climate Change Adaptation

The General Directorate of Agricultural Research and Policy (GDARP) is in charge of increasing the efficiency and quality in key fields of research such as plant rehabilitation and breeding techniques, plant health, animal rehabilitation and breeding techniques, animal health, aquaculture products, food and feed products, soil, water resources, biodiversity and agriculture economy; developing new varieties, species, breeds and technologies, and protecting and ensuring the sustainable use of genetic sources; and preparing alternative science-based policy documentation for decision makers. The scientific research and R & D efforts by the Ministry of Agriculture and Forestry on the sector are conducted by countrywide research institutes in coordination with GDARP. There are 50 central, regional and provincial research institutes<sup>91</sup> under GDARP, some of which are international, and 25 Advanced R & D and training centres with the latest technologies, specialized by subjects. These institutes undertake efforts related to agriculture policies, agricultural economy, agricultural support and policy development that are needed nationwide, and the outcomes of such research/research projects are presented to decision makers. Such studies are generally funded by GDARP, TUBITAK and EU, and conducted with the support of regional development administrations (such as KPP) or development agencies in cooperation with the private sector. Some research institutes have departments directly studying climate change impacts, while most have carried/been carrying out projects investigating the impacts of climate change within the frame of their respective remits. In such institutes, research and R & D activities are conducted and laboratory services (Soil Analysis Laboratories, Food Analysis Laboratories, etc.) provided on direct or indirect subjects concerning the impacts of climate change on the agriculture sector.

### Central Research Institutes Studying Climate Change Impacts

Soil, Fertilizer and Water Resources Central Research Institute (Ankara)- The Soil, Fertilizer and Water Resources Central Research Institute has a '**Climate Change and Agriculture Ecology Division**'. Some of the 2019 GDARP climate projects that are continuing under the responsibility of the Division include: 'Assessment of the Impacts of Elevated CO<sub>2</sub> Concentrations and Temperatures on Wheat Plants in Dry Conditions', 'Integrated Project: Agro-Hydrology-Subproject: Investigation of Relations Between Soil Moisture and Antecedent Precipitation Index (API) in Some Physical Properties of Soil', 'Impact of Split Nitrogenous Fertilizer Applications on Nitrous Oxide Greenhouse Gas Emissions', 'Determination of Carbon Sequestration and Erosion Preventing Characteristics of Some C3-C4 Plants in Marginal Areas-Konya Karapınar Instance', 'Sustainable Land Management in Arid and Semi-Arid Areas: Determination of the Impact of Climate and Land Use/Cover Changes on Land Degradation', 'Impact of Various Water Levels on Soil-based CO<sub>2</sub> Emissions during Rotations of Wheat-Chickpea, Wheat-Safflower'.

<sup>91</sup> 9 of the research institutions are central level (Ankara, Yalova, Bursa, Diyarbakır, İzmir, Trabzon), 10 are regional, and 28 are subject and product based (Aquaculture Products, Apiculture, Sheep Breeding, Poultry, Fig, Potato, Cotton, Antep Pistachio, Hazelnut, Oil Seed, Grape, Apricot, Corn, Olive).





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The International Agricultural Research and Training Centre/IARTC (Menemen, Izmir)- Directorate of International Agricultural Research and Training Centre has a '**Climate Change and Agricultural Ecology Division**'. In this division, research activities focusing on the conservation, improvement and sustainable use of soil and water resources are conducted in line with the soil and water conservation, hydrology and agricultural meteorology sub-disciplines.

Impacts of climate change, drought and desertification on soil and water resources are investigated at the Centre; the field of research of the division is comprised of studies to establish basin behaviours to determine and combat the potential impacts, and to manage the process in the best manner. Works related to the control of the Meteorology Station located on the Centre premises and the provision of data are under the responsibility of the Climate Change and Agricultural Ecology Division. The research subjects of the Centre are listed below:

- Investigating the impacts of climate change on soil and water resources,
- Determining and monitoring the change in carbon fluxes due to land use and plant production,
- Investigating wind and water erosion in basins,
- Determining the hydrological, morphological and agro-meteorological parameters of agricultural basins,
- Determining and monitoring the moisture regimes of basin soils,
- Investigating and monitoring agricultural and hydrological drought,
- Measuring and determining the characteristics of the precipitation and flows from the basin to the water storage structures,
- Preparing erosion risk maps and soil conservation planning by using erosion determination methodologies in basins,
- Determining and monitoring the locational and temporal change of land degradation in basins,
- Developing suitable methods for the country's conditions by investigating water harvesting techniques to ensure moisture conservation in arid regions.

### Regional Research Institutes Studying Climate Change Impacts

Bahri Dağdaş **International** Agricultural Research Institute (Konya)- Bahri Dağdaş International Agricultural Research Institute has a '**Climate Change and Drought Studies Unit**' in the department of Plant Research. The '**Drought Testing Centre**', established in 2010 under the Institute, aims to conduct country-wide drought resilient line and variety development studies. Accordingly, the Centre carries out studies to minimize the damages caused by climate change and drought, and develop varieties that are resilient to high temperature shocks and drought in cereals that grow based on precipitation and weather conditions in Turkey.

The national remit of the Institute includes 13 provinces (Konya, Aksaray, Karaman, Niğde, Nevşehir, Kayseri, Sivas, Eskişehir, Kütahya, Afyonkarahisar, Isparta, Burdur, and Yozgat) within Central Anatolia and gateway regions and its general task fields include grains, industrial plants, edible legume, medicinal aromatic plants, pastures and forage crops, fruit growing, vegetable growing, biodiversity, genetic resources, and livestock. It is among the duties of the institution to conduct alternative product research to increase product diversity.

Bahri Dağdaş International Agricultural Research Institute is one of the four institutions with an international status among all agricultural research institutes which are; i) International Centre for Livestock Research and Training (Ankara), ii) International Agricultural Research and Training Centre



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(Izmir), and iii) GAP International Agricultural Research and Training Centre (Diyarbakır). The international remit of the Institute covers the Caucasian, Central Asia, Balkans, North and Central Africa and other countries.

“Farmers Field Schools”<sup>92</sup>, financed by GEF of which the Bahri Dağdaş International Agricultural Research Institute is a part and under the framework of the “Sustainable Land Management and Climate Friendly Agriculture Project” implemented by FAO, instils farmers with the notion of “*Learning-by-Doing Together*”. Farmers Field Schools allows farmers to make field observations and analysis and exchange knowledge. It can be ensured that farmers conduct practical climate change adaptation studies and be personally involved in such activities as creating livelihood options based on climate resilient farming, water resources management, forest and firewood management, monitoring biodiversity, and climate friendly practices through Farmers Field Schools. It may be useful to extend the scope of the training provided to farmers in this frame and include the interactive tools on EEA member state platforms in the training content of adapted models for Turkey. For example, AgriWizard (Klimatilpasning) found on the National Adaptation Platform of Denmark is an interactive manual that guides farmers on the extreme weather events to which a farm may become exposed.<sup>93</sup>

### Subject Research Institutes Studying Climate Change Impacts on Agriculture Sector

Ataturk Soil, Water and Agricultural Meteorology Research Institute (Kırklareli)- Ataturk Soil, Water and Agricultural Meteorology Research Institute has a ‘**Agricultural Meteorology and Climate Change Division**’ whose area of responsibility includes maintaining the sustainability of and providing data to the fully automated agricultural meteorology stations in the lands of the region where agricultural production is carried out. In this framework, research projects on the interactions between agricultural meteorology and climate change are implemented in the Ataturk Soil, Water and Agricultural Meteorology Research Institute. These projects determine the vulnerability of agriculturally produced plants against climate change and produce knowledge for taking preventive measures against meteorological disasters, aiming to provide decision makers and farmers with the scientific knowledge required to make the right decisions. The research subjects of the Agricultural Meteorology and Climate Change Division are listed below:

- Determining the effects of climate change on agricultural production,
- Modelling plant production according to different scenarios using Plant-Development Simulation Models,
- Monitoring and determining meteorological and agricultural drought,
- Determining the actual water loss (evapotranspiration) of plants,
- Determining the impacts of meteorological factors on plant development,
- Determining the surface energy balance of cultivated plants,
- Continuous monitoring of carbon fluxes and determining the relationships between meteorological variables,
- Continuous monitoring of soil water content,
- Following up on plant phenology and determining their cooling needs.

Research Institute of Soil Water and Combating Desertification (Konya) - Research Institute of Soil Water and Combating Desertification has a ‘**Climate Change and Erosion Division**’ whose main tasks

<sup>92</sup> The Farmers Field School, which is a global model created by FAO, has numerous successful examples in many countries.

<sup>93</sup> For further detail: Project Component 3/3.3.1.



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are defined as: protecting, improving and making sustainable use of soil and water resources in the Konya basin, determining the problems such as desertification and drought caused by countrywide and regional climate change and carrying out proactive control and protection works for the measures to be taken. In this framework, it is planned to store water for irrigation purposes; to measure and determine the characteristics of project design criteria for flood prevention facilities and the hydrological, morphological and agro-meteorological parameters of agricultural basins, and the precipitation and flows coming from basins to water storage structures; to determine the impact of land use on basin and water efficiency; to determine hydrological basin models by using precipitation and flow data; and to conduct research on sediment measurements and efficiency in basins.

The Institute has been carrying out activities for using isotope techniques in determining precipitation and flow components in basins, investigating the viability of the models which are used to estimate sedimentary efficiency of basins in the basins in our country, and determining cultural, physical, and vegetative methods to prevent soil loss in basins. Additionally, the impact of soil quality parameters on the conservation of soil and water resources, the comparison of various erosion determination methods in basins, and erosion risk mapping works are also undertaken by the Institute.

The Climate Change and Erosion Division carries out various projects to research and monitor the moisture regime and retention of basins; enhancing the usefulness and efficiency of water storage investments and the irrigated farming infrastructure by formulating methods to estimate the long-term distributions of flows in agricultural basins; enhancing the sustainable efficiency and usefulness of undeveloped natural meadows by determining appropriate land development methodologies; mitigating the risks caused by unfavourable impacts of land use changes in upper basins on the agriculture practiced in lower basins by developing methods to determine the impact of land use changes; mitigating agricultural production risks in semi-arid regions by formulating better methods for soil moisture retention; and establishing methods to protect soil and water resources from water and wind erosion and prevent the most appropriate wind erosion prevention methods to ensure the sustainability of the areas that are under the risk of desertification by determining economic, viable and acceptable soil conservation methods. A study titled 'Evaluation of Treatment Sludge Usage Opportunities against Erosion in Eroded Meadows', as a project of the Soil and Water Resources Research Department of GDARP, was conducted on climate change and agricultural ecology in Konya, Karapınar between 2014-2018.

Soil and Water Resources Research Departments of research institutes generally engage with research on climate change impacts. For example, the Soil and Water Resources Research Division of GAP International Agricultural Research and Training Centre in Diyarbakır has carried/been carrying out various projects and activities on climate change response to, i) formulate methods for on-site conservation of soil moisture to reduce agricultural production risks in arid regions, ii) developing appropriate methods and technologies for the efficient use of water in agriculture, and directly iii) determine the potential changes to be caused by **climate change** on plant production and formulating appropriate adaptation proposals.

The "Protection of Pollinator Diversity Against Increasing Climate Change" project funded by the EU has been continuing at the Plant Health Central Research Institute (Ankara), aiming to fight the global decrease of pollinator diversity by creating public awareness and increasing global responsibilities.

The tasks of the Fisheries Management Division of the Aquaculture Central Research Institute in Trabzon are also associated with the impacts of climate change on marine ecosystems and include: estimating the stocks of economically valuable species in the Black Sea and the Marmara Sea and inland waters, examining such structures as HPPs built on coastal structures and river beds in terms of fishery-environment interaction, and determining the bioecological characteristics of important species.



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Research institutes may sometime implement joint projects; for example, Elazığ Aquaculture Research Institute worked with the Trabzon Aquaculture Central Research Institute on its project titled “Locational Analysis of Fish Farms with Geographic Information System (GIS)”.

In addition to sectoral scientific and technical research, agriculture economy and socio-economic research are also conducted at research institutes. For example, the projects ‘Poverty Analysis in Rice Farming Enterprises in the Black Sea Region’, ‘Performance Evaluation for Drip Irrigation Systems in Tokat Kazova Region’, ‘Farmers’ Approach to Crop Insurance Practices in Viticulture Enterprises, Problems and Proposed Solutions (Tekirdağ, Edirne, Kırklareli and Çanakkale Instances)’, ‘Determining the Parameters that Can Serve as Criteria for Aids for Young Farmers, and Trends for Young Individuals Staying in Agriculture’ (2018-2019) which was undertaken in Konya by the Soil Water and Combating Desertification Research Institute in Konya.

‘Agriculture Policy’ divisions of Research Institutes are particularly important; their purposes include conducting micro and macro-level research on economic, social, policy and environmental problems and development trends by using principles of economics, and producing and disseminating the useful knowledge on the Institute’s subjects of study, which include production economy and policy, environment economy and policy, natural resource economy-policy, rural economies, food economy-policy, agricultural systems, marketing, international agriculture policies, etc. Under these divisions, tasks are defined to conduct research on the efficiency of investment, production, rural development, control and support policies to increase the economic contributions of the agriculture sector.

Some research institutes, such as the East Mediterranean Agricultural Research Institute, have “Seeds and Production” division whose studies and research on native seeds, in particular, are important in terms of climate change resilience. On a regional basis, there is a National Seed Gene Bank, which has been operating for over 50 years at the Aegean Agricultural Research Institute in Izmir. The Field Crops Central Research Institute (Ankara) has been carrying out works to collect plant seeds in various regions of the country at the **Turkish Seed Gene Bank** of GDARP in Ankara.

Established in December 2011 in Samsun, the ‘**Agricultural Energy Research Centre**’ within the body of the Black Sea Agricultural Research Institute in Samsun, which is a regional research institute, is in charge of conducting basic and practical research to acquire biofuel from renewable energy sources across the country. The Centre aims to develop production technologies to obtain biofuel from non-food second generation agricultural wastes, woody and carboniferous materials such as bark, leaf, stalk, and sawdust and organic sources and algae. It is aimed to produce, and test biodiesel and bioethanol for compliance with standards and to conduct national and international research at the Centre, which carries advanced laboratories including biodiesel, biofuel, and biomass units.

The regional, national and international R & D works conducted by GDARP research institutes to formulate proposals and policies to measure and take measures against the impacts of climate change on agriculture systems emphasize the importance of integrating climate change adaptation into agriculture sector and food security policies. Evaluation meetings on ‘climate & agriculture’ are held systematically and at regular intervals by GDARP at various research institutes. Such efforts that enable continuous cooperation and coordination amongst central and local/regional ministerial organizations highlight the following findings and proposals that are directly related to climate change adaptation, according to which needs are determined:

- Climate modelling studies conducted/to be conducted in Turkey should meet the expectations of the agriculture sector.
- A single database, from which the produced data will be transferred to users and decision makers, should be established by ensuring the reliability of verified data, including climate models, that is



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required by the entire agriculture sector in the climate change adaptation process and has been collected within the body of various institutions.

- Multidisciplinary R & D studies are required for climate change and agriculture interaction.
- The priorities required for climate change and agricultural production are as such: strategies and policies on the rational use and management of soil, water and agriculture ecosystems should be developed for sustainable food production, the investments and aids must be increased in this regard, R & D activities that establish 'agriculture-environment-climate' impacts should be supported and associated with nature conservation and protection, education should be given weight and awareness raised on these subjects.
- Practices to deliver climate and environment friendly agricultural activities should be continued incrementally.
- Turkey's rich land resources should be protected, applications to increase carbon stocks in the soil should be extended, erosion control should be enhanced at the basin scale.
- Degraded areas in pastures serving as important sinks for greenhouse gas emissions should be rehabilitated and climate-friendly agricultural practices should be supported.
- Genetic resources should be created for the development of drought resilient varieties, modernized irrigation systems should be disseminated for efficient water use, and controlled use of ground and surface water resources in agriculture should be ensured.
- It should be ensured that necessary measures are taken in the short term for adaptation policies and in the long term to eliminate the impacts in combating climate change in the sector.

In terms of **strategic planning**, direct and indirect strategies, policies, plans and actions that have been implemented until today to ensure climate change adaptation in the agriculture sector in **Turkey** continue to provide a basis for the sector to have an organized and highly competitive structure. In the period which began with the Eighth Five-Year Development Plan until the current Eleventh Development Plan, many studies, projects and applications have been conducted to eliminate the negative impacts of climate change and make use of potential opportunities for almost all sectoral goals required by the Turkish agriculture.

In NNCS, CCAP and the National Adaptation Strategy and Action Plan, agriculture is referred to as a priority sector that must adapt to climate change; several actions in this area were determined, emphasizing the sector's need for climate change adaptation, and the practices were enhanced accordingly.

On the other hand, the need for priority and additional investments such as making changes in the technologies of irrigation systems in land use management plans and programmes and of water transportation and distribution systems in settlement areas, making savings and investments to reduce the demand of water users (including industrial agriculture), and implementing climate friendly irrigation investments through optimal financing models still remain among the measures taken in the sector against climate change.

The roadmap that must be followed in combating erosion in Turkey is the "National Strategy and Action Plan of Turkey for Combating Desertification".

The strategies and action plans of the Ministry of Agriculture and Forestry related to climate change are listed below:

- National Drought Management Strategy Paper and Action Plan (2017-2023)
- Industrial Forestation Activities Action Plan (2013-2023)





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- National Strategy and Action Plan for Combating Desertification (2015-2023)<sup>94</sup>
- Organic Farming Strategy Plan (2018-2022)
- National Rural Development Strategy (2014-2020)
- Erosion and Sediment Control Action Plan (2017)
- National Action Plan for Combating Erosion (2013-2017)
- Action Plan on Mobilisation for National Forestation and Erosion Control (2008-2012)
- Agricultural Research Master Plan (2011-2015)
- National Agricultural Drought Strategy and Action Plan (2013-2017)
- National Report on Balancing National Land Destruction (2016-2019).

The policy measure (Measure No: 411.6) found in the 2020 Presidential Annual Programme that is related to climate change adaptation for evaluating product patterns in the agriculture sector is as such: “Product pattern change scenarios in agriculture will be established in order to adapt to climate change. In this framework; i) areas suitable for the cultivation of important agricultural products will be re-evaluated according to today’s climatic conditions, and ii) product suitability areas will be determined according to future climate change projections. These efforts will be undertaken under the responsibility of the Ministry of Agriculture and Forestry.

In the **Strategic Plan (2017-2021)** of the General Directorate of Meteorology, it is indicated that research activities that constitute a significant part of the activities are related to environment, climate, atmosphere, renewable energy sources; that the research and analysis works included climate change and scenarios, drought monitoring and analysis, ozone and ultraviolet radiation monitoring and assessment, renewable energy works (wind and solar energy measurement result report approval), environmental impact assessment works, air pollution and acid rain works, meteorological disasters, forest fires and sudden flood early warning systems, dust transportation estimation and assessment works. Whereas the Strategic Plan included the strength, weaknesses, opportunities and threats of the General Directorate, the increasing interest in meteorological research and in particular to the issues of environment, climate change and renewable energy issues is considered as an opportunity. Among the targets indicated in the Strategic Plan is the target of “performing works for monitoring climate change at national and regional scale”. In the explanation related to the target, it is indicated that there is a need for works such as climate projections in order to perform and use current and long term climate assessments at national and regional scale.

### 3.1.3 Work by stakeholders

The “Soil Organic Carbon Project”, implemented in 2017-2018 by the General Directorate for Combating Desertification and Erosion of the Ministry of Agriculture and Forestry to support the applications to increase organic carbon stocks in the soil, aimed to; i) contribute to preparing the national greenhouse gas emission inventory report, in which soil organic carbon stocks began to be reported, and ensuring the fulfilment of the completeness, transparency, coherence, accuracy, and comparability required by the UNFCCC, and ii) enable calculating the levels of impact of land use decisions on SOC stocks and produce guiding data for decision makers.<sup>95</sup> An extensive research was conducted throughout the project to determine the organic carbon stock in Turkey’s soils, providing an important base to guide decision makers in ensuring stock increases. The soils in Turkey that must be improved and conserved were also determined according to various scenario analyses conducted under the project.

<sup>94</sup> National Strategy and Action Plan for Combating Desertification, which is the initial document involving the studies planned under combating erosion/land degradation in Turkey, was published in 2005.

<sup>95</sup> (This study was carried out between 2017-2018 under the cooperation of TUBITAK/BILGEM (Centre of Research for Advanced Technologies of Informatics and Information Security) / YTE (Software Technologies Research Institute)).



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With the “Sustainable Use of Biomass to Assist the Development of Turkey's Economy Towards Green Growth” project, which is funded by UNIDO<sup>96</sup> and the Global Environment Facility/GEF and has been implemented since 2018, it was planned to produce energy by making use of agricultural wastes. The project aims to prevent stubble burning, which destroys the organic structure and reduces the productivity of soil, and generate energy from agricultural wastes using new technologies.

Adaptation/mitigation co-benefit projects of the Ministry of Agriculture and Forestry- The “Drying of Chandler Walnuts Using Solar-Biomass Hybrid Dryer in Tekirdağ Province” and “Performance Analysis of a Photovoltaic-Thermal Hybrid System With Different Air-Based Cooling Units in Grape Drying in Tekirdağ Province” projects implemented by the Tekirdağ Directorate of Viticulture Research Institute (TBAEM) under GDARP’s “Agriculture Machinery and Technologies Programme” are hybrid research and implementation projects benefiting emission reduction and impact adaptation in combating climate change. These are two-year projects (2020-2021) that are implemented using the equities of the Ministry. The project concerning grape drying is supported by the Biosystem Engineering Department of Tekirdağ Namık Kemal University, the Mechanical Engineering Department of Erzurum Atatürk University Faculty of Engineering, and a private company. The project titled “Designing and Determining the Performance of a Solar Energy Dryer for Drying Antep Pistachio” implemented by the Antep Pistachio Research Institute Directorate in Gaziantep within the framework of the “Agriculture Machinery and Technologies Programme” of GDARP is a two-year (2020-2022) adaptation/mitigation hybrid research and implementation project that is supported by the Agricultural Machinery Department of Çukurova University Faculty of Agriculture, GAP Agricultural Research Institute, and a private company.

In 2017, a report titled “Climate Change and Agricultural Sustainability in Turkey” was prepared by the Federation of Food and Drink Industry Associations of Turkey that established the threats awaiting agricultural and food production. Emphasizing the need to determine agricultural basins based on changing climatic conditions, the report indicates that potential climate change impacts should be determined for each agricultural basin and the number of scientific research on agricultural products’ adaptation to climate change should be increased.

A project in which the potential variability and loss of crops of Malatya apricot, which is one of the most important export products of Turkey, caused by climate change impacts are investigated was initiated by Bosphorus University. As part of the research that was supported with “Bosphorus University Scientific Research Projects” funds, various climate projections for the period covering 2021-2050 were studied and an *apricot yield analysis* was conducted.

“Hazelnut Production, Climate Change and Environmental Impacts Report for Turkey” which was publicly shared by the EKOLOGOS Sustainability Research unit on behalf of the Rainforest Alliance, UTZ Hazelnut Programme<sup>97</sup>, predicts significant changes in hazelnut production in Turkey due to changing climatic conditions. Warning about significant loss of productivity in hazelnut production unless the necessary measures are taken, the report discusses the impacts of climate change at the global level as well as specifically in Turkey and the Black Sea Region and potential future changes and impacts.

The agriculture and food sector was analysed in terms of sustainable growth in Turkey in the “TUSIAD Agriculture and Food 2020” report published by TUSIAD in March 2020. The “Climate-Focused Policies” heading of the report listed the following findings and recommendations for Turkey (Karapınar et al., 2020):

<sup>96</sup> United Nations Industrial Development Organization/UNIDO.

<sup>97</sup> UTZ Hazelnut Programme is the first independent, third-party sustainability certification programme of the hazelnut sector in Turkey. The programme has rapidly improved since 2014, which is when it made its first harvest and in 2019, the number of farmers of UTZ exceeded 6,800, with 17 certificate holders.





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- In determining the agriculture policies for Turkey for the next 10 and 20 years, a 2-3 °C increase in temperature and the impacts of the increase on climate must be discussed as an assumption scenario and policy plans should be made in this framework
- With temperature increases of 1.1-1.3°C, a 1% decrease in the first timeframe (2030-2034) and a 1.4% decrease in the second timeframe (2040-2049) are predicted for the GDP.
- Whereas average yield loss between 2030-2039 is around 6-7%, it reaches up to 8-9% between 2040-2049. Even if the impacts of the changes in climatic conditions are only simulated through the agriculture sector, the impacts have an overall significant effect on the rest of the economy, as well.
- It is predicted that each one-degree Celsius increase in the global average temperature will reduce the global average land yield by 6% for wheat, 7.4% for corn, 3.2% for rice, and 3.1% for soybean.

The “Capacity Building in Climate Change Adaptation of Agriculture, Forestry, and Fisheries”, in which Euphrates University took part as the implementing institution, was implemented between 2017-2018 as a “Enhancing Required Joint Efforts on Climate Action Project/İklimIN” grant project funded by the EU. The project partners are Elazığ Provincial Directorate of Agriculture and Forestry and Elazığ Aquaculture Research Institute. Throughout the project, awareness was created for the changing climatic conditions in the villages in forests and mountains in the TRB1 Region, which includes the provinces of Bingöl, Elazığ, Malatya and Tunceli, and contributions were made to enhance climate change resilience through sustainable business plans.

Projects motivating the use of domestic and local knowledge in the agriculture sector- Local solidarity networks (local communities, cooperatives, etc.) making productions in line with the agro-ecology<sup>98</sup> principles of local networks or trying to maintain linear supply chains in consumption processes, and the non-governmental organizations working in this regard are involved in organizations and activities that promote adapting to climate change in Turkey, particularly in the agriculture and food sector. This way, such organizations aim to cross-cut/integrate local social development and solidarity economy practices while also ensuring that - in the case of agriculture sector - people are at the centre of the local decisions concerning food production and preventing climate change from affecting the agricultural production cycle negatively.

Taking into consideration that climate change has already begun to affect the food system, the following communities engaged in “Community Supported Agricultural Model” practices may be given as examples of innovative solidarity economy models in the rural-urban supply chain/link: Güneşköy, Yüzüncü Yıl Food Community, Natural Food, Conscious Nutrition Group in Ankara; Resilient Producer and Consumer Cooperative, Earth Association Consumption Union in Istanbul; West Izmir Community Supported Agriculture Group, Gediz Ecology Community, Güzelbahçe Good Food Community in Izmir; Çanakkale Ecologic Living Initiative in Çanakkale. Such organization models, which are considered by small communities and enterprises as a way to put healthy and inexpensive food on the table by means of natural and local food production, create opportunities for climate resilient food production which is brought along by agricultural biodiversity in Turkey (Green Thought Association, IPC and Green European Foundation, 2017).

Climate change adaptation projects of agriculture sector through cooperative models- When considering the activities of cooperatives in Turkey that are related to climate change adaptation, organizations in the agriculture sector and agricultural development cooperatives may be addressed

<sup>98</sup> Agroecology is a holistic approach that simultaneously applies ecological and social concepts for the design and management of food and agricultural systems. Agroecology seeks to improve agricultural production by reconnecting with natural processes, reducing the need for external inputs (chemical fertilizers and pesticides) and unwanted outputs (pollution and climate change).



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in priority and the potential of such formations in terms of calling conventional business models into question and social development and climate can/should be evaluated .

From the perspective of the state of masses, the number of women entrepreneurship (founder, partner, or member) cooperatives in rural Turkey is reportedly around 150. For example, Sarıcakaya Agricultural Development Cooperative (Eskişehir), which is chaired by a woman, is a 200-member<sup>99</sup> formation.

With regard to addressing hybrid adaptation-mitigation measures in rural areas; i) Eldivan Women's Entrepreneurship Production and Enterprise Cooperative (Çankırı) and ii) Afşar Bala'm Women Cooperative (Bala, Ankara) stand out as two important guiding applications.

The "Green Economy in the Village" project<sup>100</sup> that began in Eldivan in 2016 is a climate friendly local initiative in terms of acting in line with the principles of innovation, sustainability, and solidarity economy. At the Eldivan (Çankırı) Women's Entrepreneurship Production and Enterprise Cooperative, with expert support from the Clean Energy Foundation/CEF and the International Solar Energy Society Turkey Section/ISES TR, the fruits and vegetables (pastes, jams, marmalades) produced by women and that are indigenous to the region are dried with solar energy which allows for minimum carbon footprints. One year after the start of the project (by the end of April 2017), 8655 kWh of energy was obtained from solar energy, saving on 3980 kg of carbon dioxide. The Cooperative also created its very own brand to take part in the market, focusing on directly benefiting the women farmers of Eldivan without any rent or intermediary by providing continuous green income/jobs.

During the project titled Afşar Bala'm Herb Festival (2019) that is supported by the GEF/SGP grant fund and organised by Afşar Town Culture and Social Solidarity Association in Afşar village of Bala district of Ankara, production works are undertaken by the "Afşar Bala'm Women's Entrepreneurship Production and Enterprise Cooperative" to use worm humus in soil at the cooperative. In line with the principles of minimum carbon footprints and zero waste, worm humus is used instead of chemical fertilizers in the production of completely natural products (milk, vegetable and black sesame noodles, tomato sauce, chickpea, sweetened condensed milk, sour cherry jam, apricot jam, apple vinegar, etc.) without any additives,<sup>101</sup> the cooperative procures wastes such as herbage, tea wastes, banana peel and eggshells that are required for producing worms from local citizens. Setting a model for the role of the conservation of soil as a terrestrial ecosystem in the circular economy from seed to end user and for community-based solidarity economies, this project was initiated in early 2019 with the grant support of UNDP/GEF/SGP. The project continued thanks to production being included in the supply chain and the financial support of the Central Anatolia Development Agency, and the products were offered for sale under the brand "Afşar Bala'm" and at reasonable prices in the public market of Ankara Metropolitan Municipality (Sivil Sayfalar, 2019).<sup>102</sup>

Recently, loss of crops due to climate change are reduced by farmers by means of using more pesticides, etc. which releases more poison in nature, poisoning useful insects, water, air, other living creatures, and human beings. This practice that reduces the climate change adaptation capacity stimulates farmers to think, *if I use more pesticides, I will get more yield and get rid of pests very quickly.* The "Non-Poisonous Tables" project implemented between April 2019 and March 2020 In partnership with the Wheat Association for Supporting Ecological Living and Pesticide Action Network Europe aims

<sup>99</sup> Ministry of Trade, 2018 data.

<sup>100</sup> Financial (cash/in kind) supporters of the project: UNDP/GEF/SGP, Ankara Metropolitan Municipality, Ankara Development Agency.

<sup>101</sup> Where the use of animal manure is intended, it is necessary to cook, rest for a while or dry under the sun so that bacteria and seeds if any contained will die out. Otherwise, live seeds in the content give rise to wild plants in the soil. In the case of worm hums, waste is passed through worm digestive system and transformed into fertilizer enriched with enzymes and nutrients. The practice of feeding the waste of consumed coffee, produced in high volumes particularly in cities, is known as a method complementary to circularity.

<sup>102</sup> <https://www.sivilsayfalar.org/2019/08/05/ekolojiye-duyarli-kadin-ciftciler-afsar-balam-girisiminde-bulustu/>



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to; i) create awareness of the unfavourable effects of pesticides in agriculture in Turkey, and alternative methods to pesticide, ii) enhance cooperation among the NGOs studying pesticides in Turkey and the EU, and iii) limit the use of pesticides and enhance the capacities of NGOs for campaigning, lobbying, and advocacy.

Under the Non-Poisonous Tables project, various activities and strong campaigning strategies were used to create social awareness on pesticides and alternative farming, pest control methods, currently needed changes, relevant legal EU regulations, food security oversight mechanisms, food security in terms of pesticides, etc. The Non-Poisonous Tables Civil Society Network, which involves over 100 institutions and initiatives, investigated the harms of the pesticides that were on the Ministry's list sent to universities, in terms of human health and other living creatures as well as environmental toxicity and established that 41 active ingredients contained deadly hazards for humans as well as other living beings. The project signifies that agro-ecological production, which protects agricultural biodiversity, is as productive as conventional production and as organic production is more efficient, agriculture will be more climate resilient in arid periods.

During the project, four of the 13 active ingredients, which were requested to be banned in the Non-Poisonous Tables Campaign and marked as 'extremely hazardous', 'highly hazardous' and 'potential carcinogen' by World Health Organization, were banned by the Ministry of Agriculture and Forestry. The Ministry also banned 14 out of the 41 active ingredients for which opinion was sought by universities to end their use by 2019.

The importance of native seeds has been kept on the agenda by some non-governmental organizations in Turkey for over 20 years. The Wheat Association for Supporting Ecological Living supports maintaining agricultural biodiversity to sustain rural life and has been working for years to conserve native seeds and local seed varieties. Bringing relevant parties (farmers, consumers, researchers, state agencies, and civil society) together through the Seed Exchange Network initiated in 2007 with the support of the GEF Small Grants Programme (SGP), the Association established the TaTuTa Farm Network<sup>103</sup> to create learning and sharing environments for all segments of society through various activities, campaigns and festivals and has been continuing to support the efforts towards the continuity of local village varieties. In the framework of these activities, the number of farms within the TaTuTa network are increased, local seed varieties are researched and identified and producers are contacted to plan for their growth. TaTuTa continues to remain as an important communication network tool for different stakeholders.

From the viewpoint of local communities, local food communities that operate in various localities to ensure access to healthy food and strengthen local small producers aim to produce yields through natural (non-pesticized) and native seeds. As an example, a group of seed volunteer women who produced using indigenous seeds seen as the key guarantee to agricultural biodiversity started their work 6 years ago and culminated in 2019 in establishing Fethiye Native Agricultural Development Cooperative (Yavuz, 2019).

In terms of university activities in this area, the Agro-heritage Project, initiated as of late 2019 under the coordinatorship of Trakya University, stands out as a recent research.<sup>104</sup> Financed by the National Agency of Turkey, ERASMUS+KA203 Programme, the Project was designed to preserve Turkey's agricultural heritage which involves local plant varieties and animal breeds created after centuries of pain of farmers and conventional agriculture techniques, their use, and knowledge. The project aims

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<sup>103</sup> You can visit the official website for TaTuTa Farm Network at this link.

<sup>104</sup> The project has five partners, two of which are based in Turkey; Univerzitet Educons U Sremskoj Kamenii Privatne Ustanove, Serbia; Joint Genomic Center Ltd., Bulgaria; Dimokreitio Panepistimio Thrakis, Greece; EARD Ecosystem and Agriculture R & D Cons. Ltd., Turkey; APEC Advanced Project Education Cons. Ltd., Turkey.



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to introduce the concept of agro-heritage into the higher education system in Turkey through acting as an extensive curriculum and providing agriculture students with free online learning material supported by practical training.

Some recent projects related to climate change in the agriculture sector (food, fishing), supported by GEF/SGP grant funds are listed below.

- Agroecological Transition with Food Communities in Gdl (Wheat Association, 2018-2019)
- Reviving Fibre Genotypes of Turkey origin in Hemp Agriculture (Cooperative for Scientific Research and Development of Age-Old Ideas and New Ideas in Circular Agriculture, 2019)
- Delicious Invasive Species (Mediterranean Conservation Society, 2013-2020)
- Setting nets in Anatolia: Fisherwomen (Mediterranean Conservation Society, 2016)
- Blue Planet/Blue Jobs (Women Fishers Society, 2019-2020)
- Social Mobility for Blue Economy: Fly Fishers and Informed Consumers Project (WWF Turkey, Rasgele Society, 2019)
- Eco-friendly Fishing with Young Fishers Project (SRKOOP, 2019).



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### 3.2 Energy sector and climate change adaptation

- Whereas the energy sector is shown in national and international literature as one of the primary components that cause climate change, it is also an economic sector that is threatened by climate change.
- All energy sector subcomponents, regardless of types of sources (thermal, nuclear, or renewable), needs to be (re)planned to adapt to climate change. In this context, it is important to conduct sector-specific climate risk analyses.
- In consideration of the operational and economic structure of the energy sector, risk analyses for the energy sector need to be designed specifically for “energy system structures, energy sources, and energy production-transmission-consumption operations”.
- The vulnerability of the energy sector in Turkey is caused by the increasing extreme weather events due to the climate crisis and its impacts on water resources, similar to global trends.
- A review of the works undertaken in Turkey as part of climate change response by climate change adaptation, almost no work has been undertaken for building climate resilience for the energy sector.
- In order to prevent potential short, medium, and long term losses in Turkey’s GDP due to the climate change vulnerabilities of the energy sector, it is important to formulate and implement climate change adaptation action plans all across the energy sector (through public funds) and specifically for companies (through private equity).
- An extensive gap analysis targeting the energy sector stakeholders in Turkey needs to be conducted by taking into consideration the global models for the energy sector’s climate change adaptation.

When examining the economic sector relations with climate change, the energy sector stands out as one that contributes the most to greenhouse gas emissions, with a 33% global share and a 55% share in Turkey. In that context, the energy sector comes forward a strong “cause” in a basic cause and effect relationship with respect to climate change (Our World in Data, 2016; TURKSTAT, 2018).

On the other hand, it is now a fundamental macroeconomic fact that the impacts of climate change have been crippling all economic sectors both at global and national levels. For example, 115 platforms of 52 facilities that were built for offshore petroleum and natural gas extraction purposes were destroyed by the hurricanes that occurred in the Gulf of Mexico in 2004 and 2005. From this perspective, recognizing that the energy sector, which is the greatest cause of climate change, is also openly targeted by the negative impacts of climate change that occurs in various forms such as extreme weather events, sea level rise, drought and heatwaves is extremely important in order to develop contemporary climate change adaptation actions (Earth Networks, 2018).

By 2040, energy demand in developing countries is expected to increase by 71% which requires the energy sector, which is presently vulnerable to climate change, to be planned with reactive and proactive adaptation strategies under energy production, energy transmission and distribution, and energy utilization in such countries, including Turkey. At this point, it is also a critical move to analyse the energy sector’s relations with climate change adaptation strategies successfully (GIZ, 2017).

Relationship between Energy Sector and Climate Change Adaptation - The place of energy sector in the frame of climate change adaptation can be known primarily through comprehending the adaptation and mitigation responses on an energy scale. The greatest barriers to such a comprehension arise from the facts that the energy sector is usually not studied under the greenhouse gas emission reduction component and consequently the potential bilateral climate change adaptation action options are not taken account for the energy sector specifically.





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Understanding the energy sector's vulnerability against climate change impacts and successfully analysing the climate change adaptation strategies in line with such vulnerabilities depends on establishing a balance-relationship appropriate for the necessities of the time by harmonizing the conventional approaches developed for climate change adaptation with basic emission reduction parameters. The relationship of balance, which is diagrammed in Figure 2, provides hints on “why” and “how” the energy sector should be planned to adapt to climate change.

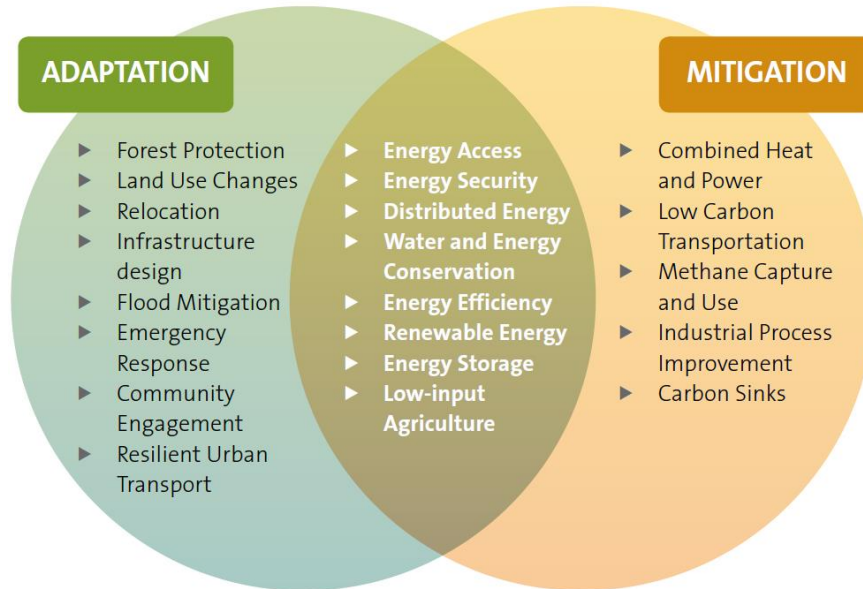


Figure 2. Adaptation-Mitigation Balance Relationship in Energy Sector (GIZ, 2017)

As evident by this balance relationship, the strategies or practices developed for mitigation may render the energy sector resilient to climate change impacts. For example, energy efficiency practices to be implemented in the transportation sector or for industrial operations will help the energy supply to extend beyond the schedule planned in the present scenario in the case that energy demand increases due to climate change impacts (e.g. increased use of air conditioner in the summer). Localizing energy production, which is only possible by increasing the national share of renewable energy source utilization, will also reduce the economic sector's vulnerability caused by its failure to meet the demands of local communities (through fossil fuel operations).

Another striking issue in terms of the relationship between the energy sector and climate change is that the energy sector directly and indirectly affects the climate change adaptation of other economic sectors. As energy is a primary source for almost all economic sectors, it is important for the successful performance of the climate change adaptation strategies of such sectors. For example, the successful climate change adaptation practices through improving food production and irrigation in the agriculture sector, improving (solid waste and wastewater) treatment services in the urbanization sector, and improving distribution activities in the service sector is directly dependent on energy access and security.

At the same time, energy also has a direct impact on the use of cooling systems, which are among the most basic practices of climate change adaptation applied in scenarios in which heatwaves are observed. Supply of secure energy guarantees the applicability of such an adaptation practice; in the case that cooling systems are needed, limited access to energy will render the receptors of such a scenario vulnerable to climate. In a sense, an energy sector that has been rendered resilient to the destructive impacts of climate change on a macro scale increases GDP, job opportunities, trading opportunities and welfare, reducing the vulnerabilities of other sectors.



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The introduction of climate change practices that ensure the energy sector's resilience to climate change impacts supports the climate change adaptation practices in other economic sectors, in addition to reducing the damages to be suffered by the energy sector, which is one of the largest sectors, and contributing to global and national GDP.

### 3.2.1 Sectoral impact of climate change

Climate vulnerability of the energy sector comprises various structure, resource and operation based components.

*Structure-based components* affect energy production equipment and electricity transmission structures, which have extremely long economic lifetime. While the lifetime of energy production equipment varies between 15-40 years (or longer for nuclear plants), transmission structures have a lifetime between 40 to 75 years, which makes it essential to take climate change impacts into account in planning for the construction and operation of such structures.

*Resource-based components* make the energy sector vulnerable due to endangering the fundamental inputs of energy generation. For example, while the reduction/destruction of water resources affects hydropower generation adversely, the reduction/destruction of the raw materials (e.g. animal manure or vegetative waste) obtained from the agriculture and livestock sector has a negative impact on the production of biogas energy.

*Operation-based components*, on the other hand, make climate change vulnerable by having a direct adverse impact on the operability of power plants. Depending on the impacts of climate change, increased temperature of the resources used by thermal plants as cooling water or reduced flow rate of the water sources on which hydropower plants are built may have extremely unfavourable impacts on the activities of these plants.

The propellant of these components that make the energy sector vulnerable to climate change impacts are the climate change impacts that are categorized as: (1) increased average temperatures, (2) fluctuating precipitation, (3) extreme weather events, and (4) rising sea levels.

Impacts of Climate Change on Energy Sources and Generation- The levels and forms of climate change impacts vary from region to region, which leads to the energy sectors of different countries/regions to have various degrees of vulnerability to the impacts of the climate crisis. The vulnerability of the sector increases or decreases based on the diversity of sources of the relevant energy sector.

Climate Vulnerability of Fossil Fuel Energy Sector- Fossil fuel energy industry, accounting for 52% of the installed power in Turkey, is vulnerable to all of the impacts of climate change that are categorized as: (1) increased average temperatures, (2) fluctuating precipitation, (3) extreme weather events, and (4) rising sea levels (TEİAŞ, 2018).

Humidity rate of coal is higher in wetter climates, which significantly increases the costs of transporting coal and the drying processes implemented before generating electrical energy from coal. This also causes a decrease in cooling waters at the thermal power plants in the regions that start receiving less rain due to climate change, also decreasing cooling efficiency. Thermal power plants that are built on riverbeds are also among those with the highest vulnerability to climate change, so much so that the floods due to extreme precipitation damage the plants, causing them to go out of service for long periods of time.

Another impact of climate change on the energy sector is seen in petroleum and natural gas extraction activities undertaken in cooler regions (e.g. Polar regions). The fossil fuel exploration structures installed in such areas should be supported by frozen ground, which is called permafrost; the permafrost that melts due to increased temperatures loosens the ground of these structures, causing





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the pipes and pillars to break. The fact that permafrost melts have increased from 120 day/year to 200 day/year in a few decades is one of the reasons demonstrating the severity of the impacts of temperature increases on the energy industry (IAEA, 2017).

Increased air temperature averages increase the temperature of the natural water resources that are used as cooling water in thermal power plants and reduce the efficiency of thermal power plants because of the decreasing thermal conversion factor. As a result of using warmer cooling water and reduced plant efficiency, thermal power plants lose 1 to 2% of their installed capacity with each degree Celsius increment. Additionally, thermal power plants powered by natural gas suffer a 3 to 4% loss of energy production with a temperature increase of 5.5°C (GIZ,2017).

Extreme winds and typhoons have devastating impacts on natural gas and oil wells. For example, one in every 5 oil wells operating in the Gulf of Mexico had to be shut down due to the effects of Hurricane Harvey which occurred in USA in 2018 (Earth Networks, 2017). Numerous refineries located on the coastline were also destroyed by Hurricane Harvey. In 2017, a refinery in Texas that is owned by Occidental Petroleum (OXY), one of the largest companies in the US fossil fuel industry, suffered 70 million USD in damages due to the hurricane (Houston Chronicle, 2017). The damaged condition of the refinery is shown in Figure 3.



Figure 3. A View of Damaged Refineries

The floods caused by Hurricane Harvey in 2017 destroyed the oil storage tanks in refineries in Texas (Bloomberg, 2018).

Sea level rises lead to the submersion of power plants or their related structures over time, which requires taking into account sea level rises as a climate change impact in designing the power plants that are planned to be built at sea level.

Impacts of climate change on the fossil fuel energy sector are summarized in Table 8.

Table 8. Impacts of climate change on the fossil fuel energy sector

Energy sector	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
Fossil Fuel	Warmer weather conditions reduce power plant	Higher water content reduces the quality of fossil	Typhoons, hurricanes or cyclones destroy	Risk of damage to power plants operating offshore



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Energy sector	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
	<p>efficiency</p> <p>Increased temperatures melt down the permafrost supporting the foundation of the structures that are built to extract fuel in Polar regions</p>	<p>fuel</p> <p>Drought jeopardizes cooling water resources</p>	<p>power plants, fossil fuel extraction facilities, and refineries</p>	<p>and on the coastline increases in the medium and long term</p>

*Climate Change Vulnerability of Nuclear Energy Sector-* Climate vulnerability of the nuclear energy sector, with a 40 to 60-year lifetime, is significantly similar to that of the fossil fuel energy industry. For example, increased average temperatures of cooling water new climatic conditions that will lower the volume and quality of nuclear fuels render the nuclear energy industry vulnerable to climate change impacts.

Although the environmental, social and economic devastations suffered by the Fukushima Daiichi Nuclear Power Plant because of the Tsunami that hit Japan in 2011 did not originate from climate change, this natural disaster demonstrated how vulnerable nuclear power plants were against floods, which are among the most distinct impacts of climate change.

Additionally, the nuclear fuel extracting operations undertaken in open uranium mines comprise another stage in which the nuclear energy industry is most vulnerable to climate change impacts. For example, floods caused by excessive precipitation in Australia in 2001 and 2012 that hit the Toro Energy Mines led to a significant increase in uranium prices.

Taking into consideration the devastations that climate change may cause in the nuclear energy sector and the environmental and economic impacts that may arise from such devastations (e.g. it is predicted that return to soil-based agriculture in Fukushima will take at least 40 years, DW (2012)), designing/operating nuclear energy power plants in a way to adapt to climate change will first reduce the potential economic losses to be sustained by the nuclear energy industry, and then the economic and environmental impacts to be suffered by other sectors.

Impacts of climate change on the nuclear energy sector are summarized in Table 9.

Table 9. Impacts of climate change on the nuclear energy sector

Energy sector	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
<b>Nuclear</b>	Warmer weather conditions reduce power plant	Floods destroy nuclear mines	Typhoons, hurricanes or cyclones destroy	Risk of damage to power plants operating offshore



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Energy sector	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
	efficiency	Drought jeopardizes cooling water resources	power plants and nuclear fuel extraction facilities	and on the coastline increases in the medium and long term

**Climate Change Vulnerability of Renewable Energy Sector-** In the process of retiring from fossil fuels, which account for 48% of the energy installed in Turkey, the renewable energy sector pioneers the mitigation leg of climate change response across the world. On the other hand, this clean energy sector, which is predicted to meet most of the global energy needs by 2040 with a share of 66%, is vulnerable to the impacts of climate change, as well. Taking into consideration that the renewable energy sector uses and runs different technologies/operations for different (hydro, wind, solar, and biomass) resources, the vulnerability analyses to be conducted on a resource basis for the sector will facilitate understanding the sector's climate vulnerabilities.

The fluctuation in precipitation is undoubtedly the parameter that renders hydropower plants (HPPs) most vulnerable to climate change impacts. The reduced flow rate of the water source on which the plant is built directly reduces electricity generation. For example, climate change impacts are expected to reduce Russia's hydropower potential by 15-20% and Europe's by 6% by 2070.

With the increases in temperature averages, the volume of water stored in the reservoirs of dam-type HPPs significantly decreases due to excessive evaporation. According to data from 2017, the High Aswan Hydropower Plant operating in the Nile Basin has begun to lose 11% of its water level, which is over double the normal levels of loss in hydropower dams due to evaporation. On the other hand, the hydropower plants built in regions starting to receive excessive precipitation due to climate change impacts are destroyed because of the effects of heavy floods.

The wind energy sector is an economic sub-sector that is less vulnerable to climate crisis impacts compared to other energy generation operations in the renewable energy sector. However, the fact that present meteorological modelling is still not very sufficient to estimate the wind-related impacts of climate change (i.e., wind direction, force, density, etc.) makes it difficult to clearly analyse the impacts on the wind energy industry.

Nevertheless, wind power plant (WPP) activities are affected by the parameters related to changing weather events due to climate change impacts. For example, the ice and dust growing on wind turbine blade surfaces, reduced air density, and physical wear of wind turbines due to extremely high temperatures have an unfavourable impact on energy generation. Additionally, the fact that instant energy access depends on the time of wind also renders the wind energy sector vulnerable to climate change impacts. The wind characteristics varying between seasons demonstrate a significant deviation in the time-based generation modelling studies conducted for WPPs.

The solar energy sector is a climate-vulnerable economic sub-sector generally as a result of the changes observed in insolation and cloudiness factors. All energy generation operations that are based on solar rays (heating, photovoltaic solar energy, and concentrated solar energy) are affected adversely by increased cloudiness in the short and medium term depending on changing weather conditions. Additionally, increased temperatures particularly in colder regions are known to generally enhance the performance of heating activities in which solar energy is the driving force. On the other hand, the



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solar energy sector becomes vulnerable to high temperatures because increased temperatures reduce the efficiency of photovoltaic conversion and the concentrated solar energy that uses cooling water. Extreme weather events such as sandstorms and hurricanes also destroy solar energy systems, rendering the sector vulnerable to climate change.

Climate vulnerability of the bioenergy sector is generally based on changing temperature averages and the increased climate vulnerability of the agriculture sector. Temperature changes in regions with a hot climate negatively impacts the biologic activities for producing methane gas which is the fundamental bioenergy fuel. Additionally, decreases in agricultural products, which constitute the raw materials for bioenergy plants, due to floods caused by excessive precipitation or to drought render the bioenergy sector vulnerable to climate change. Increased water levels of animal and plant wastes due to excessive precipitation also has a negative impact on or increases the cost of bioenergy generation (Forest Research).

Impacts of climate change on the renewable energy sector are summarized in Table 10.

Table 10. Impacts of climate change on the renewable energy sector

Energy sector	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
<b>Hydro</b>	Evaporation reduces the water volume in the plant's reservoir, or the river flow rate	Floods caused by excessive precipitation damages HPP structures  Drought reduces the volume of reservoirs and the flow rate of rivers	Typhoons, hurricanes or cyclones destroy HPPs	No significant impact
<b>Wind</b>	Energy generation is affected adversely as increased temperatures reduce air density  Increased temperatures lead to physical wear in turbines	No significant impact	Typhoons, hurricanes or cyclones destroy WPPs  Changes in the wind speed increase deviations in energy generation	Sea level rises destroy WPPs operating offshore
<b>Solar</b>	High temperatures reduce the efficiency of	Increased cloudiness reduces energy	Typhoons, hurricanes or cyclones destroy	No significant impact



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Energy sector	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
	<p>photovoltaic cells</p> <p>High temperatures reduce the efficiency of concentrated solar energy cooling water</p>	<p>generation</p> <p>Droughts jeopardize the cooling water sources required for concentrated solar energy</p>	<p>solar power plants (SPP)</p>	
<b>Biomass</b>	<p>High temperatures reduce agricultural harvest yield</p> <p>High temperatures cause forest fires, leading to the destruction of agricultural lands</p>	<p>Floods and droughts reduce agricultural harvest yield</p> <p>Water content of animal and plant wastes increase</p>	<p>Typhoons, hurricanes or cyclones destroy biomass power plants (BMP) or agricultural products</p>	<p>Erosion and salinization reduce agricultural harvest yield</p>

**Impact of Climate Change on Energy Transmission and Distribution-** In developing countries, one of the most important aspects guaranteeing the operability of electric networks providing energy access is the electric transmission and distribution systems. The energy produced in power plants are brought to end users as a result of the operation of such systems. Taking into consideration the characteristics of the regions where they are located (e.g. a significant portion of electric transmission structures are built on rural or remote non-settlement areas), such systems having a lifetime of 30 to 50 years are vulnerable to climate change impacts. For instance, it was determined that the power outages which occurred in North America between 1984-2006 were caused by extreme weather events (GIZ, 2017).

Increased temperature averages affect transmission and distribution structures in two aspects, which are; (1) reduced maximum power rating of equipment, and (2) energy loss due to increased conductor resistance. For example, the studies conducted in the United Kingdom predicts that each 1°C increment increases the loss of electricity in copper and aluminium wires by 0.4%. Additionally, fires caused by increasing air temperatures destroys electric lines. Taking into consideration that electricity is better transmitted in humid soil than in dry soil, drought renders underground transmission and distribution structures vulnerable to the climate.

Weather events causing the most damage to transmission and distribution structures are storms, hurricanes, and typhoons. Such intense weather events destroy aerial lines, distribution towers, utility poles and short-circuit systems and also cause transmission cables to touch one another, resulting in permanent damage to the cables and transmission stations.

The climate vulnerability of energy transmission and distribution systems are summarized in Table 11.



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Table 11. Impacts of climate change on transmission and distribution systems

Climate Impact	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
<b>Transmission and Distribution Systems</b>	<ul style="list-style-type: none"> <li>- Warmer weather conditions increase electrical resistance, reducing transmission efficiency</li> <li>- Fires caused by high temperatures destroy electric transmission lines</li> </ul>	No significant impact	Typhoons, hurricanes, and storms destroy energy transmission and distribution systems	No significant impact

*Impact of Climate Change on Energy Use-* As stated previously, energy use will increase globally as a result of development and population increase. The rate of increase, which is expected to be 70% by 2040 in developing countries, is largely based on the increase of temperature averages and extreme weather events. The increases to be seen in air-conditioning services due to extremely high temperatures will put energy sector under stress in terms of ensuring the adequacy of energy supply. Additionally, energy supply balances will be impacted by the changing hours and time intervals during which the demand for energy is the highest. For instance, energy demand in Thailand during the most intense hours will increase by 6.6% if global air temperatures increase by 1.7°C, and by 15.3% if global air temperatures increase by 3.4°C. Furthermore, energy access will be affected directly and energy use indirectly by all of the disruptions observed in energy sources, generation, transmission and distribution due to climate change impacts.

Impacts of climate change on energy use are summarized in Table 12.

Table 12. Impacts of climate change on energy use

Climate Impact	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
<b>Energy Use</b>	Warmer weather conditions increase air-conditioning needs, also increasing the demand for energy	No significant (direct) impact	No significant (direct) impact	No significant (direct) impact





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Climate Impact	Temperature Averages	Precipitation	Extreme Weather Events	Sea Level Rise
	The amount of energy used increases during the hours when energy demand is highest			

Impact of Climate Change on the Energy Sector in Turkey- An assessment of Turkey’s energy sector on a resource and structural basis will facilitate analysing (1) climate change adaptation gaps in the energy sector, (2) the progress achieved so far by the institutions that can take part under the umbrella of climate change adaptation in this sector.

Turkey is affected by *drought* caused by climate change; climate projections for Turkey indicates that the effects of drought will increase in the future (Partigöç and Soğancı, 2019). Additionally, all seven geographical regions in Turkey demonstrate climate vulnerabilities arising from *extreme weather events and deteriorated precipitation regime* (TEMA, 2015). Taking into account that these three factors, which are among the main impacts of climate change, have already been occurring in Turkey as well as the thermal and hydropower plants in the country, Turkey is among the countries whose energy sector is vulnerable to climate change. As mentioned in earlier chapters, the operations and operating performances of these plants are directly dependent on freshwater resources. For example, half of the 17.3 billion m<sup>3</sup> of the water taken from natural resources in Turkey in 2016 were used by thermal power plants, and the volume of water used by the plants increased in 2017 and 2018. When examining the distribution of thermal and hydropower plants in Turkey by region, which is demonstrated in

Figure 4, and the distribution of climate change impacts most seen in the energy sector in Turkey by geographical region, which is demonstrated in Figure 5, it is easily deduced that these power plants that have been commissioned or are scheduled for commission should be planned/operated to adapt to climate change (TURKSTAT, 2017).

Reducing the economic impacts that will be suffered by power plants in Turkey due to such climate change impacts depends on the implementation of strategic and rational practices that are compatible with climate change. For example, increasing the efficiency of cooling may be a critical step to ensure that the thermal power plants that have been commissioned in Turkey are resilient to climate change.



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Cooling water efficiencies of thermal power plants will be increased by applying the technical revisions listed below, particularly in the power plants that are commissioned/scheduled for commission in the Mediterranean, Aegean and Southeast Anatolian Regions which are vulnerable to drought caused by climate change (GIZ, 2017):

- Reuse of wastewater
- Reuse of water
- Recycling water from heat exchanger
- Reducing water loss due to evaporation



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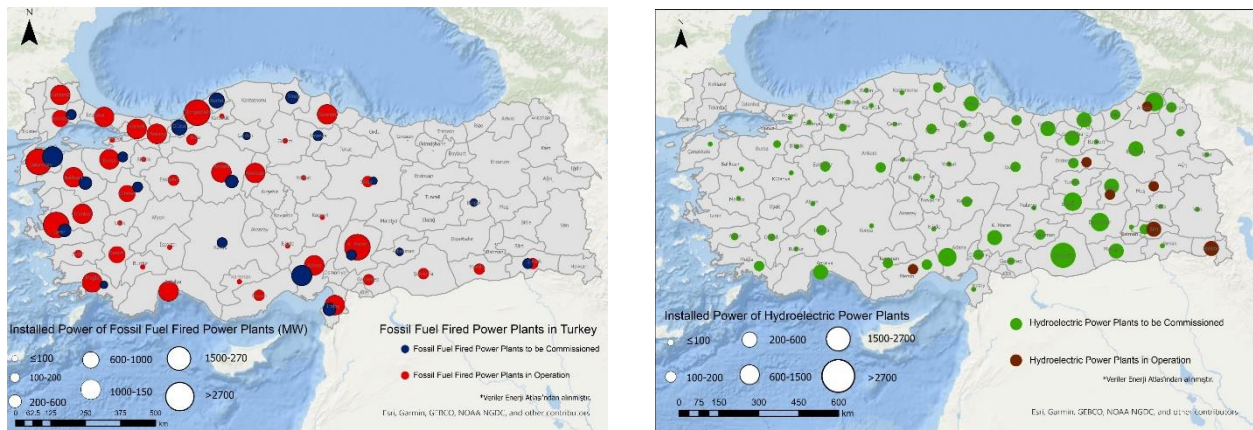


Figure 4. Distribution of the installed power of existing and prospective thermal and hydropower plants in Turkey by province

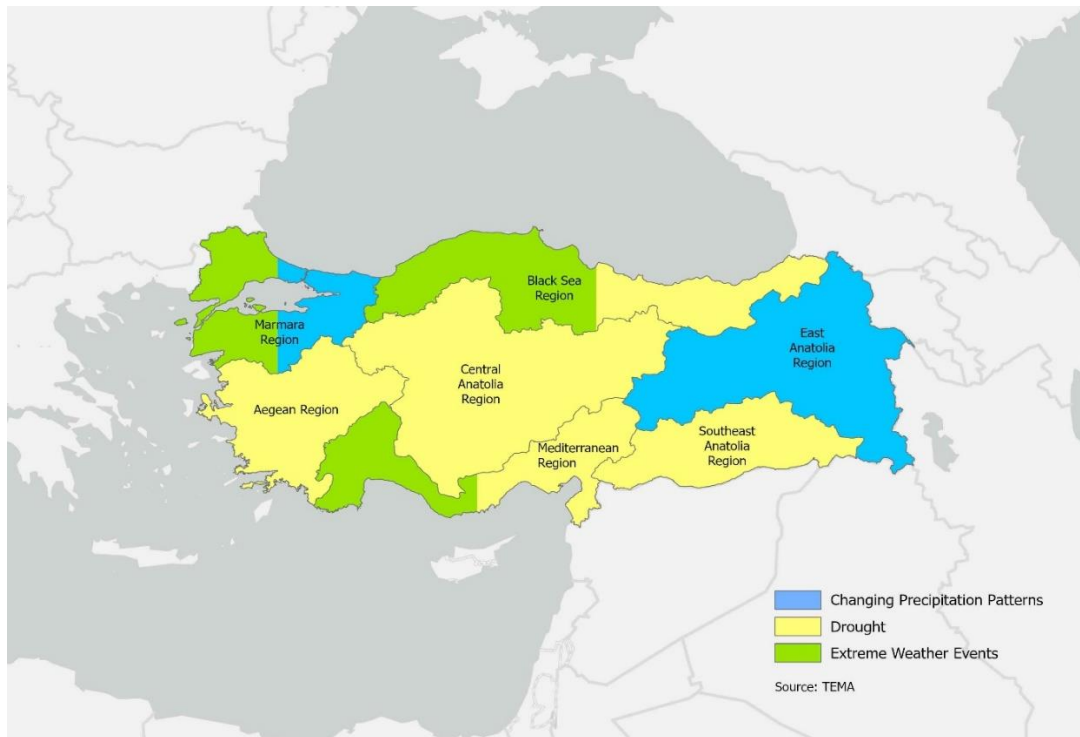


Figure 5. Incidence of climate change impacts to which the energy sector is most vulnerable

The occurrence of natural disaster, which is another climate change impact, has recently increased in Turkey. While such disasters bear the potential to damage almost all energy generation facilities in Turkey, their greatest damage is sustained by hydropower plants. For example, floods caused by excessive precipitation destroys hydropower plants; in that context, the plants can be made climate resilient by reinforcing the discharge valves or flood gates of the HPPs in Turkey or relocating the plants/tributary flows. Furthermore, increased mountain erosion speed due to climate change induced natural disasters increases the amount of fine sand and gravel accumulated on HPPs, reducing their energy generation efficiency. The application of enhanced desilting technologies in HPPs and making further detailed hydrological estimations for HPPs can be among the measures to make the hydropower sector climate resilient.



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Although hydropower plants are the energy generation facilities that are the most affected by natural disasters in Turkey, these extreme weather events have a great risk to damage the physical structure of solar, biogas and thermal power plants in the short term. For example, it is observed that cyclones and tornadoes, which are characteristic climate change impacts in tropical regions, have begun to destroy superstructures and infrastructures in Turkey and an increase is expected in the number of occurrence of such radical weather events in Turkey over the years (TRT, 2019). In that context, basic infrastructures and superstructures should be renewed in line with climate changes in the plants that have been commissioned; and the power plants to be commissioned should be planned according to long-term projections for extreme weather events.

The power plants (except for WPPs) that are and planned to be commissioned on the coastline in Turkey demonstrate vulnerability against climate change because of sea level rises. For example, Izmir and Mersin, which are respectively the 3<sup>rd</sup> and 10<sup>th</sup> largest provinces in Turkey according to GDP levels, are among the most vulnerable provinces in Turkey to sea level rises. In fact, a 4°C increase in global temperature averages will cause the submersion of a significantly immense portion of lands in these provinces, as shown in Figure 6 and Figure 7. Taking into consideration the 9% contribution of the power plants commissioned in these provinces to the national installed power, it is important for the energy sector in Turkey to adapt to climate change that relevant power plants are planned in accordance with rising sea levels (Climate Interactive, 2020).

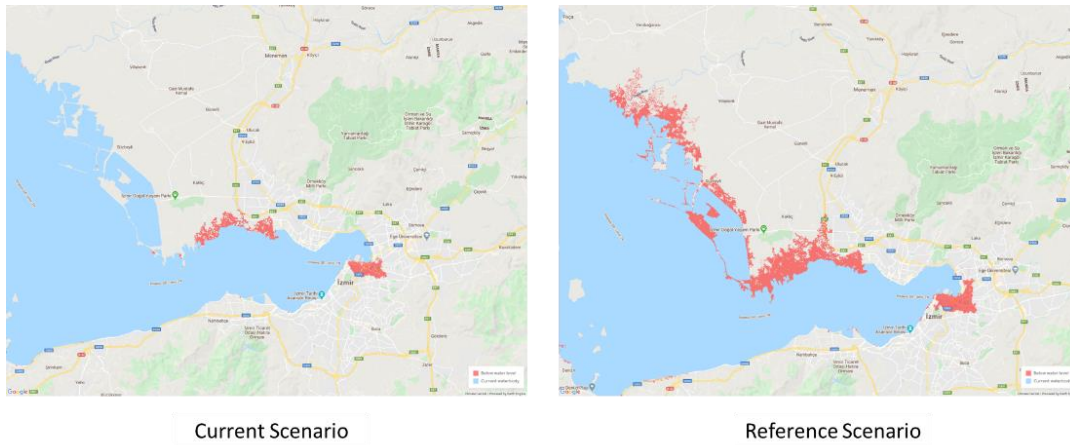


Figure 6. Sea level rises in Izmir with a 4°C temperature increase (Climate Central)



Figure 7. Sea level rises in Mersin with a 4°C temperature increase (Climate Central, 2020)



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### 3.2.2 Sectoral adaptation to climate change

Climate resilience may be defined as taking into consideration and internalizing the climate change-based risks and opportunities in designing infrastructures and superstructures (GIZ, 2011). On the other hand, planning for and implementing climate resilience without using strategic approaches gives rise to *maladaptation* practices. As is the case in all other economic sectors, designing the climate resilience of the energy sector through rational means will be a measure to prevent the observation of potential maladaptation practices, thus ensuring that adaptation practices are in tune with the times and efficient in the long term. Maladaptation may occur when the adaptation efforts in one sector creates side/secondary impacts on other sectors. In some cases, a climate change adaptation practice that is successful on a specific temporal or spatial scale may turn into maladaptation or non-adaptation.

The current functioning and development goals of the energy sector should be planned with a holistic approach that is centred around climate change adaptation as much as emission reduction practices. The adoption of such an approach will primarily reduce the damages sustained by the energy sector due to climate change impacts which will in turn facilitate the climate change adaptation measures that will be applied in the energy sector to support the prevention of climate change.

Holistic adaptation measures applicable in the energy sector may be categorized as proactive and reactive. Proactive measures, such as planning for the energy systems to be commissioned to be built on areas where climate change impacts are relatively lower, involve approaches that enable the mitigation of future risks; reactive measures, such as enhancing the existing energy systems, include actions to ensure reducing the risks that are encountered in the current situation.

Existing adaptation practices centred around *holistic climate resilience* and applicable to the energy sector are summarized below:

One of the first steps in the energy sector's climate change adaptation in developing countries is to consolidate and enhance "adaptation capacity". This capacity may be considered as building a rapid response mechanism against the short-term impacts of climate change in particular, which requires ensuring access to the social, human, natural and financial resources in the energy and controlling such resources. As an example in terms of the social development aspect, while women constitute a social segment that is more vulnerable to climate change impacts in developing countries, they are also challenged at the point of engaging as a driving force in the processes of designing and managing energy systems to be adaptive to climate change, which is also the case in many other sectors.

Climate vulnerability observed in the user wing of the energy sector can be reduced through increasing access to energy in rural regions. Communities that have difficulty accessing energy become more vulnerable to climate change impacts and have challenges sustaining their basic vital needs. The energy-climate vulnerabilities that are observed through such communities can be reduced by expanding energy networks or localizing electric networks.

Enhancing energy systems will reduce the vulnerability of the energy sector to climate change. Energy systems that are vulnerable against climate change induced extreme weather events (e.g. drought, flood, hurricane) should be redesigned by using modern technologies and rationalist strategies. For example, technological and strategic applications are implemented to enhance the climate resilience of the HPPs built on the Dong Nai river in the Ho Chi Minh City in China. Diversifying the tributaries that feed the power plant, designing new storage reservoirs or replacing old turbines with newer ones and increasing their increase the frequency of their maintenance are the technological measures implemented the most often by such power plants to adapt to climate change. Furthermore, using improved hydrological estimations and redesigning physical structures such as transmission and





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distribution structures by taking into consideration the places where extreme weather events are less frequent are among the strategic moves applied by power plants.

*Diversification of both fossil and renewable energy sources strengthens energy security.* As mentioned previously, climate change impacts all energy resources, making it essential for an energy system to feed from multiple resources. For example, distributing hydropower dependency to wind and solar in regions that are threatened by drought would be a rational climate change adaptation strategy.

*Practicing energy efficiency reduces the pressure on the energy sector, which is already climate-vulnerable.* The increase in energy demand as a result of extreme heat and drought lowers the performance of energy supply. Energy efficiency practices that can reduce energy demand will alleviate the climate vulnerability of the energy sector.

*Reducing the energy amount generated during the hours of the day when energy use is highest reduces the demand pressure on the grid throughout the year and the day.* Including such applications as smart grids and enhanced storage technologies in energy systems will alleviate the pressure of climate change on energy generation.

*Localized energy networks increase the climate resilience of the energy sector.* Since central energy systems are generally connected to multiple energy generator and user, it is much more vulnerable to climate change impacts than local energy systems as potential destructions at some critical connection points or stations can affect a large part or the entirety of an energy grid. Local energy systems are less vulnerable to climate change impacts for having fewer interconnected transmission and distribution lines.

Financial Implications of Making Energy Sector Climate Resilient- In a scenario in which global temperatures will increase by the year 2050, the annual cost of adapting to climate change in all economic sectors between 2010 and 2050 is estimated to be 70 billion-100 billion US Dollars. Energy sector has a significant share in this cost; for example, the annual cost of ensuring the climate adaptation of the energy sectors in the EU, having the most advanced energy systems in the world, is approximately 654 million Euro (World Bank, 2011).

The investment required for climate change is unavailable on a global scale. For example, the fact that the funding globally spent on climate change adaptation in 2015 did not exceed 10 billion dollars demonstrates the failure to achieve even 10% of the financial flow required. When evaluating such a limited funding for adaptation on a sectoral level, the energy stands out among other economic sectors with a share of 2% as one of those receiving the least amount of investment for adaptation. The sectoral distribution of the funding spent on global climate change adaptation in 2016 is shown in Figure 8 (CFU, 2017).





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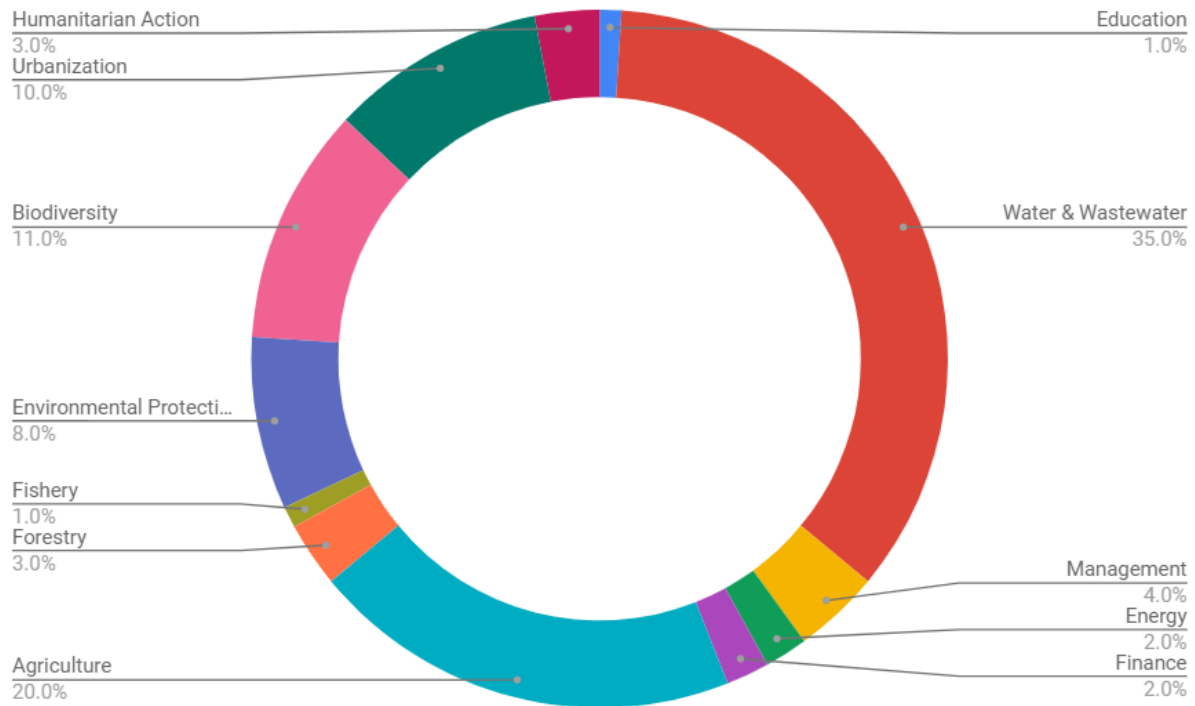


Figure 8. Distribution of global bilateral funding for climate change adaptation by sectors (GIZ, 2017)

Energy demand will increase in the next 10 years in Turkey. According to data from 2018, the electricity demand in Turkey will increase by 42% by 2027 based on the reference scenario. Thus, when assessing the devastating impacts of climate change on the energy sector, it is essential to plan and operate the energy sector in Turkey to adapt to climate change (TEİAŞ, 2018).

The successful implementation of climate change adaptation depends on the successful mobilization of all relevant stakeholders. In that context, the primary step that must be taken before mobilizing the stakeholders is to evaluate the responsibilities and roles of stakeholders and conduct a gap analysis based on this evaluation (GIZ, 2017).

As in other economic sectors, a role assessment to be conducted for the Turkish energy sector's climate change adaptation and dividing the gap analysis into specific subheadings will facilitate to understand which stakeholder is required to become further engaged in which stage. Table 13 demonstrates the energy sector's climate change adaptation stages in which the relevant stakeholders in Turkey can take an active part. Role assessment on a stakeholder basis and gap analysis are also discussed under these subheadings.

Table 13. Engagement of energy sector stakeholders in climate change adaptation stages in Turkey

Stakeholder	Public Sector	Private Sector	Academia	Civil Society
Awareness raising on climate change impacts	x		x	x
Climate change Risk assessment	x	x	x	x



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Stakeholder	Public Sector	Private Sector	Academia	Civil Society
Diversifying and increasing energy access, energy supply, and storage systems	x	x	x	
Site planning	x			
Early warning and disaster response management systems	x	x		
Reinforcing infrastructures and superstructures	x	x		
Energy and water efficiency	x	x	x	
Energy security standards	x			
Monitoring and evaluation	x		x	x

The public sector has responsibilities under all subheadings mentioned in terms of climate change adaptation in the energy sector. In consideration of the climate change adaptation practices that have been/are being implemented for the energy sector by different countries, it will be beneficial that the Turkish public sector, by whom climate change adaptation policies of the energy sector will be guided under the leadership of the Ministry of Energy and Natural Resources and its associates and affiliates, carries out works on the following issues:

- Building capacity to raise awareness on climate change impacts for the energy sector and energy companies in the sector
- Fostering the public-private sector discussions on the climate change impacts on the energy sector
- Mapping out energy access in rural regions of Turkey (including seasonal settlements)
- Planning energy supply by including the projections to be made for the impacts of climate change on energy demand
- Updating the efficiency and capacity of existing energy storage systems according to climate change impacts; planning the new storage systems to be commissioned by including the projections to be made for the impacts on energy demand
- Carrying out a site planning for energy systems by taking into account the countrywide incidence frequency of and projections related to the most devastating climate change impacts (e.g. sea level rise, drought, extreme weather events)
- Encouraging to increase the frequency of using early warning and disaster response systems in the energy sector by taking into consideration the short, medium and long term climate change impacts



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- Encouraging to reinforce the infrastructures and superstructures in every part of the energy sector by taking into consideration the short, medium and long term climate change impacts
- Revising the energy efficiency programmes in effect for the manufacturing industry and residences based on the projections to be made for the short, medium and long-term impacts of climate change on energy demand
- Enhancing energy security standards by taking into account the most devastating climate change impacts on energy access (e.g. damages to generation and transmission facilities/structures)
- Monitoring climate change impacts in the energy sector and sector companies regularly and preparing regular evaluation reports on such periods of monitoring.

The planning and strategy development works prepared by the public sector in Turkey on climate change adaptation and the energy sector does not have include too many content for directly increasing the climate resilience of the energy sector; in these works, the energy sector is planned and discussed under emission reduction. Taking into consideration the relationship between energy and climate change; the content of the works and development plans, sector reports, and climate change strategies and action plans<sup>105</sup> and national communications on climate change should be enriched to ensure the energy sector's adaptation to climate change.<sup>106</sup> In that scope, the works undertaken under the leadership of the Strategy and Budget Office of the Presidency, Ministry of Industry and Technology, Ministry of Environment and Urbanization, Ministry of Agriculture and Forestry, Ministry of Energy and Natural Resources and their affiliates have been analysed in detail.

Based on the analysis, it was understood that the energy sector was largely planned in line with emission reduction measures and the sector's contributions to climate change. No large scale plans and programmes for making the energy sector directly climate-resilient were found in the national strategy papers for climate change. Still, some impact analysis and partial actions to enhance the energy sector's climate resilience were included in these documents, such as the following:

- Conducting gap analysis for energy access, and increasing access to energy
- Reducing energy demand and relieving the future pressures on energy supply through the energy efficiency practices implemented in the manufacturing industry and on a residential basis
- Reducing the dependency on water and fossil sources in energy generation through increasing clean energy generation at WPPs and SPPs
- Increasing thermal power plant efficiency by using clean coal technologies
- Ensuring a holistic management of water basins<sup>107</sup>
- Planning hydraulic and geothermal energy resources from a climate change adaptation perspective
- Enhancing the resilience of HPPs and GPPs
- Conducting cross-sectoral natural disaster risk identification works.

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<sup>105</sup> Turkey Climate Change Strategy (2010-2023); Turkey National Climate Change Action Plan (2011-2020); Turkey's Climate Change Adaptation Strategy and Action Plan (2011-2023).

<sup>106</sup> First, Fifth, Sixth, and Seventh National Communications were examined under this report.

<sup>107</sup> This provision is a measure that is included in all strategic documents examined but is not directly discussed from the perspective of the energy sector's adaptation to climate change. However, since all water basin management plans will affect the cooling water efficiency of the energy sector, this provision is included in the analysis of the energy sector's adaptation to climate change.



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In consideration of the summarized content listed above, these works prepared by the Ministry of Environment and Urbanization and Ministry of Agriculture and Forestry included provisions and statements concerning the analysis of the climate change-induced stresses on energy resources.

The development plans<sup>108</sup> that were prepared under the leadership of the Strategy and Budget Office of the Presidency and the former Ministry of Development were also analysed through the filter of the energy sector's climate change adaptation. The analyses determined that the development plans included the impact analysis and partial actions listed below:

- Analysis of the increasing demand-supply stresses on the energy sector based on the increase in energy demand
- Medium and long-term energy demand-supply plans
- Nationwide energy efficiency practices
- Rehabilitation of natural gas transmission lines
- Rehabilitation of thermal and hydraulic energy sources
- Rehabilitation of thermal power plants and HPPs
- Enforcement of smart grid practices
- Holistic management of soil and water resources.

In addition to the strategic documents mentioned above, the activity reports and sector reports prepared by the Ministry of Energy and Natural Resources, Energy Market Regulatory Authority (EMRA), and Turkish Electricity Transmission Corporation (TEİAŞ) in 2015-2019 were also analysed under climate change adaptation strategies. It was determined that these works did not directly include content on the relationship between the energy sector and climate change adaptation and that the energy sector could only be evaluated indirectly in the context of adaptation to climate change through energy supply and demand risk studies and energy efficiency practices.

#### 3.2.3 Work by stakeholders

When examining the focus area of the projects implemented between 2014-2020 by **EMRA** in line with the findings of the sector report that was prepared in 2019 by the Electricity Distribution Services Association (ELDER), climate change projects comprised 2.58% of all R & D projects, and none of these 5 projects were implemented for assessing the energy sector's vulnerability or climate change adaptation. The distribution of all projects by area of focus is diagrammed in Figure 9:

<sup>108</sup> Ninth, Tenth, and the current Eleventh Development Reports were examined under this report.



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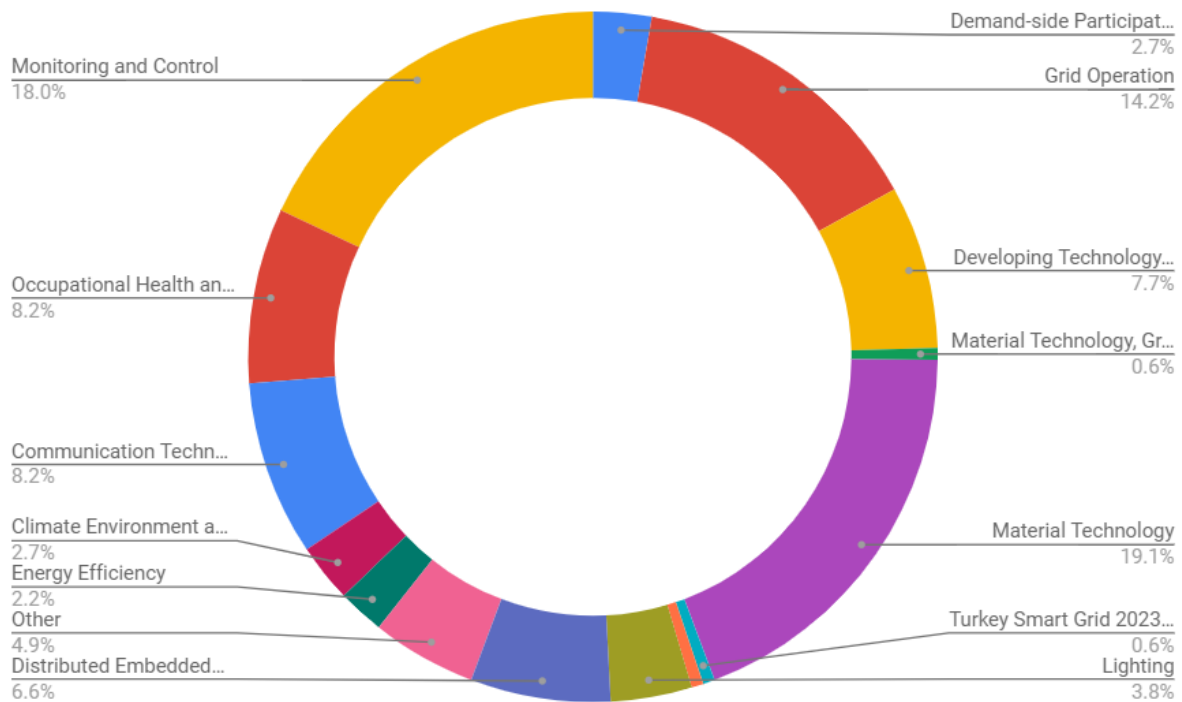


Figure 9. Distribution of EMRA R & D Projects (July 2014 - July 2020) (ELDER, 2019)

Private sector also has responsibilities that are as critical and heavy as those of the public sector in making the energy sector, accounting for over 50% of the Turkish industry's Gross Domestic Product, resilient to climate change impacts. The private sector has active responsibilities in almost all stages of stakeholders' engagement in the energy sector's climate change adaptation. Taking into consideration the energy portfolio and operations of the participating companies of the energy sector in Turkey, the responsibilities of the private sector are summarized below:

- Analysing the risks and impacts caused by climate change on energy resources and energy generation, and mentioning such analyses regularly in annual reports
- Updating the efficiency and capacity of existing energy storage systems according to climate change impacts; planning the new storage systems to be commissioned by including the projections to be made for the impacts on energy demand
- Increasing the frequency of using early warning and disaster response systems in resource exploration, resource procurement and energy generation facilities by taking into consideration the short, medium and long term climate change impacts
- Reinforcing the infrastructures and superstructures in resource exploration, resource procurement and energy generation facilities
- Monitoring climate change impacts in the energy sector and sector companies regularly and preparing regular evaluation reports on such periods of monitoring
- Actively engaging in and supporting the practices and programmes implemented by the public sector for energy and water efficiency.

In this framework, a literature review was conducted about energy companies registered in Turkey, 308 of which were power plants with an energy portfolio consisting of renewable and fossil-fired resources. A review of the climate change studies conducted in Turkey generally in the private sector



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and specifically for energy companies revealed that no strategic work was undertaken for the climate change adaptation of the sector and power plants or those that were undertaken were not available for online/physical access (Energy Atlas).

From the perspective of the **academia** and considering the programmes of the relevant departments, the stakeholder engagement areas and responsibilities of the academia may be summarized as follows:

- Participating in awareness raising efforts on climate change impacts across the energy sector in general and specifically for sector companies
- Supporting the public sector in identifying the sectoral impacts and risks of climate change
- Offering consultancy to the public and private sectors in diversifying energy supply and storage systems
- Conducting R & D studies for energy facilities, focusing on energy and water efficiency
- Cooperating with the public sector in issuing draft works that are required for the regular monitoring and reporting of climate change impacts in the energy sector and for sector companies.

In this framework, free and publicly accessible articles and reports published by the university departments providing training on energy and environment in Turkey were reviewed. The outcomes of the review revealed that no direct field study, R & D study and/or research was conducted by such university departments for the energy sector's climate change adaptation or those that were conducted were not available for online/physical access.

The responsibilities that **civil society** must assume in planning and developing the energy sector's climate change adaptation are more limited compared to other sector stakeholders. In this context, the responsibilities of civil society may be summarized as follows:

- Building capacity to raise awareness on climate change impacts for the energy sector and energy companies in the sector
- Fostering the public-private sector discussions on the climate change impacts on the energy sector
- Cooperating with the public and private sectors to conduct risk studies on the impacts of climate change on the energy sector
- Regularly monitoring, reporting of the works undertaken for the energy sector's climate change resilience under the leadership of public and private sectors and disseminating these reports on sectoral and public platforms.

There are over 15 sectoral associations operating to support the works and ensure the in-sector capacity development of the energy sector in Turkey, in addition to which there are also components of civil society with an umbrella organization status carrying out regular efforts for assessing the activities and current state of the energy sector such as the Union of Chambers and Commodity Exchanges of Turkey, Turkish Industry and Business Association (TUSIAD), and chambers of profession. A review of the strategic works undertaken by the most active 12 sectoral associations and said civil society organizations revealed that no strategic work was undertaken for the climate change adaptation of the sector and power plants or those that were undertaken were not available for online/physical access.

The civil society organizations focusing on nature conservation in Turkey undertake activities concerning the unfavourable effects of fossil fuel-based energy investments, rather than approaching the subject from the perspective of energy sector's climate change vulnerabilities.





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Being one of the few studies, a report titled “The Status of Water in Turkey and New Water Management Approaches: Environmental Perspective” was prepared in 2013 by Nature Conservation Centre (NCC) and YADA Foundation specialists for the Business Council for Sustainable Development Turkey (BCSD Turkey) with the support of the Food and Agriculture Organization of the United Nations (FAO) and General Directorate of Water Management. The report, in which water resources were referred to as a critical element of sustainable development, contained in-depth assessments concerning how the Turkish business community’s vision for water is determined based on different sectoral approaches, and specially examined the link between “energy sector and water resources. The report also emphasized the importance of planning the energy and water resources in Turkey interactively in the policies for ensuring adaptation to climate change (BCSD, 2013).



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### 3.3 Cities and climate change adaptation

- Climate change data should be used as a potential determinant in all planning decisions at different levels in cities.
- Local government associations are management tools accelerating climate change adaptation action in cities.
- Analysis for the impacts of climate change on coastal cities is not conducted in Turkey.
- Areas that will be most affected by climate change in the coasts of Turkey are coastal deltas with the highest agricultural production, wetlands, and low-altitude tourism areas.
- Cooperation and coordination between metropolitan-district and metropolitan-governorship is important in responding to climate change. If such connections are not established, there may be misalignment between the managerial and spatial purviews of local governments which will affect climate change adaptation planning processes in cities negatively.
- Metropolitan urban-agriculture policies and practices are supportive of the climate change adaptation action.
- The social development and climate justice parameters (livelihood, poverty, migration, gender equality) of climate change are not included in the existing local climate action planning practices in the cities in Turkey.
- Central government's provincial organization and municipalities are not aware of the full/anticipated extent of the fact that their work areas and services intersect with the climate change adaptation action.
- Climate change adaptation action at the urban level requires implementing location-based technical tools.
- The measures contained in the existing National Adaptation Strategy and Action Plan have a poor connection with spatial and land use planning. The plan does not directly focus on cities, where maladaptation occurs the most in Turkey.

Most risks of global climate change are concentrated in urban areas. Climate change has brought to cities various problems such as temperature changes, precipitation regime changes, drought-flood, sea level rises, population movements (migration caused by climate change), with which cities are closely concerned. These problems require coping with an extensive and integrative approach that takes into consideration not only environmental but also social and economic conditions. The most basic approaches in responding to climate change in cities are listed as such: determining and planning urbanization policies by using a climate change resilience approach, ensuring coordination with all social actors in all processes that involve making and applying decisions, and developing efficient engagement mechanisms.

#### 3.3.1 Impact of climate change on cities

The existence of urban systems is significantly jeopardized by meteorological and hydrological disasters and extreme weather events that occur/are expected to occur with climate change. The most basic risks affecting cities in terms of climate change are increasing temperatures, extreme weather events, rising sea levels, and water and food insecurity. Increased flood risks in particular are among the most common impacts of climate change on urban areas. From coastal to off-coast inland cities and the cities of developing countries to the cities of developed countries, almost all cities are expected to be affected by flood risks caused by climate change.

As such in the cities of various countries, the risks caused/to be caused by climate change in cities in Turkey and the basic measures that are required may be summarized as follows:



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- It is critical to develop urban heat management strategies, increase green areas and green roof practices, organize wind corridors and strengthen infrastructure against the problems that arise with increasing temperatures, including increased health problems, air pollution, and particularly urban heat island impacts that cause nights to be warmer.
- Reduced water resources may lead to such risks as potable water shortage, spread of waterborne diseases, reduced food security, and high food costs. Irregular precipitation and lower seasonal precipitation than expected are the main factors leading to water shortage. Irregular and low precipitation will underfeed surface and groundwater resources; furthermore, increased temperatures will increase evaporation, causing the available water in water basins and springs to decrease before consumption.
- Reducing loss and theft, collecting water separately through such methods as separate collection, rain gardens, green roofs, and improving wastewater treatment are among the strategies that can be applied for sustainable use of water in cities.
- Green areas should be increased with a systematic approach, infrastructure should be strengthened, appropriate methods for collecting wastewater and rainwater separately should be determined and disaster action plans should be formulated in this framework in order to fight against floods, overflows and disasters caused by sudden and severe rainfall as a result of sewer infrastructures that were built by ignoring climate change impacts, and the high levels of building development in cities.
- For climate change adaptation practices, critical urban infrastructures and sensitive areas need to be identified and actions formulated by taking the changing conditions into account.

*Coastal cities* in Turkey, where 28 of the 81 provinces are located on the coasts, have begun to be affected by climate change. Among these impacts are coastal erosion and floods, seawater inflow, changing agriculture, tourism, and ecosystem interactions, increased sensitive areas and hot spots, land use changes, and the changes in the water potential and water temperatures in coastal areas. According to research, the places that will be most affected by climate change on the coasts of Turkey are the coastal deltas with the highest agricultural production, wetlands, and low-altitude tourism regions. Contingency plans should be prepared to develop early warning systems against rising sea levels and storm surges, strengthen coastal infrastructures, relocate the service buildings on the coastline to hinterlands, and evacuation in case of crisis (TEMA Foundation and ICLEI).

Scientific research, data, risk assessment, etc. that can provide a basis for urban administrations against the impacts of climate change are extremely few and need to be increased in Turkey.

### 3.3.2 Climate change adaptation in urban planning

Problems arising from climate change in cities change the risk profiles of cities, demonstrating that there is a greater need than ever to address the economic, social and ecological elements of the systems comprising cities and shaping urban spaces in forward-looking policies and planning decision. Climate is affected by urban planning decisions and cities by climate change; this requires interactive urban planning (spatial, administrative) decisions and climate change adaptation parameters (scientific models, data, sectoral adaptation policies, etc.). These situations that bring along a different approach and need for strategic planning in urbanization processes are now before us with a brand-new urban planning agenda in which mitigation strategies can be applied as well as putting forward climate-resilient sustainable urban development dynamics (Çolakoğlu, 2019).

Informed choices about climate change adaptation usually go parallel with healthy living qualities and levels of welfare. From this perspective, climate change adaptation action in cities can bring along several inclusive **common benefits** in various areas. Today, climate response goals in cities should be



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considered as an integrated agenda involving broader social, environmental, and economic benefits (e.g. health, air quality, employment, equality).

*Local climate change adaptation action plans*, which have been increasingly implemented in many countries in recent years, is one of the planning tools required for urban administrations to manage climate change response. Today, numerous urban administrations have dedicated a significant portion of their local service policies to climate change adaptation at the local level, preparing and implementing local adaptation action plans. While some of these plans are directly related to climate change, others are integrated plans discussing mitigation and adaptation responses in conjunction. Based on the fact that resilience to climate change impacts is different at local/regional levels in terms of floods, overflows, drought, heatwaves, etc., there is no recipe for a local adaptation/mitigation or integrated action plan that can be used as template for all cities. Each city's climate change adaptation potential and efficiency depend on its own structure and development level and therefore, the urban development level and spatial, environmental, economic, and social factors are identified individually when assessing cities' resilience capacities for climate change adaptation, and their local climate change adaptation strategies and action plans are formulated accordingly. There are a series of methods that guide urban administrations in planning climate change adaptation action plans for cities, and studies that are available and in development that have been diversified methodologically according to certain criteria.

Research shows that the frequent and extreme weather events caused by climate change in **Turkey** are more varying in cities than in rural regions, putting specific emphasis on the importance of adaptation works to ensure urban resilience to extreme weather events (floods, overflows, drought, etc.) (Türkeş and Erlat, 2017).

When looking at how the **legislation** regulating the establishment and duties of local administrations in Turkey has determined a domain for local governments with regard to climate change response (including all policy response domains), it is important to first determine the legal position of climate change amongst the tasks of municipalities according to levels of government (metropolitan municipalities, provincial and district municipalities) and the roles of local governments in responding to climate change. Thus, the legal structure of the local governments in Turkey is further discussed below (Kocaman and Talu, 2019):

*Law on Metropolitan Municipalities-* Law No. 5216 of 10/07/2004 on Metropolitan Municipalities regulates the legal status, governance, and service performances of metropolises. Metropolitan municipalities stand out among local governments in terms of their population, surface area, and budget size. With the comprehensive amendments introduced to the Law on Municipalities pursuant to Law No. 6360 of 12/11/12, the area of power and responsibility of metropolitan municipalities were extended to provincial civil administrative borders. Pursuant to the comprehensive Article 7 of the Law that regulates tasks, metropolitan municipalities were delegated extensive planning, regulation, approval, implementation and supervision tasks and powers in a wide range of areas such as land development planning and control, transportation and public transport, water and sewer, rehabilitation of riverbeds, cultural and natural assets, natural disasters, and regional parks. Trying to gather all environmental tasks under a single subparagraph, the Article specifies the tasks of ensuring the protection of the environment, agricultural land and water basins; planting trees; gathering businesses that have an impact on public health and environment in specific places in the city; designating storage areas and sales points for certain materials; managing solid wastes; and providing services concerning industrial and medical waste in accordance with the principle of sustainable development. Metropolitan municipalities were also assigned with the task of installing central heating systems, which are still not commonly used.



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The law discusses the tasks and powers of district municipalities in more general terms, indicating that district municipalities can perform the tasks and use the powers outside of those that were exclusively assigned to metropolitan municipalities by the law. Nevertheless, tasks related to certain matters such as collecting solid wastes, licensing and supervision of certain businesses, building parks, and conservation of cultural and natural assets and the historical fabric are clearly written in the Law.

The relationship between *metropolitan-district* and *governorship/municipality* is important for responding to climate change in the management of metropolises. Successful horizontal cooperation and coordination leads to the establishment of a mutual theme of cooperation and coordination in metropolitan areas and district municipality networks/relations as well as in the provincial authorities (i.e., governorships and their extensions) of central governments, signifying a well-constructed climate planning management. Lack of cooperation in metropolitan areas will lead to conflicts among the administrative and spatial jurisdiction of local governments, affecting climate action planning processes negatively.

The Law on Metropolitan Municipalities grants the metropolitan municipalities and their district municipalities with the power to perform all kinds of activities and services to support agriculture and livestock breeding. This power in pastures and agricultural lands is important for local governments, providing a legal basis for the responsibilities they can assume under adapting to climate change. The prominence of rural-urban interactions and the recent *urban agriculture* activities in metropolitan areas in particular have brought up the issue of developing climate change adaptation for rural areas next to cities, as well. In this respect, mainly the agriculture sector's climate change adaptation comes to the forefront, considering the general development dynamics and the position of the sector within the supply chain.

Land development planning and control is one of the primary areas of duty and power for metropolitan municipalities in terms of climate change. The processes of land use planning must be managed well and failure to do so will lead to consequences such as increased impact by urban heat island, obstruction of air circulation, inability to absorb precipitation, increased air pollution, urban flooding, increased adverse impacts of snowfall on daily life, and increased energy consumption caused by widespread use of air-conditioning. It seems beneficial to engage the Ministry of Environment and Urbanization in the rehabilitation of urban land use planning and practices, where necessary.

*Law on Municipality-* Law No. 5393 of 03/07/2005 on Municipality regulates the establishment, tasks and powers of municipalities. According to the law, the municipal duties and areas of responsibility involve urban infrastructure such as land development planning and control, water and sewer, and transportation; environment and environmental health; sanitation and solid waste; water supply; removal of wastewater and rainwater; firefighting, emergency aid, rescue; urban traffic and public transport; tree planting, parks and green areas; cultural and natural assets; housing; and services aimed at development of economy and commerce. According to the Law, municipalities have the power and privilege to undertake all kinds of activities and venture in order to meet the common requirements of the town's inhabitants. In order to ensure orderly urbanization and meet the town's requirements with regard to residential, industrial and business areas except the sites requiring protection under special laws and agricultural land, municipalities are also authorized to generate a supply of planned landlots provided with infrastructure and build housing.

Municipalities may implement urban regeneration and development projects in order to create housing areas, industrial areas, business areas, technology parks, public service areas, recreation areas and all sorts of social facility areas, rebuild and restore worn-out parts of the city, preserve the historical and cultural heritage of the city or take measures against earthquake. Urban regeneration and development subjects are regulated in detail by the Law.



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Another important task of municipalities that may be considered as part of adapting to the impacts of climate change is to draw up the necessary disaster and emergency plans to protect the town from natural disasters and reduce the damage caused by such disasters and prepare the necessary teams and equipment for the purpose, bearing in mind the characteristics of the town.

The Law lists excursion areas, threshing areas, copses, leisure areas, squares, swamps, garbage dumps, ruined castles and towers and the landlots on which such ruins stand among the places in the municipality's possession.

The *Citizens' Assembly* established pursuant to the Municipal Law endeavours to implement the following principles: development of a vision of the city's future and of an awareness of citizenship of the town; protection of the city's rights, laws and regulations; sustainable development; environmental awareness; social solidarity; and mutual assistance; transparency; accountability; participation and local self-government. Opinions formed within the Citizens' Assembly, which is realized through broad participation, must be placed on the agenda of the municipal council and deliberated at its first meeting. It is projected that the municipality carries out programmes designed to encourage the voluntary participation of individuals with a view to ensuring solidarity and participation in the town's provision of certain services and to increase effectiveness, economy, and efficiency in service provision.

As can be seen, municipalities do not have any defined tasks directly related to climate change pursuant to the Law on Metropolitan Municipalities and the Municipal Law of 2005. However, their jurisdiction involves works in various areas of service, such as infrastructure, public health, green areas, parks, transportation, planting trees, waste and wastewater management, which are important in terms of climate change adaptation.

*Law on Special Provincial Administration-* Law No. 5302 of 22/02/2005 on Special Provincial Administration regulates the establishment, tasks and powers of special provincial administrations. Provided that such services be of local and common nature, the special provincial administration is mandated and authorized to provide services that are related to industry and trade; provincial environmental plan, public works and settlement, conservation of soil, prevention of erosion; tourism services; and services that are related to land development planning and control, road, water, sewer, solid waste, environment, emergency aid and rescue; supporting the forest villages, forestation, establishment of parks and gardens outside the municipal boundaries. Special provincial administrations can take on an important role in responding to climate change, considering their broad sphere of activity related to rural areas that are outside of the municipal areas of service.

*Village Law-* The management of villages, which constitute the smallest local government unit, and the works to be undertaken in villages in Turkey are regulated in the Village Law No. 442 of 18/03/1924. It is known that most of the investments are made by special provincial administrations due to budgetary and other capacity deficiencies in villages. It is important that the villagers, who are mostly engaged in agriculture and livestock breeding, are provided with information on the subjects of climate resilient agriculture and livestock breeding and with close support in applications within the scope of rural development.

The laws related to climate change adaptation, including those that directly involve urban planning, are described below.

*Law on Land Development Planning and Control-* Law No. 3194 of 03/05/1985 on Land Development Planning and Control aims to ensure that settlements and the development therein come into being in compliance with plans, science, hygiene and environmental conditions. Article 3 stipulates that, "*No site may be used for any purpose contrary to the principles of plans of any scales, to the conditions of its region, and provisions of the regulation*" as a "general principle". According to Article 8 of the Law





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No. 3194, “plans and projects that are sensitive against climate and of an ecological nature can be prepared”.

The definitions for “Master Plan” and “Environmental Plan” were amended and a definition for “Spatial Strategy Plan” was added with the amendment that was introduced pursuant to the Law No. 7153 of 29/11/2018. According to the Law, spatial plans shall be prepared as “Environmental Plans” and “Land Development Plans” in line with Spatial Strategy Plans in terms of area coverage and purpose; and land development plans as “Master Plans” and “Implementation Plans”. The Spatial Strategy Plan, which will be prepared throughout the country and in regions deemed necessary, will guide physical development and sectoral decisions by associating economic, social, and environmental policies and strategies with space, and will take into account the objectives of the development plan, and regional plans, regional development strategies and other strategy papers, if any. The Environmental Plan will determine the principles and criteria under the general land use decisions that guide the subscale plans for settlements, development areas, and sectors and will be prepared on a regional, basin, or provincial basis. The Master Plan, which will constitute a basis for implementation plans, will demonstrate the general forms of use of land plots, the development direction and size of settlements and their population density and threshold and transportation systems.

Subparagraph (h) in Article 8, which determines the principles with which the plans must comply, refers to energy efficient, climate-sensitive and ecological plans, projects and structures and stipulates that the Ministry can prepare or cause to prepare plans and projects of such nature and build, provide loans for and support structures of such nature for settlements. The same article emphasizes that agricultural lands cannot be planned for use outside of agricultural purposes unless the permissions specified in the Law on Soil Conservation and Land Use are obtained. The article also states that land use and development practices shall comply with the decisions in spatial strategy plans, environmental plans, and development plans only.

Supplementary Article 6 of the Law on Land Development Planning and Control that was introduced pursuant to Law No. 7153 of 29/11/2018 obligated the inclusion of bicycle paths and bicycle parking stations for transport in the new land development plans to be prepared as of 1 June 2019, stipulating that pedestrian roads will be arranged in places where bicycle paths cannot be built due to topography and inclined terrain.

The implementation of the Law on Land Development Planning and Control is governed by the duties and powers of the Ministry of Environment and Urbanization and municipalities, and of special provincial administrations outside of the borders of municipalities and adjacent areas.

The prominent regulations of the Law on Land Development Planning and Control that are related to climate change adaptation may be listed as follows:

- According to the provisions of the ‘Regulation on Land Development Planning and Amendments’ published in the Official Gazette of 02.09.1999 issue 23084, the standard for green areas is determined as at least 10 m<sup>2</sup> per person in urban areas and at least 14 m<sup>2</sup> per person outside municipal and adjacent area borders. The size of active green areas will be determined based on the standard of 14 m<sup>2</sup> per person in the planning to be made outside of the boundaries of the municipality and adjacent areas.
- The “Regulation on Making Spatial Plans” of 2014 determines the principles and procedures for the making and implementation of spatial plans, which introduce decisions on land use and development, that are prepared to protect and improve physical, natural, historical and cultural assets; ensure a balance of conservation and utilization; support sustainable development at the national, regional and urban levels; and create healthy and safe environments with a high quality of life. The Regulation on Making Spatial Plans provides for the preparation of an ‘urban technical



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*infrastructure impact assessment report*, which is an important provision in terms of urban climate disasters. The provisions of the Regulation that stipulate for shorter transportation distances in cities also brings evaluating the urban transportation practices to the agenda. Taking into consideration that climate change adaptation mostly requires spatial solutions that take various characteristics into account, the practices contained in this regulation have a special importance; the strategy objectives can be realized if climate change policies are integrated into spatial planning practices and into local location-based practices. Article 17 on *Data Structure and Analyses* under Chapter 5 “Principles Concerning Spatial Strategy Plans” of the Regulation refers to ‘climate change’ as a hazard and describes the data to be obtained from institutions and organizations and the surveys and analyses to be conducted within the scope of such data. The concept and scope of climate change, although limited by various definitions and expressions, has started to gain a place for itself in the planning legislation, yet the scope concerning implementation has still not been adequately described. Furthermore, the Regulation on Making Spatial Plans also provides the legal basis for the (national, regional and provincial) “Spatial Strategy Plan”, the preparations for which are still continued by the Ministry of Environment and Urbanization.

- “Regulation on Land Development of Planned Areas” of 2017 determines the principles and procedures concerning building and development, and project design and supervision in line with plans, science, health, and sustainable environmental conditions. “Regulation on Land Development of Unplanned Areas” of 1985 was introduced to ensure that the development in unplanned areas come into being in compliance with plans, science, hygiene and environmental conditions.
- Although it was not introduced on the basis of the Law on Land Development Planning and Control, another regulation that should be mentioned with regard to its relevance to the building sector is the “Regulation on Green Certificate for Buildings and Settlements”.<sup>109</sup> The purpose of the 2017 Regulation, which was issued based on the Decree Law on the Organization and Duties of the Ministry of Environment and Urbanization, is to establish evaluation and documentation systems for mitigating adverse environmental impacts of buildings and settlements by encouraging use of natural resources and clean energy.
- Another regulation introduced on the basis of the Decree Law on the Organization and Duties of the Ministry of Environment and Urbanization is the “Regulation on Rainwater Harvesting, Storage, and Discharge Systems”, which involves principles concerning the relation between urban planning and technical infrastructure planning, and rainwater harvesting systems.
- The “Regulation for Cycling Paths” which entered into force upon its publication in the Official Gazette of 12.12.2019 issue 30976 aims to determine the principles and procedures regarding the planning, project design and construction of cycling paths and bicycle parking stations to ensure that bicycles can be used for the purposes of transportation, touring and sports.<sup>110</sup> The Regulation supersedes the Regulation on Design and Construction of Cycling Paths, Bicycle Stations and Bicycle Parks in Urban Areas which was published in the Official Gazette of 3/11/2015 issue 29521.
- Law on Transformation of Spaces under Disaster Risk- The Law No. 6306 of 16/05/2012 on Transformation of Spaces under Disaster Risk, which was introduced with the purpose of transforming urban areas under disaster risk and creating healthy and safe living environments, should be considered in terms of climate change response in cities.

<sup>109</sup> OG of 23/12/2017 issue 30279.

<sup>110</sup> This Regulation was prepared on the basis of Article 97 of the Presidential Decree No. 1 on Organization of Presidential Office published in the Official Gazette of 10/7/2018 issue 30474 and Supplementary Article 6 of the Law No. 3194 of 3/5/1985 on Land Development Planning and Control.



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The implementation of the Law is governed by the duties and powers of the Ministry of Environment and Urbanization and the Housing Development Administration, which is its affiliated entity, and of special provincial administrations outside of the borders of municipalities and adjacent areas.

According to Article 18 “Planning Process” of the Implementation Regulation for the Law, it is fundamental to reduce disaster risks; improve, conserve and develop the physical environment; ensure social and economic development; and enhance the quality of living through energy efficiency and climate sensitivity in the plans to be made for the application area, according to area characteristics.

Law No. 4708 of 29/06/2001 on Construction Inspection, which is an *indirect legislation* related to climate change, and its associated regulations introduce a solution to the heat insulation problem in buildings, providing a basis for reducing energy use and thus preventing increased greenhouse gas emissions through energy saving. The “Guidelines for Public Building Standards”, which is another indirect legislation prepared in coordination with the Ministry of Environment and Urbanization, is referred to in Presidential Directive and involves energy efficient design principles in the architectural planning stage.

For the **institutional** structuring, many duties of the Presidential “Board of Local Government Policies”, albeit not directly defined in their titles, can be considered as related to climate change adaptation. This allows climate change adaptation processes in cities to integrate with higher policies by using an approach in which responding to the climate crisis is discussed in conjunction with other basic factors such as mitigation, technology, and finance. The duties of the board are listed below:<sup>111</sup>

- To formulate policy and strategy recommendations in the fields of urbanization and local government,
- To propose strategies concerning local government policies in line with Turkey’s social, economic, and political realities,
- To develop policy recommendations for migration and settlement,
- To develop protective and constructive policy recommendations in such fields as environment, forests, water, etc.,
- To develop urbanization policy recommendations inspired by Turkey’s cultural heritage,
- To make strategy recommendations by conducting research on smart urbanization,
- To undertake works related to public investment planning as required by land development implementation programmes for the Bosphorus,
- To develop policy and strategy recommendations to ensure an efficient environmental management.

The need for a low-carbon lifestyle in economic policies in developing climate change adaptation policies is also true for cities and it is fundamental that climate change adaptation is discussed in conjunction with their environmental, social and economic dimensions. Such an approach brings to light the importance of the Presidential Board of Local Government Policies.

For example, a National Smart Cities Strategy and Action Plan (2020-2023) was prepared by the Ministry of Environment and Urbanization with regard to carrying out research and making strategy recommendations about smart urban development. However, the Plan does not contain any parameters for climate change adaptation in developing smart cities in Turkey. The concept of low-carbon city mentioned in the Plan is based on a “smart” and “ecological” city model in which creative technologies are applied to reduce carbon emissions and adapt to climate change.

<sup>111</sup> Presidential Decree No. 1 on Organization of Presidential Office (OG of 10/7/2018 issue 30474).



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The effect of economic policies should not be overlooked in achieving a climate change adaptation action in the cities of Turkey. Considering the subject of urban climate change resilience together with its economic dimension, developing adequate financial resources for adaptation and greenhouse gas emission reduction actions and including strategies in line with such purposes in policies and plans will make a significant contribution to building climate resilient and sustainable cities as well as reducing the costs resulting from climate change (Tuğaç, 2020).

The General Directorate for Local Authorities, which used to be affiliated with the Ministry of Interior in the past governmental system building, was renamed as the General Directorate for Local Governments and included within the body of the Ministry of Environment and Urbanization pursuant to Presidential Decree No. 1. The General Directorate of Local Governments is in charge of improving local governments and supervising that the performance of investments and services align with development plans and annual plans. With the new institutional building, it was projected to transition from a tutelage-oriented administrative supervision approach to a management mentality that focuses on enhancing the technical and administrative capacities of local governments and supports and ensures the solid performance local services in terms of land development planning and control and environment in particular.

Duties of the General Directorate of Spatial Planning of the Ministry of Environment and Urbanizations were regulated in 2018 under Article 102 of the Presidential Decree No.1. The duties of this main service unit that are related to the climate change adaptation action include: i) Settlement, development, and land use, ii) Preparing spatial strategy plans, environmental plans, land development plans, sectoral plans, iii) Establishing disaster sensitive settlements, and iv) Management and planning for integrated coastal zones.

Bank of Provinces (ILBANK), functioning as a development and investment bank in the framework of the Law No. 6107 of 26/01/2011, is important for local governments due to its duties to develop projects on local services to and provide special provincial administrations and municipalities with consultancy and assist with the performance of technical urban projects and infrastructure and superstructure works, and to support urban regeneration practices and land development studies. Having acquired its power to undertake renewable energy, urban planning, architecture, engineering and consultancy services and infrastructure and superstructure practices pursuant to the Law No. 7161 of 17/01/2019, ILBANK can provide priority technical and financial contributions to local government projects for climate change prevention and adaptation support and thus, a unit was established under ILBANK to undertake works concerning climate change response.

The units that are and continue to be established in the internal building of some municipalities locally to combat climate change are new buildings at the local government level. The establishment of such units, which were initially formed on a voluntary basis, was later formalized by legislation. The divisions and branches of metropolitan municipalities were provided with updates pursuant to the “Regulation on Principles and Standards of Job Positions in Municipalities and Affiliated Entities and Unions of Local Governments”<sup>112</sup>, according to which a “Climate Change Division” would be established in Metropolitan Municipalities and a “Climate Change Branch” in provincial and district municipalities. The job descriptions of these growing numbers of units, which will be managed by a Head of Climate Change Division or a Climate Change Manager, are initially associated with emission reduction and occasionally represented in their names, e.g. Mersin Metropolitan Municipality Climate Change and Clean Energy Branch.

### Cooperation Grounds, Unions, Networks, Alliances for Municipalities in Responding to Climate Change:

In addition to States, there are also global supranational local government networks and alliances in

<sup>112</sup> OG of 08/04/2020 issue 31093



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significant numbers and operating at significant capacities in the field of climate change response. Such global 'voluntary' organizations that bring together local governments with various levels of development from different regions throughout the world provide urban governments with guidance in implementing climate change actions in all policy response areas (mitigation, adaptation, technology, finance, capacity development, etc.). Accordingly, local governments provide reciprocal benefits in respect to such matters as policy planning for combating climate change, increasing motivation and collective responsibilities. Below is an extensive list of organizations working on these areas:

- Local Governments for Sustainability/ICLEI
- United Cities and Local Governments/UCLG
- Cities Alliance, Germany, 1990
- The Cities Act
- One Planet Cities, WWF
- Climate Policy Initiative/CPI
- Cities for Climate Protection
- UN-Habitat, Cities and Climate Change Initiative
- Compact of Mayors/ComM
- EU Covenant of Mayors/COMs
- Global Covenant of Mayors for Climate and Energy
- C40 Cities Climate Leadership Group/C40
- Carbon Disclosure Project/CDP
- Local Government Management Association/LGMA
- Council of European Municipalities and Regions/CEMR
- Eurocities Network
- Cities Climate Finance Leadership Alliance/CCFLA
- International Alliance of Local Governments/FMDV
- Global Alliance for Buildings and Constructions
- EU Covenant of Mayors Initiative on Adaptation to Climate Change
- EU Mayors-ADAPT Initiative
- European Green Capital
- Cittaslow
- Rockefeller Foundation Climate Change Initiative
- World Mayors Council on Climate Change/WMCCC
- The *Mexico City Pact*/Global Cities Covenant on Climate
- U.S. Clean Energy States Alliance/CESA



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- U.S. Mayors Climate Protection Agreement, 2005
- *Regional Climate Initiatives* in the U.S. and Canada
- Energy Cities
- *Cities for Climate Protection Campaign/CCP Campaign*
- Climate Mayors, USA, 2014
- Metropolis
- Regions4 Sustainable Development
- Global Compact Cities Programme
- C40/Global Mayors COVID-19 Recovery Task Force<sup>113</sup>

When considered from the perspective of **Turkey**, such cooperative formations in responding to climate change at the local level are accelerating government tools for applications. Municipalities in Turkey have recently begun to join international local government networks (World Mayors Council on Climate Change/WMCCC, EU Covenant of Mayors/COMs, the renewed Global Covenant of Mayors for Climate & Energy, C40, ICLEI, Eurocities Network, Metropolis) in addition to establishing domestic partnerships which are becoming increasingly diverse with such criteria as mutual information exchange, similarity of problems/challenges, solution partnerships, etc. These formations sometimes take shape on the basis of the existing legislation, sometimes on a voluntary basis, and sometimes in the form of temporary project partnerships.

Another formation that is allowed by the legislation is local government unions. Local government unions have recently started to undertake direct or indirect climate change response activities. The Law No. 5355 on Unions of Local Governments, which has been in force as of 2005, aims to establish the legal status, establishment, organs, management, duties, powers and responsibilities and working principles and procedures of local government unions. A local government union, which is described as a public entity founded by multiple local governments to jointly undertake certain services of which they are in charge to perform, is established with the President's<sup>114</sup> permission following the finalization of the regulation, gaining a legal entity status. In the events mandated by projects related to water, wastewater, solid waste and similar infrastructure services and the conservation of environment and ecological balance, the President can decide for the relevant local governments to join a union<sup>115</sup> that has been established for this purpose. If a union is formed with the participation of local governments in more than one province, final approval for its members is received by the Minister of Interior for unions comprising special provincial administrations and villages, and by the Minister of Environment and Urbanization for the rest.<sup>116</sup>

Local unions of municipalities operate in almost every region of the country (e.g. Marmara, Central Anatolia, Turkish Thrace, Aegean, Coastal Aegean Unions of Municipalities).

The Union of Municipalities of Turkey, established on the basis of Law No. 5355 to gather all municipalities in Turkey under a single umbrella, is a legal entity with the power to represent municipalities at the national and international level.<sup>117</sup> All municipalities in Turkey are natural

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<sup>113</sup> Established in April 2020.

<sup>114</sup> The expression "Council of Ministers" in the first, second and third subparagraphs of this article was replaced with "President's" and the expression "Council of Ministers" in the third subparagraph with "President" pursuant to Decree Law No. 700 of 2/7/2018

<sup>115</sup> Leaving the unions referred to in this subparagraph is also decided upon the President's permission.

<sup>116</sup> The expression "Interior" in this subparagraph was replaced with "Minister of Interior for unions comprising special provincial administrations and villages, and by the Minister of Environment and Urbanization for the rest" pursuant to Decree Law No. 7153 of 29/11/2018.

<sup>117</sup> The other local government union at the national level is the Union of Special Provincial Administrations representing all special provincial administrations in Turkey.





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members of the Union. The Municipal Academy, which is an affiliated entity of the Union of Municipalities of Turkey, holds training programmes for the community of local governments in various fields (some examples for the past training programmes are: COVID-19/Social Opportunities in Risks in Cities, Municipalities and Environmental Law; National and International Sources of Funds for Municipalities; Global Cities; Municipal Collaborations with Other Institutions; Zero Waste Management in Municipalities, etc.). The Academy also announces master's degree programmes related to local governments in cooperation with various universities.

Solid Waste Unions of Municipalities, Service Unions of Tourism Infrastructure, Unions for Village Service Delivery, Union of Municipalities with Geothermal Sources, Union of Municipalities for Healthy Cities, and the regional Union of Van Lake and Surrounding Municipalities are some examples of the active unions in environmental protection and climate change response in Turkey.

There are also some unions set up individually by some metropolitan municipalities. For example, Samsun Metropolitan Municipality and the provinces of Samsun are members of the Union of Samsun Municipalities.

In recent periods, climate change response issues have started to be included in the areas of study of regional unions of municipalities; for example, the 2015 Istanbul Carbon Summit was held with the support of the Union of Marmara Municipalities. In the Marmara Urban Forum (MARUF), which was held in October 2019 in Istanbul through the initiative of the Union, the subjects of environment and climate change as well as the role of cities in responding to climate change were discussed by academics, international NGO representatives and practitioners.

A "Disaster Coordination and Cooperation Plan" is available, prepared by the Union of Marmara Municipalities.

The "Online Training Programme on Sustainable Cities and Climate Change" which was initiated in May 2020 by the Union of Marmara Municipalities in partnership with 350 Turkey, Yereliz, SDSN Turkey and Bosphorus University Lifelong Training Centre, was intended for municipalities and is an innovative initiative aiming to accelerate applications by enhancing municipalities' capacities in combating climate change.

There are also non-governmental initiatives in Turkey that bring municipalities together with other actors in responding to climate change. The Coastal Aegean Climate Network, founded by the Social Climate Association in early 2020, involves all actors (municipalities, non-governmental organizations, academics, activists, etc.) from the provinces of the Aegean coasts, that have a role in combating climate change. The main goal of the network is to contribute to the regional climate change response.

A study titled "Determining Climate Change Adaptation Capacities of Cities" was conducted by the Healthy Cities Association in its member cities between 2015-2016 (Türe and Ar, 2005). This study, which was conducted based on a comprehensive survey that involved 40 member municipalities and was prepared to determine cities' climate change vulnerabilities, established the strengths and weaknesses of cities in terms of climate resilience and took ICLEI's (Local Governments for Sustainability/ICLEI) principles with regard to local climate change.

Within the framework of voluntary formations, 24 municipalities at various administrative scales established the "Sustainable Urban Development Network" with a perspective that involves local governments to establish bonds with the global agenda, i.e., climate crisis, poverty, inequality, and enhancing institutional resources and structures. The Sustainable Urban Development Network, which basically aims to achieve the Sustainable Development Goals at the local level and receives mostly provincial municipalities as participants, aims to build partnerships in this area. The Network's initial secretariat was undertaken by the Izmir Metropolitan Municipality and its founding municipalities are



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Bursa Gürsu Municipality, Bursa Nilüfer Municipality, Denizli Acıpayam Municipality, Eskişehir Tepebaşı Municipality, Giresun Espiye Municipality, İstanbul Avcılar Municipality, İstanbul Küçükçekmece Municipality, İstanbul Maltepe Municipality, İstanbul Kadıköy Municipality, İstanbul Sultanbeyli Municipality, İzmir Metropolitan Municipality, İzmir Çiğli Municipality, İzmir Konak Municipality, Kars Metropolitan Municipality, Rize Fındıklı Municipality, Muğla Fethiye Municipality, Mardin Metropolitan Municipality, Siirt Municipality, Şanlıurfa Ceylanpınar Municipality, Van Metropolitan Municipality, Zonguldak Çaycuma Municipality.

One of the most significant challenges for cities to achieve sustainable development goals is withstanding the climate resilience. Sustainable urban development does not seem possible without combating the impacts of climate change. Some member municipalities of the Sustainable Urban Development Network have initiated various efforts in the fields of mitigation and adaptation in responding to climate change.

One of the initiatives to strengthen metropolitan municipalities' *urban agriculture* policies and allow for collaborative atmospheres in this area was initiated in November 2019 under the leadership of the İzmir Metropolitan Municipality and with eleven metropolitan municipalities (Adana, Ankara, Antalya, Aydın, Eskişehir, Hatay, İstanbul, İzmir, Mersin, Muğla, Tekirdağ) The initiative aims for the reciprocal evaluation of the agricultural production capacity and consumption potential of the eleven cities and to create a common marketing and solidarity network in these cities where consumers and producers can gather without any intermediaries. In these activities, the issue of agriculture, production and food will not be discussed in terms of its economic aspects but as a whole by including its social, ecological, historical, cultural and political dimensions. This initiative will create such opportunities in metropolises as establishing circular urban economies, protecting consumers by cutting the supply chain shorter through urban agriculture, and protecting agricultural biodiversity, thus contributing to developing climate change adaptation policies in cities.

In December 2019, 24 provinces and their municipalities<sup>118</sup>, 6 of which were metropolitan municipalities, came together under the grounds that the biggest problem in coping with the climate crisis occurring in the cities was in application and the mental transformation of decision makers, and issued a joint declaration. With the "Climate for Cities" declaration, 25 signatory municipalities (Adana, Ankara, Aydın, Bursa, Erzurum, İzmir Metropolitan Municipalities, Bolu, Edirne, Rize, Tunceli Provincial Municipalities and Acıpayam Municipality (Denizli), Tepebaşı Municipality (Eskişehir), Avcılar Municipality (İstanbul), Bağcılar Municipality (İstanbul), Beşiktaş Municipality (İstanbul), Kadıköy Municipality (İstanbul), Sarıyer Municipality (İstanbul), Sultanbeyli Municipality (İstanbul), Bornova Municipality (İzmir), Çiğli Municipality (İzmir), Karşıyaka Municipality (İzmir), Fethiye Municipality (Muğla), Çerkezköy Municipality (Tekirdağ), Bodrum Municipality (Muğla) and Ayvalık Municipality (Balıkesir)) made a commitment to fulfil their municipal responsibilities and take concrete steps to achieve the 1.5°C goal of the Paris Agreement (Climate for Cities, 2019). Such commitments, which also include those for climate change adaptation, are listed below:

- To prepare Climate Change Action Plans to reduce carbon emissions and implement adaptation policies against the crisis in the light of scientific data, by using data collecting methods in line with international standards

<sup>118</sup> Adana Metropolitan Municipality, Ankara Metropolitan Municipality, Aydın Metropolitan Municipality, Bursa Metropolitan Municipality, Erzurum Metropolitan Municipality, İzmir Metropolitan Municipality, Bolu Municipality, Edirne Municipality, Rize Municipality, Tunceli Municipality, Acıpayam Municipality (Denizli), Tepebaşı Municipality (Eskişehir), Avcılar Municipality (İstanbul), Bağcılar Municipality (İstanbul), Beşiktaş Municipality (İstanbul), Kadıköy Municipality (İstanbul), Sarıyer Municipality (İstanbul), Sultanbeyli Municipality (İstanbul), Bornova Municipality (İzmir), Çiğli Municipality (İzmir), Karşıyaka Municipality (İzmir), Fethiye Municipality (Muğla), Bodrum Municipality (Muğla), Çerkezköy Municipality (Tekirdağ).



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- To prioritize the prevention of climate crisis and its impacts in the land use planning processes to protect the citizens at risk in our city and urban infrastructures
- To prioritize sustainable transportation, renewable energy, and ecological agriculture practices in our cities for a liveable future
- To support local, national and international institutions, entrepreneurs, cooperatives, and non-governmental organizations combating climate change and to engage in collaborative networks.

In some cases, municipalities individually undertake efforts through reciprocal cooperation protocols with unions of municipalities. The “Protocol on Cooperation for Implementation of Smart City Projects” was executed between Ankara Metropolitan Municipality and the Union of Municipalities of Turkey.<sup>119</sup> Another example is in Samsun, where there is a joint protocol that was enforced in 2019 and executed between “Samsun Kızılırmak Delta Protection and Development Association-SAMKUŞ”, which was established in 2015<sup>120</sup> to protect socio-economic balance, ecological balance and bio-diversity and ensure sustainability in the Kızılırmak Delta, and Samsun Metropolitan Municipality.

In addition to local government unions with which the municipalities in Turkey will cooperate and coordinate in climate change response, the need for collective work among the internal management units of municipalities is also very important, especially in the field of climate change adaptation. Additionally, metropolitan and provincial municipalities are expected to determine their adaptation policies and actions together with district municipalities by taking a multi-level governance approach.

The subjects of urban climate impacts and adaptation in Turkey have been discussed directly or indirectly in national climate change **strategy and policy** papers. Such initiatives are the first important steps towards building climate resilient cities in Turkey and providing local decision-making authorities with guidance on how to ensure adaptation in cities.

The policy goals under the “Liveable Cities, Sustainable Environment” heading of the Eleventh Development Plan (2019-2023), intended for making cities climate resilient, are specified below:

*“In order to ensure the sustainable development of cities; the works, such as the establishment of an accessible high-link urban transport system, a disaster- and climate-resilient infrastructure, and a sustainable production and consumption mechanism, long-term integrated urban planning and design, and implementation of effective disaster management, require the participation and comprehensive cooperation of all stakeholders (Paragraph 666).*

*Cities, in coordination with the development vision, will be planned with an approach that supports polycentric, mixed-use, and provides accessibility; where harmonization with topography and addressing disaster risk, climate change, geographical characteristics and historical values in spatial plans will be taken as a basis (Paragraph 674).*

*Within the scope of green city vision, in order to improve the quality of life and adapt to climate change, Millet Gardens will be built in cities and the amount of green spaces will be increased (Paragraph 676).*

*Ensuring that everyone, especially those with low incomes, have access to an adequate, liveable, durable, safe, inclusive, economically affordable, sustainable, climate change-resistant housing with basic infrastructure services is the main objective (Paragraph 685).*

<sup>119</sup> Resolution No. 264 of 14/02/2020 of Ankara Metropolitan Municipality.

<sup>120</sup> The regulation of the Union entered into force upon its publication in the Official Gazette of 01/06/2015 issue 29373.



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*In order to adapt to climate change and to take the necessary measures, regional and city-scale needs will be identified, and solution proposals will be determined, and Climate Change Action Plans will be prepared for 7 Regions, particularly for the Black Sea Region (Paragraph 714.3)”.*

The NCCS discussed “Climate Change Adaptation” under a separate heading, determining short-term goals to ensure the climate change adaptation of cities. Accordingly:

- Possible adverse impacts of climate change on vulnerable ecosystems, urban biotopes and biological diversity shall be identified; vulnerability assessments shall be conducted and measures shall be taken for ecosystem and biodiversity protection.
- Use of architectural styles and construction materials appropriate for local climate change shall be encouraged.
- Efficient use of wastewater shall be promoted in urban green areas.
- Rainwater capture, use and recycling strategies shall be developed for settlements and buildings, including the introduction of new technologies.
- Compulsory urban wastewater and rainwater storage areas will be developed and the criteria for site selection will be updated.

NCCS also includes long-term goals to build climate resilient cities under the heading “Land Use, Agriculture and Forestry”. Accordingly:

- Strategies for mitigation and adaptation to climate change in settlements shall be developed together with procedures and principles for planning and housing.
- Strategies for efficient use of urban land shall be developed in order to prevent the formation of urban heat islands.
- Procedures and principles on climate change adaptation in integrated coastal areas shall be determined.
- Increasing open green space systems in urban areas shall be encouraged and urban forestry shall be improved.
- Measures shall be taken in order to reduce urbanization pressures on rural and natural areas.

The CCAP (2011 -2023) policy and implementation paper includes goals and actions for emission reduction in cities, especially in relation to the transportation and waste sectors. CCAP focuses on the problems related to water resources management in cities in Turkey with the perspective of adaptation to climate change, determining goals and actions by associating climate risks with efficient use of resources, utility water shortage, etc. The prominent actions in CCAP regarding cities’ adaptation to climate change are specified below.

- Making necessary legal regulations to ensure inclusion of ecologic elements in stream improvement activities undertaken by municipalities.
- Preventing channelling in order to increase water quality and carbon sequestration in streams where risk of flooding is not high and supporting practices that encourage restoration of streams with botanical elements.
- Promoting settlement practices that infiltrate rainwater to soil, such as roof gardens and permeable coatings, and rainwater recycling systems.
- Increasing the capacity of local governments to prepare and implement projects on the protection and development of urban forests and other green areas.



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- Developing and implementing urban settlement plans covering sustainability elements such as land use, ecology, transportation, water management, grey water, green/white roofs, etc., using lifecycle assessment<sup>121</sup> cost evaluation methods, within the framework of pilot projects.
- Identifying principles and procedures for energy-efficient, climate-sensitive, sustainable urban settlement planning and, using the results of pilot projects, transferring the outputs to the physical development planning legislation so as to put sustainable urban plans into practice.

The key objectives determined in various sectoral areas (with significant weight to water management) for cities' adaptation to climate change in Turkey's "National Climate Change Adaptation Strategy and Action Plan", which has been in effect since November 2011, are as follows:

- Revision of spatial planning concepts, in order to ensure cities to address water management with a climate change adaptation approach, and realizing up-scaling plans, especially in the management of metropolitan areas (large cities, metropolitan municipality), taking into account climate change is being targeted.
- In Spatial Strategy Plans and Environment Plans prepared for ensuring the economic, social and cultural development of the country within the context of sustainable development principles, it is aimed to take ecological decisions, to pay attention to the balance between protection and use and to take the climate change adaptation capacity into consideration (water resources management, waste management, protection of air quality, etc.) and to conduct the urban development in an efficient way.
- In order to realize integrated water management and planning in settlements in a healthy way, activities such as the separation of sewage and rain water harvesting systems, reuse of collected and treated water (such as the target in the NCCS on the effective use of wastewater in urban green areas) are targeted.
- Developing pricing policies and making legal regulations for increasing water use efficiency in cities by taking into account socio-economic conditions.
- Identifying water loss and theft in cities and taking measures to reduce the loss and theft rate, expanding the SCADA (Data-Based Control and Observation System) system nationwide.
- Ensuring access of network water to consumers as a potable water in order to reduce the pressures on water resources.

**KENTGES Objective14:** Establishing Environmentally Sensitive Lived Spaces in the Cities); Strategy 14.1 (The approaches paying attention to sustainable use of natural resources, maintaining of ecological balance, prevention of pollution, energy efficiency and environmental conscience will be adopted in the planning of settlements.

**KENTGES Action 14.1.4:** In settlements, adjustment and reduction strategies for climate change will be developed; procedures and principles for planning and housing will be established (Realization Period 2010-2023).

Turkey's INDC document contains no measures or goals aimed at adapting to the impacts of climate change on cities. The goals in the document are directly related to emission reduction, and the measures predominantly involve the energy sector.

One of the important international policy initiatives of the political will in combating climate change in cities is the role it has taken on in the preparations for the UN Climate Action Summit which took place in 2019. The efforts related to the theme of *Infrastructure, Cities and Local Action*, which was one of the nine themes<sup>122</sup> on the agenda of the UN Climate Action Summit that was hosted by the United

<sup>121</sup> Life Cycle Analysis is a method used to identify, report and manage the environmental impacts throughout various stages of a life cycle, which includes all processes starting from the acquisition of raw materials used in the production of a product or service through production, transport, use by consumers, and disposal.

<sup>122</sup> UN Climate Summit 2019 Themes: 1) Mitigation, 2) Social and Political Drivers of Change, 3) Youth Engagement and Public Mobilization, 4) Energy Transition, 5) Industrial Transition, 6) Nature-based Solutions, 7) Resilience and Adaptation, 8) Climate Finance and Carbon Pricing, 9) Infrastructure, Cities and Local Action.





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Nations Secretary-General and took place in New York on 23 September 2019, were held under the leadership of Turkey and Kenya with the support of the BM-Habitat organization. Having assumed the responsibility of setting global policies into motion in local climate change response in this process, Turkey's position was also nationally motivating for the development of urban and climate policies, as well.

Turkey's Seventh National Communication (2018) addressed local government actors under the title of "sub-state actors" and underlined the importance of the Integrated Urban Development Strategy and Action Plan (KENTGES) which guided municipalities' climate change response policies and covered the years 2010-2030.

Implemented in coordination with the Ministry of Environment and Urbanization, KENTGES aims to achieve the following in cities: ensuring sustainable spatial development in settlements by creating an environment-conscious living environment, ensuring sustainable and diversified land and dwelling house production, establishing sustainable urban transportation system, developing open and green areas in the spatial plans in system integrity, ensuring protection of natural and cultural assets and values, sustainable use of natural resources, taking efficient use of water resources in settlements into consideration in planning processes, protection of urban ecosystems and forests, prevention of pollution, promoting approaches taking into consideration energy efficiency and environmental consciousness, and mitigation of disaster and settlement risks. By building a relationship between spatial development strategies and water management, risk management and integrated coastal zones management, KENTGES introduces actions that support the climate change adaptation process.

The Integrated Urban Development Strategy and Action plan (KENTGES/2010-2023)<sup>123</sup> can be considered as an important step for Turkey in terms of guiding sustainable urbanization policies with a participative approach and addressing the issues of climate change in cities extensively for the first time in 2010. The key subjects that were discussed by KENTGES in urban planning in the context of climate change were transportation, spatial planning, green areas, energy efficiency and renewable energies, infrastructure, and waste management.

Strategic development goals related to increasing efficiency in urban water and energy use, increasing flora and open, permeable areas through afforestation, and mitigating the air quality degradation and greenhouse gas emissions especially in metropolitan cities has had extensive coverage in KENTGES.

- The "Turkey Habitat III National Report"<sup>124</sup>, which was prepared by the Ministry of Environment and Urbanization in 2014 for the United Nations Conference on Housing and Sustainable Urban Development (UN-Habitat III) and presented to international authorities, contained the following topics: urban demographics, land and urban planning, environment and urbanization, urban governance and legislation, urban economy and housing, and basic services; the topic of climate change was discussed in a separate chapter as one of the items on the new urban agenda in environment and urbanization in the Report (United Nations, 2016). The Turkey Habitat III National Report is based on KENTGES principles and contains many items that are on the New Urban Agenda of the UN-HABITAT. In this framework, the HABITAT National Report involved certain matters concerning climate change adaptation; for instance, rural-to-urban migration due to droughts caused by climate change and its negative impacts on the agriculture sector were discussed in the Report.

<sup>123</sup> KENTGES (Integrated Urban Development Strategy and Action Plan 2010-2023), Ministry of Public Works and Settlement (Official Gazette of 4 October 2010 issue 27749) (KENTGES is the official commitment document, covering 2010-2030 and approved by the HPC/Higher Planning Council in 2010.

<sup>124</sup> See [this link](#) for Turkish and English versions of Turkey Habitat III National Report.





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- In terms of combating climate change and ensuring energy efficiency in cities, it was emphasized that the use of new technologies and consumption patterns needed to be changed, and a series of objectives were set for the effective and efficient use of energy and utilization of renewable energy sources in buildings.
- It was emphasized that there were challenges in terms of the alignment of the measures to be taken for climate change in cities with economic sustainability and problems in supporting such matters through national incentive mechanisms.
- Some innovative standards (e.g. Ecological Settlement Unit) were brought to the agenda to ensure that urban regeneration areas are resilient to climate change impacts and climatic disasters and the reduction of carbon emissions. In this framework, it was projected to support activities related to climate change response in cities and accelerate the efforts by selecting a pilot settlement in line with the determination of the “Ecological Settlement Unit” Standard by the Ministry of Environment and Urbanization in 2016.<sup>125</sup>
- It was highlighted that meteorological disasters cause loss of life and property in cities, which signifies the indispensable importance of cities in climate change response. In this framework, the need was emphasized to update the current disaster law in order to introduce concepts such as hazard reduction, contingency planning and risk management, including climate-induced disasters and technological disasters.
- It was determined that “There is an obligation to get rid of polluting cities and transition them into green cities in the long run. Green building and green city efforts should be encouraged with the advancement of green technologies” (MoEU, 2014).

The Council of Environment and Urbanization, which convened with the theme of “New Vision in Urban Development” in 2017 as one of the Councils determining the recommendations for public administration in policy development, has made some important decisions that bring climate change response in cities to the agenda, and almost all of the Council Commission Reports contain recommendations that will directly/indirectly benefit responding to climate change in cities.<sup>126</sup> One of the matters discussed by the Council was that cities would become more non-resilient due to increasing extreme weather events caused by climate change in Turkey.

The Council Recommendations, made by the “Commission for Urban Identity, Planning, and Design”, that are directly related to climate change adaptation actions are given in Table 14.<sup>127</sup>

<sup>125</sup> [A pilot application project](#) is known to have been carried out in this framework by the University in the Reserve Building Lot determined by the Ministry in Eskişehir Province, Kocakır Site.

<sup>126</sup> T.R. Ministry of Environment and Urbanization, Council of Environment and Urbanization, Commission Reports, October 2017.

<sup>127</sup> T.R. Ministry of Environment and Urbanization, Council of Environment and Urbanization, “Commission Report on Urban Identity, Design, and Planning” p: 69.



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Table 14 Council of Environment and Urbanization, 2017, “Commission for Urban Identity, Planning, and Design Recommendations (quoted directly)

Problem Area	Recommendation No	Recommendation	Recommendation Description	Institution in Charge	Relevant Institutions/Organizations	Period for Realization
2.1. Aspect of Natural-Ecological Values	2.1.3	National and local policies to guide planning and design should be established to build green infrastructure networks and develop relevant nature-based design solutions.	Control of more carbon dioxide in natural ecosystems by ensuring carbon storage and sequestration, increasing biodiversity and wildlife conservation, decreasing maintenance and repair costs due to water and energy savings will increase natural habitats and recreational areas.  <i>Therefore, urban climate change adaptation plans should be made and integrated into existing strategies.</i>	Ministry of Environment and Urbanization	Local Governments, Ministry of Development, Ministry of Forestry and Water Affairs, Ministry of Energy and Natural Resources, Universities, TOKI, Relevant NGOs.	Long-Term <sup>128</sup>
	2.1.4	Eco-smart urban solutions should be developed and quality control instruments such as certification should be implemented.	Reducing the impacts of urban heat islands, green building/neighbourhood certification systems, smart city practices should be encouraged.	Ministry of Environment and Urbanization	Ministry of Development, Ministry of Forestry and Water Affairs, Ministry of Energy and Natural Resources, Universities, TOKI	Short-Term <sup>129</sup>

<sup>128</sup> Here, ‘long term’ is defined as a period of fifteen years or more that involves macro-targets.

<sup>129</sup> Here, ‘short term’ is defined as one year.



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The first official initiative for preparing local climate adaptation plans for cities in Turkey was taken in the Strategic Plan (2018-2022) of the Ministry of Environment and Urbanization. The Strategic Plan, which was revised to cover 2019-2023 upon Turkey's transition to the Presidential System, stipulated that 10 metropolises should prepare a climate change action plan every year between 2021-2023.

In the current situation with regard to climate change adaptation action planning at the local level, the first effort to be made was the study under the "Pilot Programme for Developing Capacity to Prepare Flexible Urban Strategies and Action Plans in line with Climate Change (2013-2014). Under the project, the administrative organization and institutional capacity of Bursa Metropolitan Municipality were enhanced for adaptation actions. In the process in which the experiences acquired on preparing climate change adaptation strategies in several European cities in cooperation with ICLEI, the outputs of the project provided guidance not only to Bursa but to other municipalities, as well. It is well known that local governments in Turkey have yet to pay adequate attention to climate change adaptation measures as much as they do to emission reduction measures. In addition to Bursa and Gaziantep Metropolitan Municipalities, Istanbul Bağcılar, Pendik, Şişli Municipalities, İzmir Bayındır Municipality and Bursa Nilüfer Municipality have also committed to climate change adaptation within the frame of the Covenant of Mayors.

The practices in the climate action plans prepared by municipalities has had negligible contributions to local sustainability in Turkey so far due to two main reasons; first of which is that the elements of combating climate change are not taken into consideration in all local planning practices, and second is that the strategies for adapting to climate change are neglected in climate action planning. Monitoring and evaluation mechanisms in existing local climate action plans are not well-constructed or unavailable, which is why the sustainability of the plans are open to question (Talu, 2019).

The sectors and areas that can best represent the mitigation and adaptation synergy in climate change response in cities are energy, building, waste and transportation sectors and food security, and conservation of green areas and water resources. If local governments are to integrate such matters into the scope of the services which they currently perform, they will have included climate change response into their own self-management through a holistic planning approach.

Mechanisms (physical, administrative, financial, participatory) have not been determined on how to reflect national climate change adaptation policies to local planning processes and to ensure **central-local coordination**. For example, the extent to which current legislation is guiding and challenging in terms of urban climate resilience in producing physical plans should be examined, and deficiencies should be identified.

As it is recognized that spatial planning decisions affect the climate, it should be kept in mind that **spatial planning** is an important tool in formulating such decisions based on cities' climate change vulnerabilities because a significant factor of urban climate change is the changes in the land caused by urban growth. The most important local regulatory tool in cities is spatial planning. When looking at the role of climate change in the spatial planning practices in **Turkey**, there is no interaction between the current physical planning practices in cities and planning.

In order for cities to develop, the elements of adapting to climate change need to be added to various strategic plans (municipal strategic plan<sup>130</sup>, urban waste management plan, urban transportation macro/master plan, natural disaster response plan, urban water management master plan<sup>131</sup>, urban clean air action plan, provincial wetlands management plan, provincial drought action plan, urban

<sup>130</sup> Recently, some municipalities have started to set targets for combating climate change in their strategic plans; e.g. Tekirdağ Metropolitan Municipality.

<sup>131</sup> Ankara Metropolitan Municipality has been preparing for the 30-year [Ankara Water Management Master Plan](#) for 2024-2054.



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economy and investment programme, etc.), including spatial plans, that are prepared at the macro level and/or for various sectoral and thematic areas.

From the perspective of the **housing sector** in cities, there is no comprehensive practice in Turkey about ensuring the climate change resilience of existing and new buildings as of yet. The “Green Building and Settlement Certification Systems” application, which is one of the positive steps taken in this framework and was initiated in cities by the MoEU on the basis of the Regulation on Green Certification for Buildings and Settlements, is considered to be an innovative instrument in responding to climate change in the housing sector. Accordingly, taking into consideration their technical characteristics and requirements, the existing and new buildings and settlements are evaluated and certified according to their environmental, social and economic performances and sustainability. On the other hand, planning tools that take into account the risks that arise or will arise from climate change in the public investments for the housing and construction sector are still lacking. This situation primarily signifies the need for addressing climate change within the scope of urban regeneration policies and practices which have brought significant innovations to the building stock in Turkey. In Turkey, urban areas in which housing sector stocks are accumulated are vulnerable to climate change due to their low adaptation capacity and high population density (OECD, 2018). In order for spatial planning to regain its functionality, it is essential to undertake applications by establishing a link between the housing sector and cities’ resilience policies.

In terms of prospective problems related to climate change in cities, Turkey has begun to give priority to **rainwater management**. Additionally, water-based urban design, making use of natural water retention systems, and rainwater management through better management of the networks connected to treatment plants are areas of adaptation solutions which require planning and investment.

The study “Enhancing Turkey’s Climate Change Adaptation Capacity/Participatory Vulnerability Assessment (PVA)”, which was conducted in Turkey in 2010 to develop climate change adaptation capacities in 11 provinces<sup>132</sup> through a stakeholder engagement approach, was a first in Turkey in terms of **participatory tools**. Implemented under the “UN Joint Program on Enhancing the Capacity of Turkey to Adapt to Climate Change” in coordination with the Climate Change Department of General Directorate of Environmental Management of the Ministry of Environment and Urbanization, this study is a guiding planning tool to ensure the climate change resilience of the cities in Turkey.

The purpose of the Participatory Vulnerability Analysis is to analyse the climate change vulnerabilities in the selected regions in order to facilitate the determination of local response strategies and activities that can be discussed and formulated in the process of developing a national adaptation strategy for Turkey. In the process of the Participatory Vulnerability Analysis, which lasted for four months between 2009-2010, local vulnerabilities against climate change impacts in selected provinces were determined with the active engagement of local stakeholders, the impacts on the relevant sectors and themes were questioned under changing climatic conditions, and cities’ levels of preparedness against climate change-induced disasters were observed (Talu et al., 2010).

Today, the efficiency and appropriateness for application of PVA analyses in the cities of the world are supported by Geographic Information Systems (GISs). For example, the flood vulnerability of properties in the real estate sector in cities in the United Kingdom are identified by GIS through the ‘*Participatory Spatial Analysis Method*’ by taking people’s experiential knowledge into account (Bhattacharya, 2017).

<sup>132</sup> Tekirdağ, Trabzon, Kastamonu, Kars, Sivas, Şanlıurfa, Van, Antalya, Eskişehir, Samsun, Izmir.



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- It is not sufficient to take past meteorological data into account when making climate projections for urban infrastructure design in Turkey. Climate change impacts should also be taken into consideration, in addition to meteorological data, in these calculations.
- Water loss and theft is a serious problem in Turkey. It is essential to put GIS-based monitoring systems into practice in order to monitor the existing infrastructure system and prevent loss and theft.
- Green infrastructure potential of the cities in Turkey should be revealed.

Urban Infrastructure and Climate Change Adaptation- This section examines cities' wastewater-potable water infrastructure, treatment plants, and green infrastructure components under the urban infrastructure sector.

The main function of **Wastewater Treatment Plants** is to create clean exit water by eliminating the inorganic and organic pollutants contained in domestic and industrial wastewaters (Nierro et al., 2014). Such parameters as the characteristic of the wastewater entering the plant, the characteristics of the receiving medium to which exit water will be discharged, and the characteristic of the exit water determined in line with regulations are taken into account in the designing stage of such facilities. The treatment processes of a standard wastewater treatment plant consists of the following:

- Pre-treatment where coarse solid materials such as paper, textile wastes, plastic, metal and materials such as sand and oil-grease are separated,
- Primary treatment where slumpy solids floating on wastewater are separated and treated by means of physical/mechanical and/or chemical or other process/processes,
- Secondary treatment where wastewater is treated through biological treatment in line with the standards for discharge to the receiving medium, or other processes,
- Further treatment where the pollutants that could not be eliminated through secondary treatment are eliminated through physical, chemical and biological means,
- Sludge disposal where the wastewater sludge is disposed of through such methods as burning, using as fertilizer, or storing in solid waste storage facilities (Tolou and Zouboulis, 2015).

The infrastructure components carrying the wastewater of a city to a treatment plant are collector lines. There are two types of collector lines, i.e., separate and combined. In separate systems, rainwater is collected separately without mixing with wastewater. In the combined system, rainwater and wastewater are collected together and carried over to the wastewater treatment plant.

EU Green Infrastructure Policy and Actions- The "EU Strategy on Green Infrastructure" promoting green infrastructure investments was adopted pursuant to a decision taken by the European Commission in 2013. The strategy specified that green infrastructure would make major contributions to regional development, climate change, disaster risk management, agriculture/forestry and environment in particular, emphasizing the need to integrate green infrastructure practices into spatial planning and regional development by taking such benefits into consideration. In this framework, it was indicated that green infrastructure needed to be integrated to projects that are financed by funding mechanisms such as the Common Agricultural Policy, European Regional Development Fund, Horizon2020, Trans-European Networks Facility, European Maritime and Fisheries Fund (EMFF) to ensure their effective application and that green infrastructure would contribute to regional policy and sustainable growth in Europe. Accordingly, the Commission describes green infrastructure as a priority area of investment in the Cohesion Fund and European Regional Development Fund (ERDF) recommendations.



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The Strategy promotes increasing the number of green infrastructure applications across Europe and developing TEN-G (Trans-European Network for Green Infrastructure in Europe). It is projected that the TEN-G formation will enhance the resilience of the ecosystems in Europe and consequently provide social and economic benefits. Such initiatives also set an example at national, regional and local levels, highlighting the importance of establishing a green infrastructure network in making political, planning and financial decisions in Europe. Member states and regions are encouraged to undertake green infrastructure practices through regional strategies supported by the European Regional Development Fund (ERDF), and European regional cooperation programmes (European Commission, 2012).

Upon examining the Urban Agenda for the EU Action Plan, one of the greatest problems in the development of climate change adaptation plans by local governments is the lack of knowledge and capacity concerning the role and significance of green infrastructure in terms of cities' adaptation to the impacts of climate change. As a solution to this problem, the Action Plan gives prominence to the following actions:

- Developing the national adaptation guidelines of the European Union by focusing on the needs of local governments
- Improving the pages of the countries included in the European Climate Change Adaptation Platform (Climate-ADAPT) to include further information about national data sources and facilitating the access of local governments in particular to verified data and knowledge
- Gathering model studies, relevant national, local and regional legislation, and local climate change adaptation strategies and making them accessible for the EU member states and their local governments
- Accommodating the funding of projects related to climate change adaptation
- Examining all existing directives and documents (urban planning strategies, land use plans, etc.) related to urban planning and infrastructure by taking national and European climate change adaptation strategies into account, and implementing such papers with a “bottom-up” approach by making revisions where necessary
- Enhancing the communication and cooperation among local governments, national governments and the European Union
- Developing guidelines and instruments that support the decision-making mechanism in local governments' infrastructure projects including green infrastructure and that take social, financial and environmental factors into account when making final decisions (Urban Agenda for EU, 2018).

**Green infrastructure** is a component of urban infrastructure that grows increasingly important. The ways in which cities will adapt to climate change is one of the greatest challenges that spatial planners will encounter in the 21<sup>st</sup> century (Measham et al., 2011). Various solutions that spatial planners will recommend in order to overcome this challenge can cause a problem for having costs requiring major changes in the current planning systems or being subjected to changes in future property

rights. However, green infrastructure comes to the fore among all these measures to be taken as a climate change adaptation action that yields relatively quicker results and that is easily acceptable in

**Green infrastructure** is defined as a network of green spaces formed by interconnected natural, semi-natural and cultural areas that preserve the functions and values of the ecosystem.

This network comprised of corridors and parts (centres) contains natural areas such as forests, bushes, grass, wetlands, river corridors and cultural and semi-natural components such as parks, sports fields, school gardens, campuses, private and institutional gardens, roof gardens, horizontal/vertical gardens, zoos, botanical gardens, agricultural lands, cemeteries, vegetated roads, etc. (Hepcan, 2019).





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this period in which urban infrastructure is given increasingly more weight in planning (Matthews et al., 2015). Urban-integrated green infrastructure components are demonstrated in Figure 10.

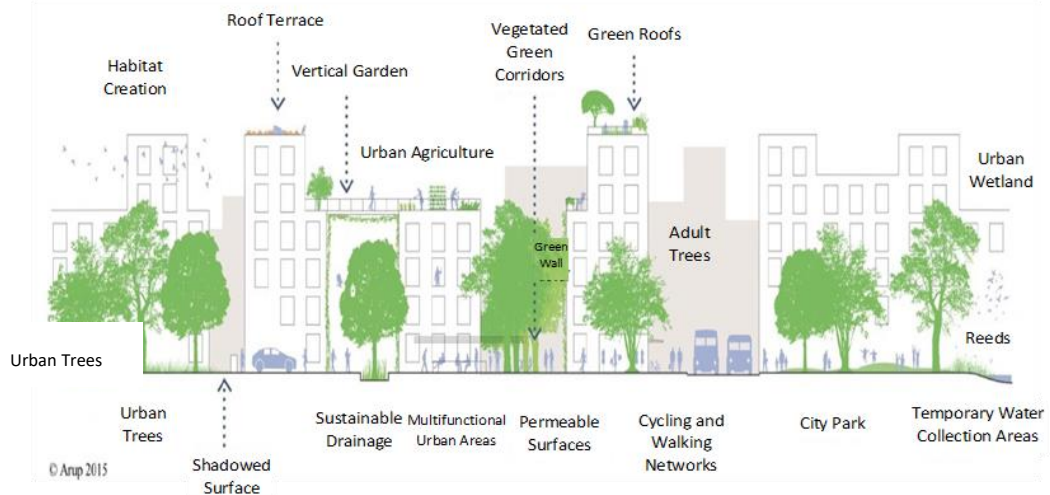




Figure 10. Urban-integrated Green Infrastructure System (Hepcan, 2019)

Green infrastructure items are given in Table 15.

Table 15. Green Infrastructure Items (Hepcan, 2019 & EPA, 2015)

 <p>Green Roof Example</p>	<p><b>Green Roofs</b> are made from vegetation, soil, drainage and a waterproof membrane, built on flat or low-pitched roofs, retaining a portion of the rainwater and directing excess water to the drain. Green roofs;</p> <ul style="list-style-type: none"> <li>• Have a longer life than traditional roofs.</li> <li>• Reduce energy cost and rainwater speed.</li> <li>• Vegetation forms a habitat for wildlife and reduces solar radiation.</li> </ul>
 <p>Trees</p>	<p><b>Trees;</b></p> <ul style="list-style-type: none"> <li>• Slow down the speed of and absorbs rainwater.</li> <li>• Reduce urban heat island formation.</li> <li>• Reduce air conditioning costs by forming a shaded spot in summer and preventing wind in winter.</li> <li>• Reduce greenhouse gas emissions by absorbing CO<sub>2</sub>.</li> <li>• Improve air quality by absorbing dust, O<sub>3</sub> and CO particles that cause urban air pollution.</li> </ul>



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Rain Barrel and Tank Example

**Rain barrels and tanks** are containers that harvest the rainwater flowing from the roofs and allow for the reutilization of harvested rainwater.

- Reduces water consumption and associated costs.
- Reduces the need for clean water by harvesting and enabling the use of rainwater.
- Increases the available water source for other areas of use by saving water.
- Significantly reduces rainwater discharge from roofs.



Swale Example

**Swales**<sup>133</sup> are narrow and long, vegetated trenches that allow for harvesting, retaining and filtering run-off water.

**Rain gardens** are shallow pits covered by vegetation, through which rainwater is directed without any treatment. Their basic function is collecting the run-off water after rainfall in areas such as gutters, roads/walkways, car parks, etc. and improving water quality through biological treatment. Rain gardens are easily applied in the public and private institution gardens, university campuses, school gardens, detached houses and apartment building gardens. Central administration and local governments have a joint responsibility to promote and encourage the use of rain gardens; all that must be done is to make legal regulations to make this an obligation, define the rules, and encourage application. Rain gardens and swales;

- Contribute to the urban aesthetic.
- Reduce the risk of flood and overflow by creating a permeable space.
- Allows water to infiltrate into the soil and feeds groundwater sources.
- Ensures non-point source pollutants are retained before reaching receiving waters.



Rain Garden Example

<sup>133</sup> Swales aim to make further use of rainwater. They increase the groundwater level by allowing more precipitation to infiltrate under the ground, treating the water through the plant cover, increasing biodiversity, reducing the need for irrigation water, preventing erosion by slowing the run-off speed, improving driving safety by collecting the rainwater on the road pavement, and contributing to infrequent and less severe flooding by decreasing the overflow rate.



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Permeable (Porous) Pavement Example

**Permeable (porous) pavement** is a type of pavement made from concrete, asphalt, etc. that has the ability to infiltrate water into the soil with its porous structure, and used in vehicle roads and walkways;

- Reduces run-off water
- Allows water to infiltrate into the soil and feed the groundwater.
- Lightens the burden on the urban infrastructure system and extends its life.
- Its maintenance is easier than standard pavement.

The green infrastructure component is a solution used for the purpose of ensuring adaptation to climate change. According to research, green infrastructure has the following benefits;

- Reducing the risk of flood by conveying the water harvested by rainwater storage and preservation areas (ponds, channels, rain gardens, etc.) to water channels such as the sea or rivers, or if further treatment is planned for, to wetlands and further biological treatment channels
- Reducing run-offs thanks to the vegetation decelerating the speed of rainwater and allowing for water to transition through permeable areas
- Reducing urban heat impacts as a result of evapotranspiration and therefore indirectly reducing the consumption of energy used in the heating and cooling systems of buildings and vehicles
- Cleaning the water by acting as a natural filter and maintaining the quality of clean water (Swale<sup>134</sup>)
- Ensuring heat insulation in buildings through applications such as green roof and green wall,
- Helping species to migrate by creating land corridors

which demonstrate that it is a globally used, economically viable, and effective instrument to combat and adapt to climate change (Matthews et al., 2015 & Hepcan, 2019 & European Commission, n.d.).

No studies were found on the impacts of climate change on green infrastructure systems.

***Impact of Climate Change on Urban Wastewater Treatment Plants-*** Climate change will lead to severe problems in the functioning of urban wastewater treatment plants in the next ten years. In this scope, it is important to adapt to the changing climate conditions in order for wastewater treatment plants to function properly. Taking into consideration wastewater transmission lines and basic climate data, climate factors such as precipitation, rising sea level, storm surges, floods, extreme temperatures (too low and too high), snowfall, wind speed (excessiveness and severity), frosts and icing are very important for such plants, according to research (Yapicioğlu and Demir, 2017).

In this frame, it is predicted that sea level rises, extreme weather events and temperature changes will affect wastewater treatment plants and collector lines. Such impacts are detailed below:

- The sea level rises caused by climate change are expected to affect particularly the plants built on the coastline. Wastewater treatment plants that become submerged or get in contact with seawater will affect the aquatic ecosystem.

<sup>134</sup> Swales aim to make further use of rainwater. They increase the groundwater level by allowing more precipitation to infiltrate under the ground, treating the water through the plant cover, increasing biodiversity, reducing the need for irrigation water, preventing erosion by slowing the run-off speed, improving driving safety by collecting the rainwater on the road pavement, and contributing to infrequent and less severe flooding by decreasing the overflow rate.





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- Extreme weather events caused by climate change reduce the efficiency of treatment at plants, causing problems in the collector lines. Especially the rainwaters that are sent to channels by mixing with wastewater impose additional burden to the channels in the combined system through which they are conveyed and to the wastewater treatment plant. In combined sewer systems without a rainwater line, rainwater is unloaded to the sewer line that leads to the wastewater treatment system, causing the inlet flow of the plant to increase and the inlet water to thin. Since wastewater treatment plant units are designed according to the flow and pollution load results based on various studies and calculations, there may be floods at the plants. In order to prevent this, the untreated wastewater is directly discharged to the aquatic ecosystem through the bypass line<sup>135</sup> in the plant which significantly damages the environment and human health. In case of operation of the plant, flood damage may be seen in units and they may become disabled. The inability of the plant to operate efficiently for this reason creates a financial burden for municipalities, in addition to posing a threat to human health. In the case of wastewater pipelines, flow rates that exceed design parameters damage wastewater pipes.
- Temperature plays a major role in the operation of wastewater treatment plants. The degree to which plants are affected by temperature changes vary based on the processes applied at treatment plants. Treatment plants that involve biological processes are among the plants that are most affected by temperature. Temperature has a determinant role particularly in non-mechanical systems that apply natural treatment (Yapıcıoğlu and Demir, 2017). When looking at warm regions, it is seen that the land requirements are lower for wastewater treatment plants that are built, the treatment efficiency of the plants are higher and their biological treatment processes are more effective. Since plants are designed by taking into consideration the existing climate conditions of the region, sudden temperature changes have an inhibiting effect on the biological treatment reaction. Another reason why temperature changes are important for treatment plants is that the bacterial population that plays a role in treatment is temperature-sensitive and can survive within a specific temperature interval (Tolou and Zouboulis, 2015).

Table 16 demonstrates the ways in which the processes in wastewater treatment plants may be affected by climate change.

Table 16. Climate-induced impacts in treatment processes

Treatment Process	Climate Change Impacts
Settling	<ul style="list-style-type: none"> <li>• Heat increases bacterial reaction speed, reducing the density of the settling sludge. This affects sludge quality and process.</li> </ul>
Bioventing	<ul style="list-style-type: none"> <li>• BOD (Biological Oxygen Demand) increases with increasing temperature. The system diverges from stable operating conditions.</li> </ul>
Processing of wastewater sludge	<ul style="list-style-type: none"> <li>• The amount of settled sludge decreases with increasing temperature.</li> </ul>
Stabilization ponds	<ul style="list-style-type: none"> <li>• Odour problem occurs in stabilization ponds.</li> </ul>
Chlorination	<ul style="list-style-type: none"> <li>• Sudden temperature changes affect the efficiency of disinfection adversely.</li> </ul>

<sup>135</sup> Bypass line allows water to pass through pre-treatment and directly discharge to the receiving medium in cases when the plant is inoperable, such as during repair.



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Below are the applications and recommendations for *climate resilience of urban wastewater and drinking water infrastructures in Turkey*:

- Separate sewer system in which rainwaters are collected separately from domestic and industrial wastewaters need to be extended. Sending rainwater to channels by mixing with wastewater imposes additional burden on the channel system and the plant, as well as wasting the rainwaters that can be used by means of pre-treatment. Separate collection will ensure the recycling of water. Additionally, rainwater can be stored without reaching the channels through efficient use of green infrastructure components (Ağaçayak, 2019). The prominence of the separated system was also emphasized in the NCCS (2011-2023) which also explained the methods about recycling the rainwater that has been harvested separately. Furthermore, “Separating Sewer and Rainwater Collecting Systems in Settlements” was determined as a strategic action (US4.2.3) that is projected to be implemented between 2011-2017. Local governments were determined by the NCCS as those in charge of this matter and the MoEU, Ministry of Agriculture and Forestry, DSI, and ILBANK were referred to as relevant institutions.
- The floods resulting from extreme weather events cause problems in the sewer line. In this frame, problematic areas should be identified and the sewer lines of such areas should be strengthened.
- The “Special Project Specifications for Sewers” published by the Bank of Provinces takes into account parameters such as population projections and the region’s past annual precipitation average when calculating flow rates. Similarly, Bank of Provinces also states in the specifications that maximum flow rate should be used in collector line designs. However, in the calculation of the maximum flow rate, future changes in the precipitation regime and sudden severe weather events are not mentioned. In that case, it should be taken into consideration that the transmission line may not be able to handle the load in the case of severe weather events and that problems such as floods and overflows may occur. In this context, future climate change projections should be taken into account in designing wastewater transmission lines.
- The Technical Procedures for Wastewater Treatment Plants was issued in 2010 with the purpose of coordinating the basic applications and procedures related to wastewater treatment, selection of treatment technologies, sludge disposal methodology, and wastewater treatment plant design criteria. The procedure describes the precipitation averages of past periods as an input for flow rate calculation in the plant’s design and does not include climate change-induced changes in the precipitation regimes and severe weather events in calculations. Similarly, the process of selecting a location for the wastewater treatment plant is based on criteria such as topography, soil properties, groundwater distance, and proximity to critical area whereas there is no mention of coastlines that will be affected by rising sea levels. The changes in the precipitation regime and severe weather events, which will be inferred in accordance with climate projections should be taken into consideration in the designing stage of the plant. One of the criteria that should be taken into account in the location selection process for plants that will be built on the coastline and will make deep sea discharge is the ways in which the planned area will be affected by rising sea level.
- As seen in the research conducted specifically for the Çiğli Wastewater Plant on the impacts of sea level rise, rising sea levels pose a major problem for the plants. The risk analysis studies conducted for Çiğli should be undertaken for all wastewater treatment plants in Turkey that make deep sea discharge and are located on the coastline and action plans should be prepared by taking emergency measures for the plants that are under risk. It is mentioned in the NCCS that rising sea levels will create pressure on infrastructures. While the transport and energy infrastructures are given prominence as the infrastructure systems that will be affected by this situation, there is no mention of any measures related to the wastewater infrastructure.



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- Treatment sludge management is extremely important in terms of climate change impacts. The treatment sludge, a large portion of which is sent to solid waste storage facilities as a method of disposal, constitutes a major burden for storage facilities and causes greenhouse gas emissions. Treatment sludges can be disposed of through the method of burning and the sludge can be used in electricity generation, thus ensuring energy recycling. Applying sludge on land as a fertilizer can be selected as another method of disposal pursuant to the “Regulation on Use of Domestic and Urban Treatment Sludges on Soil” (Ağaçayak, 2019).
- Treated wastewater is an alternative water resource for countries with arid climates and water shortages. Wastewaters that are adequately treated for their intended use can be used in various areas. Particularly in the use of wastewater in agriculture, the nutrients contained in the wastewater serve as a natural fertilizer for the soil while achieving an economic benefit through wastewater disposal. Other than in agricultural land irrigation, treated wastewater can be used for landscape irrigation or as cooling and process water in industries, in construction areas and for non-human consumption purposes (fire protection, toilet water, etc.) (Silkin, 2014). Ensuring the fulfilment of the usage criteria of wastewater treatment plant effluents that are specified in the “Recycling and Reuse of Treated Wastewaters” chapter of the “Technical Procedures for Wastewater Treatment Plants” No. 27527 of 20.03.2010 and applying and using the pre-treatment required for protecting public health and environment will be an important step towards the conservation of water resources. In this scope, the “Wastewater Treatment Action Plan” for 2017-2023 prepared by the General Department of Environmental Management of the Ministry of Environment and Urbanization indicates that the current wastewater treatment plants are modified according to needs and the new wastewater treatment plants to be built are planned by taking into consideration the recycling and recovery of water. Additionally, the target determined by the Ministry for the recovery of treated waters is 5% for the year 2023. NCCS addresses the measure of ensuring the efficient use of wastewaters in urban green areas and emphasizes the significance of reutilization of treated water. The Ninth Development Plan contains the statement that “use of treated wastewater in agriculture and industry will be encouraged”.
- Grey water is lightly contaminated domestic wastewater from places such as the shower, bathtub, sink, kitchen, and dishwasher, i.e., it is the portion of domestic water that does not contain black water (water containing cesspool waste and water from toilets). Approximately 60% of domestic wastewater consists of grey water. Reuse of grey water through treatment without being transmitted to the wastewater transmission line will reduce water consumption as well as reducing the burden of the plants. For example, Republic of Cyprus has reduced per capita water consumption by 40% by carrying out an incentive policy for the reuse of grey water for garden irrigation and toilet flush tanks (Silkin, 2014). Recovery of grey wastewater that has become microbially secure and pollution-free after the treatment process should be encouraged as this will reduce the burden of wastewater treatment plants and significantly contribute to saving water. The NCCS refers to grey water as “alternative water resources for planning flexible water and wastewater systems and addresses the importance of formulating a plan for grey water recovery within the scope of adapting to the impacts of climate change.
- Water loss and theft observed in drinking water networks and their domestic connection points is a major problem for our country. As seen in Figure 11, the average water loss and theft, which is also referred to as “non-revenue water”, is 42% across Turkey (Dilcan et al., 2018). In that case, 58 m<sup>3</sup> of each 100 m<sup>3</sup> water that exit drinking water treatment plants across the country are transmitted to subscribers while the remaining portion cannot be invoiced. Water loss is categorized into two, as *real or physical water loss and visible or commercial water loss* (Silkin, 2014). Real losses occur as a result of leakage caused by the cracks or abrasions on pipe connections, domestic connection points, and the pipes in the infrastructure system. Water loss and theft, mainly caused by the aging and poor control of infrastructure systems, results in major





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waste of water. It is important to divide the existing drinking water networks into sub-regions and identify and replace the problematic areas in the networks. Additionally, monitoring the existing infrastructure through the Data-based Monitoring and Control System (SCADA) allows water managements to monitor their systems at all times and produce solutions by instantly viewing any problem that occurs/will occur. In that context, it is important for the prevention of water loss and theft to develop monitoring system solutions in drinking water networks and to monitor the system instantaneously (Silkin, 2014). Additionally, the NCCS highlights the necessity of identifying water loss and theft in cities, taking measures to reduce the loss and theft rate, and to extend the use of the SCADA System (Data-based Monitoring and Control System) at the national level.

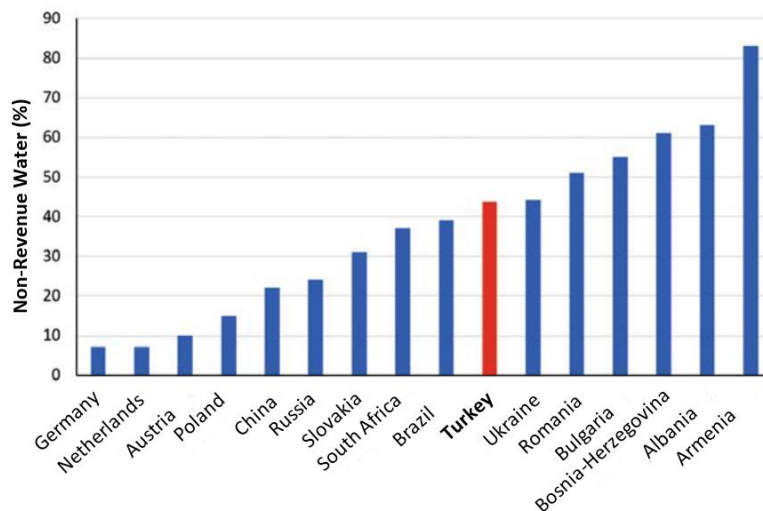


Figure 11. Non-revenue water percentages of countries (Dilcan et al., 2018)

In the **legislation** on urban infrastructure in Turkey, the matter is mainly addressed in the Law No. 3194 on Land Development Planning and Control and regulations. In Turkey, the primary legislation guiding the planning of green areas is the land development legislation. The per capita green area was determined by the Law No. 3194, which has been in effect since 1985, as 7 m<sup>2</sup> and later increased to 10 m<sup>2</sup> pursuant to the Regulation on Land Development Planning and Amendments published in the Official Gazette of 2 September 1999 issue 23804 (Yazgi, 2016). According to the Regulation, the per capita green area shall be at least 10 m<sup>2</sup> in urban areas and at least 14 m<sup>2</sup> outside the municipality and adjacent areas.

According to the World Health Organization, this standard must be at least 9 m<sup>2</sup> and the ideal range is 10-15 m<sup>2</sup>. Whereas the average amount of green area is 20 m<sup>2</sup> per capita in developed countries, this value varies between 1-9 m<sup>2</sup> in Turkey. According to the results of the “Research on Green Area Amounts in Metropolises”, the per capita amount of green area is 4.9 m<sup>2</sup> in Istanbul; it is 19.85 m<sup>2</sup> in Ankara based on the information on the Ankara Metropolitan Municipality’s website, and 13 m<sup>2</sup> in Izmir. It is indicated in the research that the per capita green area is 6.2 m<sup>2</sup> across Turkey.

The purpose section of the Regulation for Making Spatial Plans does not contain any statement regarding rural and natural areas, which are important components of the green infrastructure system. While “urban design project” is defined in the “Definitions” section of the Regulation, the infrastructure elements are addressed in an interdisciplinary manner by taking a holistic approach, in such a way as to provide a foundation to establish a relationship with green infrastructure. Urban design projects can be considered as an important step in terms of developing green infrastructure plans in the future. The regulation adopts the principle that open and green areas and other social and technical infrastructure areas shall be planned in a holistic and accessible manner, in conjunction with



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centres. This is an important provision with regard to planning and designing open and green areas to be interconnected on an urban scale. Such terms as “spatial strategy plan”, “integrated coastal zone plan”, “action plan”, “transportation master plan” that had not been given a definition in the Law No. 3194 on Land Development Planning and Control, which provides the legal basis for the RMSP, were defined for the first time in this regulation. This situation is not legally suitable for the hierarchy of norms, and the manner in which to ensure the coordination of the said plans with other existing plans is unclear in the Regulation, which may cause a problem in implementing the plans involving the green infrastructure system. Although Article 7 of the Regulation points out that climate change impacts are among the subjects to be examined in the preparation of spatial strategy plans, Article 5 describes open and green areas solely as social infrastructure areas where recreational needs can be met. This demonstrates the failure to establish a connection between urban green areas with climate change.

Whereas the Regulation on Plans to Be Made for Protected Areas does not mention green infrastructure, the qualified elements (national parks, natural parks, special environmental protection zones, etc.) of the system are referred to as “protected areas”.

According to the Type Regulation on Land Development of Planned Areas, green areas are considered as a part of social and cultural infrastructure areas and green areas are defined as “playgrounds, children’s park and resting, strolling, picnic, entertainment, recreational and recreative areas (including metropolitan fairs, botanical gardens, zoos and regional parks). The regulation does not address the functions of green areas and their contributions to urban climate change adaptation actions.

The Regulation on Rainwater Storage and Discharge Systems is a pioneering step with regard to rainwater management in cities. Containing solutions for the planning, design, project design, construction and operation of rainwater harvesting, storage and discharge systems, the regulation does not mention that the systems that involve rainwater management solutions are a component of the green infrastructure and should be installed in integration with green area systems (Hepcan, 2019).

The “Regulation on Preparation of Plans”, which is an implementation regulation of the Law on Land Development Planning and Control, is important in terms of paying attention to the importance of the functions of green areas. The Regulation contains the expression “10 m<sup>2</sup> active green area per capita” which calls for paying attention to apply the 10 m<sup>2</sup> active green area strategy in applications (Hepcan, 2019).

When examining the **strategies** and/or policy papers regarding green infrastructure, which is an urban infrastructure component, Turkey’s Climate Change Adaptation Strategy and Action Plan (2011-2023) does not directly include any action concerning green infrastructure; nor does the strategy explore such topics as green infrastructure components, their applicability in Turkey and adaptation to climate change. The strategy only alludes to the fact that green infrastructure is a component that is valued by the European Union in the field of climate change adaptation and accepted by the EU as an efficient adaptation action.

With the Integrated Urban Development Strategy and Action Plan (KENTGES), strategies and actions that take into consideration the functions (green mass, carbon sink and breathing points, urban heat islands, urban biotope protection areas, urban forests, urban parks, green corridors) of green infrastructures and green areas and are based on planning urban development by paying attention to environmental factors were developed (MoEU, 2010). KENTGES refers to the “Open-Green Area System” according to which regulations that protect the existing green areas in settlements and recommends open and green areas in spatial plans are projected. The Plan also emphasizes the need to introduce legal regulations to develop planning and design standards and prepare a guide (Hepcan, 2019).



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The Eleventh Development Plan contains to direct emphasis on or objective for green infrastructure. The objectives of the plan include the statements that, i) “Cities, in coordination with the development vision, will be planned with an approach that supports polycentric, mixed-use, and provides accessibility; where harmonization with topography and addressing disaster risk, climate change, geographical characteristics and historical values in spatial plans will be taken as a basis”, and ii) “Within the scope of green city vision, in order to improve the quality of life and adapt to climate change, Millet Gardens will be built in cities and the amount of green spaces will be increased”.

Turkey’s Seventh National Communication does not contain any statements regarding green infrastructure.

In the examples specific to the U.S. and Europe, local governments, in particular, provide the public with economic support to create green infrastructure components. Local governments, in particular, assume nearly half of the required cost to create rain gardens or sell the plants to be used in rain gardens free of charge or for very low (symbolic) costs. In order to undertake similar activities in Turkey, providing various kinds of support and incentive to those who would like to individually set up green infrastructure systems in their gardens will be particularly important in terms of the public’s active engagement in climate change adaptation.

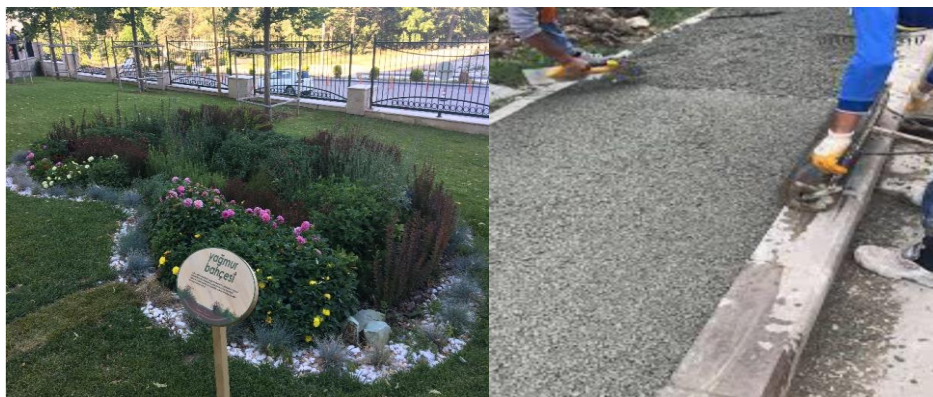
Whereas Turkey does not have any holistic examples for green infrastructure that includes ecological solutions, there some are small-scale project-based studies (Hepcan, 2019). Yet, the green infrastructure potentials of all cities in Turkey must be revealed. It should also be kept in mind that the ecosystem services provided by green infrastructure components reduce the adverse impacts of climate change.

#### 3.3.3 Work by stakeholders

The Rain Garden Handbook published by the General Directorate of Spatial Planning of the Ministry of Environment and Urbanization guides the component of rainwater harvesting, which has an important role in green infrastructure practices especially in cities.<sup>136</sup>

The Ministry of Environment and Urbanization implemented a project in which permeable concrete was applied to the walkway in the central campus and a rain garden was established on the roadside with the purpose of discharging rainwaters to the green area and the rain garden. The Ministry recommends similar practices to be implemented in other public institution gardens, as well and continues their efforts in this regard (Hepcan, 2019). The rain garden and permeable concrete application are demonstrated in

Figure 12.



<sup>136</sup> The Rain Garden Handbook is further detailed in the Third Component of the Project.



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Figure 12. Rain Garden and Permeable Concrete Application

The efforts to issue a catalogue of nature-based solutions that will support the seven regions and the cities of Turkey in climate change response have been continuing as a sub-component of UNDP Turkey/Climate Promise Project.

As of 2019, Izmir Metropolitan Municipality has become involved in the Green Cities Programme of the European Bank for Reconstruction and Development (EBRD) and begun preparatory works for the “Izmir Green City Action Plan”. Preparations for the development/renewal of the Izmir Sustainable Energy and Climate Action Plan<sup>137</sup> have also been continuing under this project.

Izmir Metropolitan Municipality prepared “Izmir Green Infrastructure Strategy (2000)”, containing the following steps:

- *An inventory-taking and information gathering step* that includes the data for the existing green infrastructure (natural structure, rural area, grey infrastructure systems, etc.) and the data required within the scope of green infrastructure strategy (e.g. infrastructure, transport) and projects the transfer of the collected data into the GIS medium and public sharing as an open source,
- *An analysis step* that involves the mapping of wind corridors, water filters, sound (noise) screens, habitat, and climate and determining the priority areas (microclimatic areas, areas with various urban densities),
- *A planning step* that involves establishing the programme areas and action sub-regions within the central green belt area; improved cooperation with the central government to prevent decisions that are added into high level plans by the central government to reduce the development pressures on the central green belt area and that contradict the Green Infrastructure Strategy; formulating planning decisions to determine and protect potential areas with regard to organic/good farming policies in high level plans; and preserving the buffer zones projected in the central green belt area and making them a part of the green system,
- *An implementation step* that involves preparing a strategic road map and action plans, scheduling the works by stages, preparing a guide, and public engagement,
- *A management step* that ensures building the relation between thematic planning and physical planning processes; establishing a project coordination unit in the municipality for rural area planning; establishing a Centre for Green Infrastructure Coordination (YAKOME), that is similar to the Centre for Transportation (UKOME) and Centre for Infrastructure Coordination (AYKOME), for addressing grey and green infrastructures in conjunction; preparing regulations for Central Green Belt protection and development; preparing R & D areas for green infrastructure and building centres to create projects; ensuring the integration of the Planning and green infrastructure process with the national legal legislation (e.g. Mining and Olive Farming Laws) and determining the risks and opportunities arising therefrom.

Furthermore, the Strategy indicates that financial and risk analyses will be conducted for green infrastructure projects, the projects will receive financial support, the public will be provided with green infrastructure training, and women and children will be engaged in all processes in Izmir.

The “Building a Climate Change Resilient City through Empowering Women” project, implemented by the Çankaya (Ankara) Municipality in 2019 under the Town Twinning Grant Programme between

<sup>137</sup> By signing the Covenant of Mayors in 2015, Izmir Metropolitan Municipality aimed to reduce greenhouse gas emissions by 20% by 2020. Carrying out a carbon inventory study based on the year 2014, the Metropolitan Municipality prepared the Izmir Sustainable Energy Action Plan in 2016.



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Turkey and the European Union (EU), is the first study that addresses climate change adaptation by municipalities and gender equality in conjunction. The basic logic behind the project is: one of the important elements in solving the problems caused by the climate crisis is direct engagement by all segments of society in the decision-making processes in this area. As 100% of the population should be involved in this fight, it is only natural for women, who make up half of the population, become partners to creating just, effective and sustainable climate-friendly solutions in Çankaya. In this framework, Çankaya Municipality strived to involve the gender equality aspect in their policies and activities for climate resilience throughout the project, drawing inspiration from the social policy-oriented practices by the Frankfurt Municipality, the co-partner of the project, in terms of climate change response (Talu, 2019).

The “Ecosystem Services as an Urban Planning Tool: The Case of Çankaya” project was implemented in 2019 in partnership with the Nature Conservation Centre (NCC) and Eurosite Association.<sup>138</sup> The project, which was a component of the Nature and Cities Project supported within the frame of the Turkey-EU Civil Society Dialogue V Grant Programme, was implemented in cooperation with Çankaya Municipality and beIN IZ TV. This study, the general purpose of which was to encourage urban-based solutions and green infrastructure in cities, is a guiding tool for decision makers and practitioners in urban planning. As part of the study, the ecosystem services provided by green areas in Çankaya (Ankara) were mapped out at the neighbourhood scale, the benefits of each service were identified, the problems concerning the inadequacy of the existing ecosystem services were discussed and recommendations were formulated accordingly.

A submersion analysis was conducted for the Izmir Çiğli Wastewater Treatment Plant, studying how this plant which is at risk due to its location would be affected by threats related to sea level rises and storm surges caused by climate change. According to the GIS-based analyses, a water intrusion into the plant is predicted as a result of a storm surge caused by a sea level rise of 0.3 and a sea level rise of 1.0 m (a total water level elevation of 1.3 m). In the event of a 1.4 m storm surge that can result from a severe storm (a total water level elevation of 17.3 m - Figure 13), the water level is expected to fully cover the sludge drying beds and reach the top elevation of aeration tanks. A potential 0.8 m sea level rise and a 1.7 m storm surge (a total water elevation of 2.5 m - Figure 13) would submerge the plant completely. Under such circumstances, it is predicted that the roads to the plant will also be submerged, causing transportation problems (Kara and Gündüz, 2015). Based on the studies that were conducted, it is understood that even a 0.3 m sea level rise will have adverse effects on the plants.

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<sup>138</sup> Details of the project are given in the annexes to this report.





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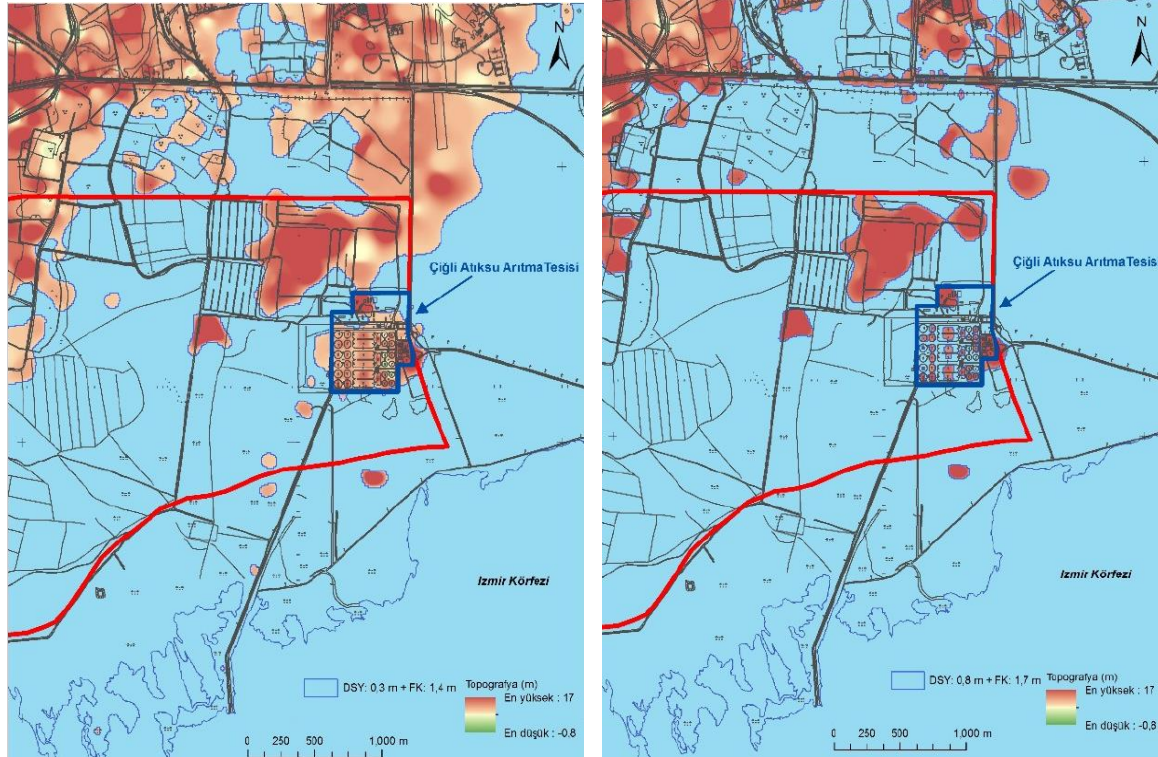


Figure 13. 2.5 m and 1.7 m scenarios

In Turkey, Çaycuma Municipality (Zonguldak) stands out among district level municipalities in green infrastructure applications. Çaycuma Municipality is the first municipality to prepare and approve with a Municipal Council Decision the “Regulation for Harvesting and Using Rainwater” for the municipalities’ local practices in 2019.<sup>139</sup>

The “Every Drop Matters” project was implemented in 2006 in cooperation with the UNDP (United Nations Development Programme) and Coca Cola Turkey in order to allow for domestic reuse and potability of rainwater by being collected from the roofs of the houses in Tekke Kuyumcu village of Beypazarı district of Ankara. The project aimed to apply rainwater harvesting systems in 30 houses in the village. In this direction, a rainwater harvesting system was initially installed in the house of the village master to collect rainwater into a tank through gutters. The applicability of the system was demonstrated to the locals by supplying the construction materials from nearby marketplaces. The filter placed at the entrance of the tank prevents foreign substances from entering the tank. After filtering the tank water, which fills up within 2-3 hours during April showers, with a small booster pump system through a sieve filter and a resin-based filter, clean water that is suitable for domestic use is obtained. By this means, the water problem of the village was eliminated, ensuring that 18 households with almost no access to water were provided with clean water. The five items required to build such a system are a clean roof area, pipes, filter, booster pump system and an appropriately sized tank. After completing the model works, the villagers built and started using their own rainwater harvesting systems by procuring the necessary equipment from local markets. The project cost was calculated as 6,000 Turkish lira per house in 2014 (Silkin, 2014). The components of the green infrastructure that was built are demonstrated in Figure 14.

<sup>139</sup> The practices of Çaycuma Municipality are further discussed in the annexes to this report.





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Figure 14. Components of the Green Infrastructure

The “Pedestrian Association”, which is the first in its field across Turkey and Izmir, was established in 2018. Alluding to a pedestrian-scale planning in urban transport and therefore the need for a low-carbon lifestyle, this brought such efforts that are required for urban climate resilience to the agenda by also underlining the rights of pedestrians. The Pedestrian Association is the sole representative member of the International Federation of Pedestrians (IFP) from Turkey.

A swale has been applied in Istanbul Technical University’s Ayazağa Campus which allows for retaining rainwater on walking trails (MoEU, 2018). The swale that was created is shown in Figure 15.



Figure 15. ITU Swale

A study conducted in Istanbul ensured the conservation of water in two collective housing establishments through rainwater and grey water recycling applications. According to the calculations, 10 million litres of water were saved annually in the housing establishments in *Ataköy 1<sup>st</sup> Section* whose total water consumption amounted to 134 million litres. Accordingly, approximately 9% of the water need of the establishment can be met by SACF rainwater harvesting systems. When calculated based on the current ISKU water charge tariff of 5 TRY/m<sup>3</sup>, approximately 50 thousand Turkish Lira worth of annual savings is achieved (Silkin,2014).

According to the calculations for the *Ataköy Mansions* establishments, 20 million litres of water is supplied annually through rainwater harvesting systems. Accordingly, approximately 7.9% of the water need can be met with rainwater harvesting systems, which amounts to a saving of approximately 100 thousand Turkish Liras based on a water charge tariff of 5 TRY/m<sup>3</sup> (Silkin, 2014).

The research titled “Climate Change and Urban Resilience: Vulnerability and Risk Assessments for Istanbul”, studied in 2015 as a master’s thesis in Istanbul Technical University, identified the lack of comprehensive climate change resilience studies in Istanbul, which is the largest metropole in Turkey;



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addressing urban development, future applicability as well as sectors providing main services, sectoral fields that will be affected in Istanbul, and different areas of planning for a more comprehensive approach, the research also analysed 11 sectors and 26 areas of planning through a vulnerability analysis and the risk assessment methodology described in the literature (Aygün, 2015). According to the research results, the top priority sectors are public safety (urban risk areas), health (heat), water resources (water supply), ecology and biodiversity (biodiversity), and infrastructure (rainwater management). Sector vulnerabilities and risk factors were also determined to be closely related to the urban development model of Istanbul. The outputs of the study are summarized below:

- Uncontrolled urban development, official and unofficial settlements on river basins, earthquake zones unsuitable for urban development increase sectoral vulnerabilities and undermine public safety.
- The lack of wind corridors and green areas in dense settlements creating an urban heat island effect exacerbates the heat vulnerability of settlements.
- This situation compels further priority to the healthcare sector in terms of climate change adaptation.
- Increasing population, sprawling of the city in surrounding areas increase the pressures on natural resources and the vulnerabilities of water resources and ecology, which endangers resources.
- The infrastructure of the city is not adequate, especially for the population in dense and old settlement areas. The infrastructure system will not work productively in cases of extreme/frequent weather events.

A study conducted by Süleyman Demirel University in 2013 investigated the extent to which the metropolitan city of Ankara was sensitive to climate change (Çobanyılmaz and Yüksel, 2013). The study, which was conducted to determine the climate change-induced damages sustained by Ankara, examined the damages caused by climate change on the basis of the city's social, economic, environmental, institutional and spatial structure and determined that the city could be highly damaged, and the urban systems (infrastructures) were unprepared for the potential risks and threats of natural disasters that could be caused due to climatic changes.



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### 3.4 Water resources and climate change adaptation

- One of the important steps taken towards changing the current complex management system of water resources and wastewaters by the central government in Turkey is adopting an integrated basin management approach, which is a positive step in terms of climate change adaptation.
- In the context of water resources management and climate change adaptation, basin-based drought and flood policies and practices light the way for the future.
- Ecosystems are critically important in the water cycle, which obligates an ecosystem-based approach to eliminate the adverse impacts of climate change on water resources.
- The lakes in Turkey are affected adversely by climate change in terms of quantity and quality.
- Aside from the strong aspects of the current legislation in terms of mitigating the impacts of climate change on water resources in Turkey, the need for a revision to develop it with a holistic perspective still remains. Climate change impacts must be taken into account in the preparations of the Water Law.

Water, on which all living creatures depend for survival, makes up approximately 70% of the Earth. Considering that only 3% of the said amount is fresh water, two-thirds of which is in glaciers, only 1% of the water amount on Earth can be used by humans. According to shared data, only 20% of the water used across the world is reused through recycling (Schleifer, 2017). Therefore, not wasting water resources and recycling grows more important with each passing day.

#### 3.4.1 Impact of climate change on water resources

One of the most important threats to water resources is climate change. Increasing temperatures caused by global warming has a direct impact on the hydrological cycle. According to scientists, two important effects of climate change on water resources is the degradation of the water cycle and change in water quality. The impacts of climate change that are seen/predicted on water resources and the changing water system indicate that water demands will increase, leading to greater pressure on various sectors that are already under water stress. The important changes caused by climate change on the hydrological cycle can be listed as follows (Ministry of Agriculture and Forestry, 2020)

- Changes in seasonal distribution and quantity of precipitation
- Increase in precipitation densities
- Changes in the balance between snow and rain
- Increase in evaporation and decrease in soil moisture
- Changes in plant cover based on temperature and precipitation
- Increase in glacial melting
- Rise in sea levels and salinization of groundwater.

The changes in the seasonal distribution and quantities of precipitation and the decreasing precipitation in almost every part of the **Earth** increase the frequency and severity of droughts. Considered differently from other natural disasters, droughts, unlike many natural disasters, can develop slowly and cause severe economic, environmental and social impacts in vast regions and sometimes throughout the country. It is an anticipated potential impact that the increasing frequency of droughts will affect crop yields, putting food security at risk. This hazard can occur due to a number of parameters such as losing soil productivity as a result of soil loss and salinization brought by



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excessive precipitation, or the inability to provide irrigation water due to low precipitation. The social impacts of drought come into existence in the forms of deteriorated living and health qualities of humans, conflicts among water users, injustice in the distribution of disaster aids due to drought (e.g. those engaged in agriculture are the groups that are most affected by drought due to loss of revenue/livelihood difficulties), and migration. All of such threats demonstrate the knock-on impacts of climate change on water resources.

It is only natural that many sectors such as agriculture, energy, livestock breeding and tourism which have a relation with water will be affected by climate change. In terms of the security of energy systems, electric supply can become under the risk of water shortage in hydropower plants. Decreasing precipitation, occasional excessive precipitations, changing rainfall times throughout the year, etc. caused by climate change can also make it difficult to manage the dams generating hydropower.<sup>140</sup>

It is important in projecting water investments to take regional climate variances and prospective climate change data into account while also assessing the impacts on ecosystem and ecosystem services. The UN 2018 Report, “Nature-Based Solutions for Water” explores the reflections of human-induced destruction and changes in the ecosystem with a focus on water (UNESCO, 2018). Drawing attention to the critical importance of ecosystem in the water cycle, the report underlines the climate change pressures on water resources while also signifying that destruction of forests are among the key reasons behind water shortage, in consideration of the fact that forests regulate waterflow, clean the water, and stabilize the humidity rate in the atmosphere. This further emphasizes that an ecosystem-based perspective is essential for the adaptation of water resources to climate change.

Considering climate change impacts on the basis of water basins, the universal impacts can be listed as follows (Çapar, 2019):

- Flood; river flows, run-offs and floods are expected to increase during the winter due to extreme weather events.
- Drought; drought is anticipated as a result of high temperatures and increasing precipitation.
- Hydropower; changes in flow will reduce clean power generation.
- Agriculture; the need for irrigation water will increase.
- Snow mass; a decrease by 25% will change water supply.
- River flow; changes will impact water supply, water quality, fishing and recreation activities.
- Groundwater; some shallow wells will dry as a result of low water levels caused by hydrological changes and increased water demand.
- Water use; agricultural, urban and environmental water demands will increase.
- Water quality; brine intrusion caused by sea level rises will affect deltas and coastal aquifers.
- Water dams in deltas; rising sea levels will threaten water dams.
- Habitat; warming river waters will distress the cold-water fish such as salmon

According to the Falkenmark Water Index<sup>141</sup>, **Turkey** is not a water rich country. Taking population growth into account, it is predicted that the per capita water potential will decrease to 1120 m<sup>3</sup> by 2030. The per capita amount of renewable freshwater resources in Turkey is below the OECD average.

<sup>140</sup> This subject is discussed separately under “Energy Sector’s Adaptation to Climate Change” chapter of the report.

<sup>141</sup> The thresholds referred to as the “Falkenmark Index” describe the pressure on water resources and are commonly used. According to the index, the per capita minimum domestic water need is 100 litres per day, and the water need for agricultural and industrial purposes is 500-2000 litres per day.



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The predicted increases in population and water usage rates will naturally boost the pressure (water stress) on the water resources of the country. It is also estimated that cross-sectoral competition for accessing water has been increasing and will become even more challenging due to increasing urbanization, expanding irrigation areas, and climate change.

The increasing frequency of excessive hydrological events caused by the increasing precipitation and water flow variabilities due to the impact of climate change on the hydrological cycle in Turkey has started to bring along significant changes in the supply and quality of water resources. It is recognized that such changes will have adverse impacts on the integrity of the ecosystem (soil degradation, coastal erosion, etc.) and on drinking-utility waters and agricultural production. In addition, such causes as the existing growth rates and water consumption habits throughout the country create additional and significant pressure on water resources.

The precipitation regime of Turkey, which is located in a semi-arid part of the world in terms of water resources, varies widely by seasons and regions. The water needs in some river basins have exceeded the potential of the resources. Impacts such as increasing temperatures in summer, decreasing precipitation in winter, loss of surface waters, frequent droughts, soil degradation, coastal erosion, overflows and floods caused by climate change pose a direct threat to the availability of Turkey's water resources.

It is known that in some river basins, there is a decrease in precipitation, a significant increase in temperatures and therefore a tendency for a decrease in flows. For example, it is estimated that 50% of the surface waters in Gediz and Greater Meander Basins will become lost in this century, leading to an extreme shortage of water for water users in agriculture, settlements, and industries. Research demonstrates that the most remarkable water gaps are observed in Euphrates, Tigris, East Mediterranean and Konya Closed Basins.<sup>142</sup> It is also predicted that the frequency, intensity, and countrywide spatial distribution of natural disasters that are sensitive to the changing water cycle such as floods and droughts will also increase due to climate change. The intensity of precipitation is predicted to increase in some regions in the country, therefore increasing flood risks in the rural and urban areas in such regions.

From the perspective of combined sectoral impacts, a significant level of water shortage is anticipated for almost all sectors in Turkey, and particularly agriculture. The seasonal shifts that have started with the changes in water cycle and temperatures due to climate change will unavoidably have a direct impact on the agriculture sector. As a result of the changes in temperature and precipitation regime, there will be an increase in the range and species of agricultural pests. The climate change predicted in agriculture will affect production, production areas and livestock breeding and the intensity, frequency and probability of increase of extreme weather events will significantly increase the risk of reducing harvests in agriculture.

The lakes in Turkey are also affected unfavourably by climate change in terms of quality and quantity. For example, the surface area of Lake Tuz that was 92,562 hectares in 1987 has decreased to 32,552 hectares in 2005, demonstrating a reduction by 35%. With the impact of drought and agricultural irrigation, the water potential of Lake Beyşehir, which is a freshwater lake, decreased by approximately 23%. Similarly, the water amounts and surface areas of Lakes Eğirdir, Manyas, Ladik, Van, and Sapanca have also suffered a significant decrease (Çapar, 2019).

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<sup>142</sup> "Turkey's Seventh National Communication", Ministry of Environment and Urbanization, Chapter 6.3.1 Water Resources, UNDP Turkey, 2018, p: 138 (Turkish version).





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Attention must be paid to the risks of combined sectoral impacts, considering that most of the electricity obtained from renewable energy sources are met from hydropower plants in Turkey and therefore the dependence of the sector on water. Ecological destructions caused by hydropower plants will be prevented through taking into consideration the impacts of climate change on water resources in basins, as well as by taking adaptation measures.

#### 3.4.2 Water resources management and climate change adaptation

In addition to reducing carbon emissions on the path to low-carbon economies, one of the key aspects of building climate resilient economies requires adapting to the impacts of climate change almost in every sector. In terms of water resources, the profitability and brand value of any sector with a greenhouse gas emission mitigation goals/plans could be affected by the quantity or quality of the water used as a raw material, which also demonstrates the extent to which climate change adaptation policies for water management resources depends on mitigation policies. Therefore, water resources management<sup>143</sup> is directly related to various sectoral policy areas such as agriculture, industry, nature conservation and ecosystem services, forestry, energy, transport, tourism, urbanization, rural development and regional development.

The reliability and abundance of the data and knowledge on water availability and how such availability will change based on different scenarios is essential for the correct management of water resources under climate change risks. Therefore, it is also important to improve the existing efforts in this direction and to reduce uncertainties. For example, more data and knowledge are available on surface waters than on groundwaters; there is also little scientific evidence available on the transformation of ecosystems (on the extent to which they are resilient), which are crucial within the context of the affection of water resources in climate change scenarios. These reasons signify that there needs to be further scientific research on the impacts of climate change on the water sector and adaptation measures.

Based on the fact that agricultural production is under a major risk caused by the changing water cycle in Europe, the **European Union** determined new measures, in addition to the existing practices, in line with the outcomes of various research in order to encourage and facilitate the reutilization of water for agricultural irrigation purposes in 2018. It was predicted that such measures would help farmers to make the best use out of wastewater, mitigate water shortage, and also protect the environment and consumers. While the measures were a part of the 2018 Work Programme of the European Commission practicing the EU Circular Economy Action Plan, they were also complementary of the existing EU legal framework regarding water and foodstuffs. EU stipulated the management of water resources at the scale of basins as a policy, designing the entire managerial building based on this approach.

In terms of **legislation**, various laws and decree laws on the protection, development and management of water resources are in force in Turkey, starting from the Constitution. There are also various regulations, communiques and circulars regulating the practices of relevant institutions. Such legislation is directly and/or indirectly related to adapting to the impacts of climate change on water resources. The primary legislation includes the Village Law, Law on Waters, Law on Agricultural Land Reform for Arrangement of Lands in Irrigation Areas, Law on Irrigation Unions, Law on Protection

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<sup>143</sup> Water resources management is meeting social, economic and environmental needs making water available to individuals at a low cost, in an adequate quality and when needed.





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Against Flood<sup>144</sup>, Law on Drinking Waters of Villages,<sup>145</sup> Law on Groundwaters, Environmental Law, Law on Geothermal Resources and Natural Mineral Waters, Law on Potable and Industrial Water Supply for Municipalities, Law on Special Provincial Administration, Turkish Civic Code Law on Coastal Protection, Law on Aquaculture Products; and the secondary legislation includes Water Pollution Control Regulation, Regulation on Conservation of Basins Supplying Drinking Water, Regulation on Protection of Groundwaters Against Pollution and Degradation,<sup>146</sup> Regulation on Monitoring Surface Waters and Groundwaters, Regulation on Urban Wastewater Treatment and the Regulation on Sensitive Water Bodies and Determining Areas Affecting Such Bodies and Improving Water Quality, Regulation on Preparing, Implementing and Monitoring Basin Management Plans<sup>147</sup>, Regulation on Strategic Environmental Assessment, Regulation on the Protection of Waters against Agricultural Nitrate Pollution.

According to Environmental Law No. 2872 of 9 August 1983, it is essential to ensure the use of marine, underground and surface water resources and aquaculture production areas by protecting them from pollution. The penal provisions of the Law stipulate administrative fines for those who discharge waste contrary to protection principles to the protection areas of drinking and daily water, to the source itself and subterranean surface waters that feed the source, irrigation and drainage tunnels.

The fact that water resources management requires a multi-stakeholder management - such as irrigation unions, agriculture cooperatives, industrial agriculture stakeholders, sectoral non-governmental organizations, village masters, etc. even only in terms of the agriculture sector - brings along multi-heads in this area. This is one of the most significant challenges in Turkey in introducing a framework law concerning water, with the complexity of the sources of the problems being another.

In line with such approaches, one of the objectives of the Eleventh Development Plan (2019-2023) to introduce a **Water Law**, which is still currently being worked on, and relevant supporting legislation in order to ensure the rational management of water resources using modern practices and to be prepared against droughts and floods that are experienced/anticipated in Turkey.

Aside from the strong aspects of the current legislation in terms of mitigating the impacts of climate change on water resources in Turkey, the need for a revision to develop it with a holistic perspective still remains. For example, a legislation is required that will allow controlled and supervised feeding of aquifers with treated wastewater within the framework of protecting groundwaters against pollution and degradation. Additionally, Turkey also lacks a legislation regulating the operations of enterprises

<sup>144</sup> According to this Law, a Presidential Decree will designate the boundaries of areas with rising levels, public and private, or closed or flooded by river overflow or potentially vulnerable to floods.

<sup>145</sup> Law No. 3621 of 04/04/1990 on Coastal Protection aims to set out the principles for protection of the sea, natural and artificial lakes and river coasts by paying attention to their natural and cultural characteristics and for their utilization towards the public interest and access for the benefit of society. According to the law, technical and social infrastructural facilities can be built on land areas gained through reclamation and drainage in cases required by public benefit, by taking into consideration the ecological characteristics of seas, lakes and rivers.

<sup>146</sup> Pursuant to the provisions of the Regulation on Environment Permissions and Licenses to be obtained pursuant to the Environmental Law, permission for the indirect discharge of treated wastewaters to groundwater bodies according to the purpose of use of groundwater shall be granted permission by the Ministry of Environment and Urbanization.

<sup>147</sup> The Regulation published in the Official Gazette of 28.10.2017 issue 30224 contains direct provisions on climate change adaptation. The Regulation considers it a basic principle to consider the adverse impacts of climate change on water resources at the basin scale in the protection and use of water resources (Article 5/g) and provides that the effects of climate change shall be taken into account in the preparation of basin management plans (Article 10/1)



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in terms of utility water quality with regard to the areas of use of recycled grey water in Turkey<sup>148</sup> (T.R. Ministry of Agriculture and Forestry, 2020).

Two Prime Ministry Circulars on floods and overflows were sent to the relevant addressees (governorships/municipalities), signed by the then-Prime Minister and current President Recep Tayyip Erdoğan, in 2006 (Circular of 9 September 2006 on “Riverbeds and Overflows”) and 2010 (Circular of 20 February 2010 on “Rehabilitation of Stream and Riverbeds”), respectively. The Prime Ministry Circular of 2010 was directly aimed at climate change response, containing the statement “*In consideration of the changing quantities and intensities of precipitation due to global climate change and the overflow disasters caused by the frequent floods in our country in recent years, river and streambeds must be rehabilitated shortly in order to combat any potential floods that may occur in the future*”.

The Circular of 22.01.2019 titled “Climate Change and Disaster Measures”, which was sent by the Ministry of Environment and Urbanization to all governorships and municipalities, indicated that the number and intensity of disasters, particularly floods and overflows, caused by global climate change had been increasing in the recent years and requested from local governments with the capacity and responsibility to respond to the problem on the spot and in a timely manner to implement the measures immediately. The measures that were directly related to overflows in the Circular were; i) accelerating the works for stream and canal rehabilitation, ii) carrying out the works for building bridges and culverts to ensure waterflow at the lower elevations of the land and allow for the construction of infrastructural facilities, and iii) rehabilitating the existing structures that fall short in the removal of overflows and rainwater.

According to the **institutional building**, it is the responsibility of the Ministry of Environment and Urbanization to formulate and coordinate policies regarding wastewater management.

Under the Ministry of Environment and Urbanization, the efforts regarding direct management of water resources and prevention of water pollution are undertaken by the Department of Water and Soil Management of the General Directorate of Environmental Management. The fundamental role of The Ministry of Environment and Urbanization in water resources management involves the conservation of resources, quality enhancement, and pollution prevention (treatment plants/water pollution/monitoring, etc.) and the Ministry has been carrying its works at provincial, regional and basin levels. In this framework, Pollution Prevention Action Plans were prepared by the Ministry of Environment and Urbanization for 8 basins (Greater-Little Meander, Seyhan, Ceyhan, West-East Mediterranean, North Aegean, and Gediz) in order to ensure the conservation of water resources at basins and the prevention of pollution. The measures established for achieving the short, medium and long term objectives determined in the plans are monitored.<sup>149</sup>

As water quantity and quality management has been exercised by different institutions for a long time in Turkey and water management is a cross-cutting subject, institutional cooperation and coordination has been difficult to establish. The General Directorate of Water Management was recently formed as a main service unit of the Ministry of Agriculture and Forestry pursuant to the need for an institutional structure to respond to holistic approaches in water management and in order to perform the tasks

<sup>148</sup> Areas in which water is used have their own specific quality requirements, which is why the water obtained from the grey water recovery system must comply with the standards of its place of use. Generally, utility water obtained from treated grey water should be hygienically and microbiologically safe, non-colour, and completely free of solid wastes. The grey water that has been treated should be odourless, even few days after storage.

<sup>149</sup> Eleventh Development Plan (2019-2023), Water Resources Management and Security Specialized Commission Report, T.R. Ministry of Development, Ankara, 2018, p: 61.



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related to strategy and policy making and planning. Works regarding sectoral water allocation, determination of environmental quality standards, and maintaining water bodies and their quality is undertaken by the General Directorate of Water Management of the Ministry. While one of the tasks of the General Directorate of Water Management is directly to “undertake works regarding the impacts of climate change on water resources”, almost all of the other tasks address the need for the conservation and management of water resources against the impacts of climate change:<sup>150</sup>

- To determine policies related to protection, improvement and usage of water resources,
- To prepare and cause to prepare river basin management plans on the basis of river basins and conduct the relevant legislation studies about integrated river basin management plans, with the aim of protection and improvement of ecological and chemical quality of aquatic environment by taking protection-use balance into account,
- To follow up processes arising from international agreements and other legislations related to protection of water resources and management, to undertake works related to trans-boundary and frontier waters in coordination with related institutions,
- To establish a national database for water,
- To determine and monitor sensitive areas in terms of water quality and areas nitrate-sensitive,
- To determine the design principles, norms and criteria for drinking and utility water treatment plants, identify the institutions and organizations authorized for project approvals, to ensure the training and certification of the personnel to operate the plants,
- To perform studies on climate change impacts on water resources,
- To determine, assess and update precautions, on the basis of basins, together with related institutions and associations and follow up their implementation,
- To determine, together with related institutions and associations, objectives, principles and receiving environment standards for the protection of surface waters and ground waters, to monitor or cause to monitor water quality,
- To determine strategies and policies related to floods, to prepare related legislation and flood management plans,
- To make necessary coordination related to water allocations on the basis of sectors, according to river basin management plans.

If so requested, public entities are obliged to provide the General Directorate of Water Management with the water-related information and data available to them, to be registered to the water database. Apart from the responsibilities of the General Directorate of Water Management specified above, the powers and duties of the Ministry of Environment and Urbanizations and municipalities (Metropolitan municipalities and others) are reserved.

The General Directorate of Combating Desertification, which is one of the main service units of the Ministry of Agriculture and Forestry, holds duties and powers in water resources management against drought in Turkey.<sup>151</sup>

The General Directorate of State Hydraulic Works (DSI), an affiliated agency of the Ministry of Agriculture and Forestry, is in charge of the planning, development and operation of water resources

<sup>150</sup> Presidential Decree No.1 (Official Gazette of 10 July 2018 issue 30474).

<sup>151</sup> This topic is discussed individually under the chapter “Agriculture Sector’s Adaptation to Climate Change”.



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in Turkey and maintains its operations as an investor with a public entity status and special budget (investments such as building dams, building flood control structures, building irrigation facilities, rehabilitating rivers and swamps, generating hydropower, etc.). The organization and tasks and powers of DSI are regulated under Articles 119 to 126 of the Presidential Decree No.4.

The priority work undertaken by the DSI include flood protection, encouraging irrigated farming, generating hydropower and supplying drinking water to metropolitan cities in addition to carrying out efforts of building dams, which serve as the common points of said services to supply drinking, utility and industrial water to municipal settlements. Furthermore, DSI has been authorized for the building of drinking, utility and industrial water plants and if required, wastewater plants in all municipal settlements (Metropolitan, provincial, district municipalities) since 2017.

DSI supervises water resources with regard to energy utilization and works with regard to drinking and irrigation water and flood management. The services of the General Directorate<sup>152</sup>, which has been delegated comprehensive duties and powers in various areas, that are associated with the impacts of climate change on water resources and ensuring adaptation to such impacts are listed below:

- To establish protective facilities against overflows and floods
- To build irrigation facilities, produce or cause to produce maps and plans, and if required, survey maps demonstrating the entirety or parts of the available plots in irrigation areas.
- To rehabilitate wetlands, conduct or cause to conduct study and planning works concerning erosion and sediment control, undertake forestation works for the purpose of erosion control to protect its own facilities
- To undertake field improvement and land consolidation
- To audit, ratify and inspect drinking water and sewer projects of cities and towns
- To rehabilitate rivers and make those navigable as necessary
- To build or cause to build the necessary facilities to recover used waters
- To control whether the operationalized hydropower plants are operated in line with water use rights agreements, to undertake all kinds of accounting and collection procedures in this regard; lease out for a rental price those requests approved for the installation of solar power systems on the surfaces of dams, ponds and canals and locations between the maximum water elevation and the maximum operational elevation.
- To undertake works related to its remit with regard to transborder and terminal waters
- To undertake water allocation works, monitor surface and groundwaters for quality, identify and report to the relevant ministry the contamination of surface and groundwaters by wastewaters.

Climate change is emphasized in the 2017-2021 Strategic Plan of DSI. In this framework, the Strategic Plan foresees that climate change impacts on water resources, response methods, and adaptation methods will be determined, and studies will be conducted on the basis of pilot basins in line with the objectives of maintaining, improving and monitoring the quality and quantity of water. While the Strategic Plan refers to increasing the hydraulic energy supply as one of its objectives, it also addresses climate change and favours the climate-friendly operation of HPPs.

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<sup>152</sup> Presidential Decree No.4 (Official Gazette of 15 July 2018 issue 30479).



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Turkish Water Institute (SUEN), an affiliated entity of the Ministry of Agriculture and Forestry, has been serving to formulate national water policies since 2011.<sup>153</sup> The primary duties of the institute are to guide and monitor the forward-looking works related to water, and to develop Turkey's short and long term water management strategy. Accordingly, the duties of SUEN include contributing to the development of the facilities and instruments required to produce strategies to formulate sustainable water policies and resolve global water problems, undertake works regarding international water law, conduct and support the conducting of scientific research to develop national and international water policies. SUEN is also responsible for producing knowledge for determining the principles regarding the use of water resources in Turkey for the purposes of sustainable development and renewable energy generation.<sup>154</sup> SUEN supports the efforts to increase the climate change adaptation ability and capacity of the agriculture sector. Within the frame of its international activities, SUEN represents Turkey within the Union for the Mediterranean (UfM), which is an intergovernmental regional organization, and together with Italy, co-chairs the "Water-Employment-Migration Nexus" among the UfM task forces for Food-Energy-Ecosystem Nexus, Climate Change, Water and Finance, Water-Employment-Migration Nexus and Sanitation-Hygiene (SUEN, 2020).

SUEN Steering Committee, which is a higher council for guiding policies, is chaired by the Ministry of Agriculture and Forestry and consists of Deputy Ministers of Industry and Technology, Environment and Urban Development, Foreign Affairs, Energy and Natural Resources, Interior, Health, Agriculture and Forestry; General Director of State Hydraulic Works, General Director of Water Management, General Director of Meteorology, Head of Scientific and Technological Research Council of Turkey, Head of Institute, and two university faculty members or non-governmental organization representative to be determined by Ministry of Agriculture and Forestry.

SUEN Executive Board is chaired by the Deputy Minister of Agriculture and Forestry and consists of the Head of Institute, Deputy Head of Institute, Policy Development Coordinator, Policy Development and Administration Coordinator and representatives from the Ministry of Environment and Urbanization, Ministry of Foreign Affairs, Ministry of Energy and Natural Resources, General Directorate of Water Management, General Directorate of State Hydraulic Works, General Directorate of Meteorology, and Scientific and Technological Research Council of Turkey.<sup>155</sup>

One of the important steps taken towards changing the current complex water resources and wastewater management<sup>156</sup> system by the central government in Turkey is adopting an integrated basin management approach, which is a positive step in terms of climate change adaptation. It has been accepted that the water resources will be managed with policies to be determined on the basis of basins at the level of central authority, as in the EU. Even though the Water Law, which has been worked on for a long time by taking this approach, integrated solutions on a basin basis have begun to be practiced through supporting administrative, legal and institutional (technical commissions, committees, etc.) regulations.

The Water Management Coordination Board was established under the Ministry of Agriculture and Forestry in order to determine the measures required for the protection of water resources in the frame of an integrated basin management approach in Turkey and to ensure high-level coordination

<sup>153</sup> Decree Law No. 658 of 2011 on the Organization and Functions of Turkish Water Institute.

<sup>154</sup> Eleventh Development Plan (2019-2023), Water Resources Management and Security Specialized Commission Report, T.R. Ministry of Development, Ankara, 2018, p: 161.

<sup>155</sup> Presidential Decree, No. 4 (Official Gazette of 15 July 2017 issue 30479).

<sup>156</sup> Wastewater management is further discussed in the "Climate Change Adaptation in Cities" chapter of the report.



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and cooperation between institutions.<sup>157</sup> The Water Management Coordination Board ensures the acceleration of water investments, develops strategies, plans and policies to achieve the objectives set out in national and international documents, and assesses the actions that must be taken by public agencies in the basin plans. A programme of measures for each River Basin Management Plan are submitted to the Board for approval. The Water Management Coordination Board also has provincial organizations; with the renewed institutional building, Provincial Flood Coordination Boards were abolished and replaced with Provincial Water Management Coordination Boards. Since 2015, a provincial structure of basin management has been established in 25 river basins under the coordination of governorships, with Provincial Water Management Coordination Boards and Basin Management Boards in 81 provinces.<sup>158</sup> It is projected that such boards, which were established in 81 provinces with a multi-stakeholder engagement model, will complement the local water resources management structure.

In addition to the Water Management Coordination Board, the Central Basin Management Board also coordinates the activities undertaken in 25 basins and is reported to by the Basin Management Boards.

Some **policy** amendments were recently introduced in Turkey to evaluate and adapt to climate change on water resources, and **strategic plans** were drafted accordingly. In this direction, some past practices such as building various dams, misuse of groundwater, water transfer between basins<sup>159</sup>, and policies to encourage sea water treatment began to be withdrawn (WWF Turkey, 2007).

Water resources were one of the five important areas that were adopted under the “National Climate Change Adaptation Strategy and Action Plan” as a result of the study that was conducted with a participatory approach and supported by technical and scientific studies regarding the most affected sectors by climate change in Turkey. Accordingly, the Plan involved numerous objectives and actions on determining the impacts of climate change on the water sector, elimination of such impacts, and adaptation efforts. The priority subjects determined in the National Climate Change Adaptation Strategy and Action Plan were to develop strategies for adaptation and sustainable water management (surface and ground waters) under water resources management; determining the needs of various sectors (drinking water, industry, irrigation) and ensuring realistic supply/demand balances, ensuring the efficient use of water resources and minimizing the pressures of sudden changes in basins (drought and flood) on water quality, improving dams (drinking water/industrial water supply, irrigation, hydropower, flood control dams), building irrigation and drainage systems, and improving the water supply and treatment plants.

The Plan further highlighted that the adverse impacts of climate change on other sectors could be mitigated, the damages could be minimized, and the favourable opportunities of climate change could be made use of through the water management measures determined for climate change adaptation in water resources management. These subjects were also included in the Climate Change National Action Plan (CCAP).

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<sup>157</sup> The Water Management Coordination Board was established pursuant to the Prime Ministry Circular published in the Official Gazette of 20 March 2012 issue 28239.

<sup>158</sup> Communiqué on the Organization, Functions, Working Principles and Procedures of Basin Management Boards (Official Gazette of 20.05.2015 issue 29361).

<sup>159</sup> The rationality of water transfer practices between basins are still debated. According to one of the approaches in these debates, moving water from one region to another does not increase the quantity of water but only relocates the problem, leading to new environmental and social impacts. Water transfers generally create problems between the relevant regions and countries.





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The National Water Plan, covering 2019-2023, was prepared by the General Directorate of Water Management between 2017-2018.

The policy planning for **basin management** was guided by the “National Basin Management Strategy (2014-2023)” prepared by the Ministry of Agriculture and Forestry in 2014. The priority topics stipulated by the strategy were the conservation, efficiency and saving of water resources in river basins with basin-based management model, supplying water to water users, and planning the investments to be made for water. In this process, based on the need to convert Basin Protection Action Plans into River Basin Management Plans for a more efficient use of water resources, a project titled “Conversion of Basin Protection Action Plans into River Basin Management Plans” was initiated in 2014 and initially, River Basin Management Plans were drafted for Susurluk, Greater Meander, Konya, Meriç-Ergene and Gediz Basins in order to ensure the integration of River Basin Management Plans with high-level plans, followed by the preparation of other river basin management plans within the framework of the programmes determined by using own funds and international funds.

As of 2014, an individual Basin Protection Action Plan (BPAP) and Basin Protection Action Plans and Strategy Booklets” were prepared, and implemented in the same year, for each of the 25 water basins in Turkey.

In order to comply with the EU Water Directive and ensure their integration with other relevant plans by adopting a new management approach in basins, the basin protection action plans were converted into “Basin Management Plans” (river basins, drought, flood management plans, etc.) pursuant to legislative amendments. The “Basin Protection Action Plans” that were prepared constituted a basis for the River Basin Management Plans. In the process of converting Basin Protection Action Plans into River Basin Management Plans, the first River Basin Management Plans were completed for Susurluk, Greater Meander, Konya, and Meriç-Ergene Basins by the end of 2017.

With River Basin Management Plans, the basin-based water bodies were categorized and classified, which they had not been in Basin Protection Action Plans, in line with the EU Water Frame Directive and hydro-morphological pressures were determined through ecologic assessments and biological parameters, and a monitoring method for such parameters are clearly established. The Ministry of Agriculture and Forestry aims to complete the River Basin Management Plans in 25 basins by 2023.

From the perspective of **drought management**, the “National Drought Management Strategy and Action Plan (2017-2023) to minimize the unfavourable impacts of drought in Turkey was published pursuant to the Prime Ministry Circular (Circular No: 2017/19).<sup>160</sup> The Ministry of Agriculture and Forestry has been continuing the preparations of the “Regulation on the Preparation, Implementation and Monitoring of Drought Management Plans”.

The preparations of drought management plans, which addressed the studies involving multiple basin-based measures with an integrated approach within the frame of a plan and a programme, started in 2013 and the Drought Management Plans for Konya and Akarçay Basins were completed in 2015. The “Project for Preparation of Drought Management Plans” to determine the required measures before, during and after droughts in order to mitigate the negative impacts of drought risks are continued by the General Directorate of Water Management of the Ministry. By means of the drought management

<sup>160</sup> Official Gazette of 31.08.2017 issue 30170.



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plans, which are scheduled for completion by 2023 for 25 basins, it is aimed to put a risk-based and holistic management approach in place that addresses the periods before, during and after drought.

From the perspective of **flood management**, Turkey's oldest legislation on flood events is the Law No. 4373 on Protection Against Flood.<sup>161</sup> The Law contains provisions on determining closed areas or areas that can be submerged or flooded by river overflows, and the measures to be taken in such areas.

The purpose of the current Flood and Sediment Control Regulation is to determine the basic hydraulic design criteria for engineering structures designed for flood and sediment control purposes and civil structures, such as bridges and culverts, on rivers; the permission and approval procedures required for the arrangements and other works to be undertaken in riverbeds and adjacent areas; and the interventions to be made and measures to be taken in riverbeds flood control facilities, and issues concerning pre-rehabilitation site delivery.

The legislation on flood management has been in force since 2016. In accordance with the "Regulation on Preparing, Implementing and Monitoring Flood Control Plans"<sup>162</sup>, flood management plans, in which basins are addressed not partially but as a whole, are prepared for all basins across Turkey.

The first Flood Management Plan in Turkey was prepared in 2015 with a two-year project (2013-2015) and covered the entirety of Tokat Province and some parts of the Samsun, Amasya, Çorum, Sivas, Yozgat, Gümüşhane, Giresun, Erzincan, Ordu and Bayburt provinces. "Flood Hazard Maps" demonstrating the geographical area, water level or depth in the event of flood were produced under the Yeşilirmak Basin Flood Management Plan. "Flood Risk Maps" were also produced based on these maps, demonstrating the adverse impacts of flood in the basin, the population likely to be affected by the flood, the nature of economic activities, the facilities that may cause pollution, and potential protected areas. The Yeşilirmak Basin Flood Management Plan also determined construction measures (hard adaptation measures) such as rehabilitating the bridges with inadequate cross sections before, during and after flood and increasing the height of banks to mitigate the flood's impacts on basins as well as other measures (soft adaptation measures) such as flood forecasting and early warning systems, information activities, and evacuation maps; and flood management plans for Antalya, Ceyhan, Sakarya, Susurluk basins were prepared thereafter. The General Directorate of Water Management of the Ministry of Agriculture and Forestry aims to finalize the flood management plans for all 25 basins in the country by the end of 2021.<sup>163</sup>

Pursuant to the *Strategic Environmental Assessment (SEA)* legislation, SEA scoping works are recently approached as part of flood management plans. In flood management plans prepared by the General Directorate of Water Management, the key subjects to be covered by the strategic environmental assessment, which is defined by legislation, in the basin on which works are undertaken are determined as a priority. For example, the East Black Sea Basin Strategic Environmental Assessment Scoping Report was drafted while preparing the Çoruh and East Black Sea Basins Flood Management Plans and its outputs were taken into account in the basin flood plan.<sup>164</sup>

<sup>161</sup> Official Gazette of 21 January 1943 issue 5310.

<sup>162</sup> Official Gazette of 12 May 2016 issue 29710.

<sup>163</sup> Eleventh Development Plan (2019-2023), Water Resources Management and Security Specialized Commission Report, T.R. Ministry of Development, Ankara, 2018, p: 163.

<sup>164</sup> East Black Sea Basin Flood Management Plan Strategic Environmental Assessment (Draft) Scoping Report, Ministry of Agriculture and Forestry, General Directorate of Water Management, June 2019.



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As flood disasters primarily affect spaces and therefore those living in such places/settlements, the relation between flood management and spatial planning processes and practices is of particular importance. Therefore, flood management plans are expected to affect spatial planning decisions in the first place, which comes to mean that the measures/recommendations determined under flood management plans and the associated Strategic Environmental Assessment (SEA) that are/will be prepared should be taken into account in environmental and land development plans. In Turkey, spatial plans are produced by using the environmental plans prepared by the Ministry of Environment and Urbanization and the land development plans prepared by local governments. DSI General Directorate serves as an important investor in flood management both in rural and urban areas, which requires the establishment of continuous and functional cooperation and coordination with the Ministry of Agriculture and Forestry, which is responsible for preparing flood management plans, and its main service units and affiliated entities. Such an atmosphere is important for the management of existing and possible climate change-induced floods and droughts in rural and urban areas.

Basin Flood Management Plans must align with and complement other –prepared, ongoing, and planned– relevant management plans (National Water Plan, National Drought Management Strategy Paper and Action Plan, Basin Protection Action Plans, River Basin Management Plans, Drought Management Plans, Upper Basin Flood Control Action Plans<sup>165</sup>, Water Quality Action Plans, Sensitive Area Project Basin Action Plans<sup>166</sup>, Modelling Strategy and Roadmap Action Plan<sup>167</sup>, Sectoral Water Allocation Action Plans, Drinking Water Conservation Plans). Additionally, it must not be overlooked that the local level strategies, plans, action plans, etc. of local governments of the provinces that are in basin areas can be related to the flood management plan.

Recent flood management plans that have been/being prepared at the provincial level are also on the agenda. For example, Ankara Basin Flood Management Plan (ASKI) was prepared in September 2018 for the province of Ankara; the key purpose of the plan was to establish a structure that focuses on assessing and managing flood risks at the provincial level, mitigate the adverse impacts of floods on human health, environment, cultural heritage and economic activities, and establish coordination among the institutions involved in the basin flood management. In sectoral terms, certain measures such as preventing and reducing flood damages that impact the agriculture sector and rural development and increasing the benefits gained from flood plains were also determined in addition to the measures to be taken in settlements.

In accordance with the legislation, i) General Directorate of Water Management of the Ministry of Agriculture and Forestry is responsible for preparing, monitoring and coordinating the Ankara Basin Flood Management Plan, ii) Basin Management Boards (Provincial and district governors in the Basin

<sup>165</sup> Upper Basin Flood Control Action Plan covers 2013-2017.

<sup>166</sup> Akarçay Basin Management Plan, Antalya Basin Sensitive Water Bodies Recovery Action Plan, West Mediterranean Basin Action Plan, West Black Sea Basin Action Plan, Burdur Basin Sensitive Water Bodies Recovery Action Plan, Greater Meander Basin Action Plan, Ceyhan Basin Sensitive Water Bodies Recovery Action Plan, Doğu Akdeniz Basin Action Plan, Doğu Karadeniz Sensitive Water Bodies Recovery Action Plan, Gediz Basin Sensitive Water Bodies Recovery Action Plan, Kızılırmak Basin Sensitive Water Bodies Recovery Action Plan, Konya Closed Basin Sensitive Water Bodies Recovery Action Plan, North Aegean Basin Sensitive Water Bodies Recovery Action Plan, Little Meander Basin Sensitive Water Bodies Recovery Action Plan, Marmara Basin Action Plan, Sakarya Basin Sensitive Water Bodies Recovery Action Plan, Seyhan Basin Sensitive Water Bodies Recovery Action Plan, Susurluk Basin Sensitive Water Bodies Recovery Action Plan, Lake Van Sensitive Water Bodies Recovery Action Plan, Yeşilirmak Basin Sensitive Water Bodies Recovery Action Plan (Source: Ministry of Agriculture and Rural Affairs, General Directorate of Water Management, <https://www.tarimorman.gov.tr/GDWM/Sayfalar/Detay.aspx?Sayfald=8>).

<sup>167</sup> Prepared in 2014 by the Ministry of Agriculture and Forestry, General Directorate of Water Management, Scientific Working Group for Water Resources Modelling.

(<https://www.tarimorman.gov.tr/GDWM/Belgeler/Modelleme%20Hakk%C4%B1nda%20Strateji%20ve%20Yol%20Haritas%C4%B1.pdf>)



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under the chairmanship of the Basin Coordinating Governor) are responsible for executing and reporting the Plan, and iii) relevant institutions and organizations (regional and provincial Ministerial directorates, municipalities, etc.), to whom the power, duty and responsibility to implement the measures in the Plan were delegated by law, are responsible for implementing the Plan.

From the perspective of **irrigation methods**, the Action Plan for Effective Use of Water in Agriculture was implemented in 2015 in order to seek a solution for the increasing water stress in agriculture due to the anticipated decrease in precipitation as a result of climate change in Turkey. Having an important place among the objectives of the Tenth Development Plan (2014-2018), the Plan is considered to be a significant step to ensure the sustainable management of water resources and economic use of water in agriculture and has the key viewpoint to ensure less utilization of groundwaters and further use of economic irrigation technologies in Turkey. The objectives of the Plan include increasing the rate of irrigation and expanding modern irrigation -digital irrigation methods, etc.- through advanced technologies, rehabilitating the existing irrigation facilities, expanding modern monitoring systems, closing the open irrigation systems, expanding the use of sprinkler and drip irrigation systems, raising the awareness of relevant stakeholders and particularly farmers on efficient use and saving of water, and reviewing the water management and pricing model in Turkey.

In Turkey, most, i.e., approximately 90% of the abstracted fresh water is used by the agriculture sector in Turkey while the rest is mainly intended for public water supply purposes. Agricultural fresh water withdrawal has shown an upward trend in the last twenty years. The uncontrolled use of groundwater for irrigation purposes is known to have increased to the point of necessitating the registration of wells (OECD, 2019).

As a solution to this, drip irrigation practices have had a partial increase throughout the country in the recent years. Drip and sprinkler irrigation systems are the most efficient irrigation systems as they convey the water directly to the roots of the plant, reducing evaporation during irrigation. Therefore, the topic of irrigation systems and their management maintains its importance on the agenda in terms of mitigating the impacts of climate change on water security and adaptation to impacts.

The prominent problems related to water resources management in Turkey in the 'Climate Change and Adaptation Working Group Report' of the Second **Forestry and Water Council** meeting held in 2017 are as follows:

- There are shortcomings in the preparation of drought action plans.
- The evaporation measurements conducted by the GDM should be used in project designs and plans related to water.
- There are current legal problems in transforming the settlements in floodplains.
- There are problems related to expropriation.
- Urbanization has an adverse impact on floodplains.
- River crossings are becoming narrow and river gradients change due to urbanization and reduced green spaces.

At this stage, three fundamental policy areas have been adopted for the rational management of water resources in Turkey:

1. Managing the increasing water demand without increasing water supply



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2. Reducing vulnerability and increasing productivity in all sectors (agricultural irrigation, fishing, urban water loss and theft, unplanned use of wastewater and rainwater)
3. Implementing integrated basin management practices throughout the country.

The implementation of such policies is deemed essential for the water sector's adaptation to climate change.

#### 3.4.3 Work by stakeholders

The "***Impact of climate change on water resources***" project implemented by the Department of Flood and Drought Management under the General Directorate of Water Management of the Ministry of Agriculture and Forestry is the most comprehensive study in this regard. The overall goal of the project was to identify the impacts of climate change on Turkey's surface and groundwaters on a water basin level. The project determined the impacts of climate change on the water resources in all basins across Turkey were determined, paving the way for all institutions and organizations to take long-term measures. The project was started in 2014 and completed in 2016 (T.R. Ministry of Forestry and Water Affairs).

The project's execution area was 25 river basins across Turkey and the projection period was between 2015 and 2100. Under the project, a regional climate model covering Turkey was run by using the outputs of three global models selected from the CMIP5 archive, which is the basis for the 5<sup>th</sup> Assessment Report of the Intergovernmental Climate Change Panel (IPPC), and RCP4.5 and RCP8.5 emission scenarios. Through model simulations, projections were made for 17 climate indices representing a total of 11 parameters and extreme cases across all basins and the variances in the examined parameters until 2100 were calculated as 10- and 30-year seasonal and annual averages, based on the simulations for the period of reference which was taken as 1971-2000. Three global climate model results at a 10x10 km resolution were obtained for Turkey for the first time with this project.

As part of the hydrological projections, which was the second stage of the projection studies, the water potentials of all basins in Turkey were calculated for the first time by using a joint hydrological model. Hydrological models were run by using climate model outputs, converting precipitation values into flow values and modelling/calculating the water potentials by taking into account the existing and projected states of the surface and groundwaters across all basins. As part of the hydrological studies, basin-level aquifer environments were defined in geological and hydro-geological terms and the current groundwater potential was calculated by assessing certain characteristics, i.e., groundwater level observations, details of existing and planned wells, at the basin level. Basin-specific potential groundwater quantities were calculated for the projection period by adding the existing groundwater potential data and the precipitation, evaporation and temperature data, which had changed as a result of the climate change projections. Turkey's static groundwater reserves were calculated for the first time as part of this project, which allowed for predicting the potential changes in the groundwater level by considering the dynamic and static reserves together.

Based on the sectoral (main drinking water, agriculture, industry, ecosystem, tourism and energy sectors) vulnerability analysis results under the project and the on-site determinations made in pilot basins (Greater Meander, Meriç-Ergene and Ceyhan Basins), the vulnerability levels of main sectors were determined for these basins for the next 10-year periods. According to the sectoral vulnerability





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analysis results, drinking and utility water sector reached a considerably high level of vulnerability in all three pilot basins, except for the projection period. Industry and tourism in the Greater Meander Basin, agriculture and textile products sub-sector in the Meriç-Ergene Basin, and energy and ecosystem sectors in the Ceyhan Basin stood out for their high vulnerability levels. With regard to all of the basins, various adaptation activities such as regional rainwater harvesting<sup>168</sup>, water pricing, closed irrigation systems, etc. for drinking and utility water, agriculture and industry sectors were recommended to eliminate the adverse impacts of climate change on water resources. By the end of the project, Susurluk, Greater Meander and Meriç-Ergene Basin Protection Action Plans were converted into River Basin Management Plans.

All results and data (temperature, hydro-meteorological, topographical, etc.) produced under the project were registered into the web-based İklimSu Database equipped with a GIS application, allowing for the sustainability of the project outputs as well as their ability to be used in similar projects. The İklimSu Database is the most actively used database in Turkey in water resources management.

The contributions of the project outputs to the climate change adaptation practices in Turkey are listed below:

- Serving as a base for planning and project design activities such as sectoral water allocation plans, flood and drought plans, environmental plans.
- The GIS-based “Climate Database”, where climate and hydrological projections as well as all collected, used and produced data are entered, will provide public institutions and organizations with data and visual bases.
- Sectors may conduct their own baseline assessments and plan their adaptation activities by using the sectoral vulnerability analysis that was conducted to determine adaptation activities.
- The impacts of climate change on water resources in all basins in Turkey were determined, paving the way for all relevant institutions and organizations to take long-term measures.
- Various projects/plans supporting the project objectives were implemented and implemented under the İklimSu Project. The studies aimed at ensuring climate change adaptation in various basins in Turkey include Burdur Basin River Basin Management Plan, Little Meander Basin River Basin Management Plan, Konya Closed Basin Sectoral Water Allocation Plan, Little Meander and Gediz Basins Water Allocation Plans, West Mediterranean Basin Water Quality Monitoring, Impact of Climate Change on Snowmelts and Flows, Project for Determining and Modelling Reference Points for Monitoring Water Qualities in Kartalkaya Dam Reservoir Basin, Conservation Plan and Special Provision Determination Project for Kurtboğazi, Eğrekkaya and Akyar Catchments, Conservation Plan and Special Provision Determination Project for Çamlıdere and Gerede Işıklı Regulator Drinking Water Basins, and projects for preparing drought management plans.

<sup>168</sup> Regional Water Harvesting: Regional water harvesting is one of the ways to reduce regional water consumption. Water harvesting techniques (micro-basin water harvesting, macro-basin water harvesting, flood harvesting, etc.) have been used for a long time across the world to reduce soil erosion and sedimentation and to increase soil water storage and soil productivity. Water harvesting techniques are applied in cultivated agricultural areas; water harvesting structures can be successfully used to store and make agricultural use of run-offs coming from natural areas and forestlands as well as in building recreation areas such as lakes and lagoons through various open-channel structures within the frame of the suitability of topographical structures and settlements, allowing for substantial savings on regional water consumption.





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A list of nationwide river basin, flood, and drought management plans prepared by the General Directorate of Water Management by the year 2019 was provided in the Seventh National Communication.<sup>169</sup>

The “Project on Application of Total Daily Maximum Load Approach to Gediz River Basin” was implemented by the General Directorate of Water Management between 2015-2017 and the “Project for Preparation of Drought Management Plan of Lake Van” and “Project for Preparation of Drought Management Plan for Antalya and Burdur” between 2016-2018.

The “Project for Potential Measures to Maintain Drinking Water in City Centres in case of Drought” was prepared by the General Directorate of State Hydraulic Works between 2018-2019.

Between 2017-2019, the “Project for Preparation of Drought Management Plan of Seyhan, Ceyhan and Asi Basins” was studied by the General Directorate of Water Management of the Ministry of Agriculture and Forestry<sup>170</sup> in order to prepare drought management plans for Seyhan, Ceyhan and Asi basins, which are among the important regions of the country in terms of energy and agricultural production and predicted to be affected adversely by climate change, starting from 2019. Under the Project, Drought Management Plans for Seyhan and Ceyhan Basins were prepared, after which the measures required before, during and after drought were determined in this framework. The Asi Basin Drought Management Plan established the dry periods of the basin in the past years and the effects of climate change on the drought events in the basin through frequency and trend analyses, followed by the determination of the impacts of drought and climate change on groundwater (Asi Basin is one of the most critical basins in terms of groundwater) and surface water resources as well as the required measures (T.R. Ministry of Agriculture and Forestry, 2019). By the end of the Project, sectoral (drinking-utility, agriculture, energy, industry, tourism, etc.) vulnerability analyses based on the drought analysis that were conducted in Seyhan, Ceyhan and Asi basins, water budget, and the changes in the basin’s surface and groundwater budgets resulting from the potential events of drought were completed and the measures required to mitigate or prevent the impacts of drought and water shortage in basins were determined (T.R. Ministry of Agriculture and Forestry, 2019).

The “Project on Impact of Climate Change on Snowmelts and Flows”, which was completed in 2019 and implemented by the General Directorate of Water Management, aimed to identify the impacts of climate change on snow load and snowmelt in the Upper Euphrates Basins and the consequent changes in the stream flows. As part of the projects, characterization studies for the current snow-covered area and snow cover were conducted and hydrological models were built by using the daily naturalized stream flows and meteorological parameters for the reference period of 1971-2000. Additionally, the climate projections produced in the İklimSu Project were used to make projections for the water equivalent of snow cover for the 2020-2100 projection period based on the increases and decreases in stream flows, periodical shifts and peak flow quantities in accordance with the 2971-2000 reference period. As a result of the project, it was indicated that snowfall was slowly becoming replaced by rainfall due to the temperature increases anticipated in the projection period and therefore the sectors operating in the Upper Euphrates Basin that fed on snow would be affected unfavourably and recommended making plans to ensure climate change adaptation (GDWM, 2019).

<sup>169</sup>“Turkey’s Seventh National Communication”, Ministry of Environment and Urbanization, Chapter 6.3.1 Water Resources, UNDP Turkey, 2018, pp: 198-199 (Turkish version).

<sup>170</sup> Niğde, Kayseri, Osmaniye, Adana, Kahramanmaraş provinces are located on the basins.



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Some projects on ensuring Turkey's adaptation to climate change on water were supported by GEF/SGP, e.g. Planning of Forests for Their Water Function Project (Nature Conservation Centre, 2019); Datça Water and Climate Workshop (DAÇEV, 2019), etc.

In partnership with Bosphorus University, Harran University and the GAP Regional Development Administration of the Ministry of Industry and Technology, the “Digital Cotton Project” for the digitalization of agriculture in Turkey started in June 2020 and aims to implement a smart technology-supported model for agricultural production (Bosphorus University, 2020). The project was designed based on the modelling needs for local and smallholders' access to technology in Turkey. Implemented with public-university-private sector partnership, the project's supporters include Isbank, Vodafone, agriculture technology companies METOS Turkey and tarla.io, Türk Traktör, and Directorate of GAP Agricultural Research Institute of the Ministry of Agriculture and Forestry. As part of the project, the water quantity that used in irrigation is optimized through sensors; the project prescribes the close monitoring of the field through moisture sensors which will automatically activate the drip water system pump, applying the automated digital irrigation method based on the moisture in the soil and ensuring the better growth of plants and mitigation of environmental damage by using less fertilizers by way of technology. According to the results of the project, similar practices will be possible for other products in the region, except for cotton, through such innovative applications. The project will use instant data obtained from the climate station and field sensors; it is aimed to prevent excessive use of water, fertilizer and pesticide by using the software and technology co-developed by expert academics in Harran University and achieving the production of cotton, which is a very important product for the region, in a less environmentally harmful manner that is up to 20% more efficient. The project applications will allow producers to save on inputs in cotton, which is a strategic product for the textile sector in Turkey and therefore the national economy, and prevent producers from using uncontrolled water and more fertilizers and pesticides.

The study titled “Water Is the Next Diamond”, prepared by the Industrial Development Bank of Turkey (TSKB) in 2019 as one of the Economic Research reports, contains current and extensive knowledge on water stress which is one of the most important upcoming threats across the world and in Turkey (Hakyemez, 2019). Serving as a guide for public administration and business community in Turkey, the report also provides a basis for the ongoing efforts by TSKB and Finish Turkey in this area. Within the framework of the Finish Water Index studies, it is planned to digitize the water risk between 2020-2021 in Turkey.

**The goal of the “Capacity Development Project on the Climate Change Vulnerability of the Agriculture Sector in Turkey” which was implemented in 2018 by Ankara University Water Management Institute** was to understand and evaluate the agriculture sector's vulnerability against extreme hydrological conditions and climate change in the West Mediterranean River Basin in Turkey and increase the awareness and capacity of various economic sectors affected by such circumstances. With the contributions of sectoral representatives and stakeholders in Muğla, the climate change vulnerability of water resources in the agriculture sector were determined, publications showing the impacts of climate change on the regionally cultivated agricultural products such as wheat, corn, orange, olives, etc. were issued, and forward-looking measures for regional climate change adaptation were determined throughout the project.

With respect to the monitoring activities of the General Directorate of Water Management, the “EU Project for Capacity Building on Water Quality Monitoring” was implemented in 2014 with



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contributions from the DSI. As part of the project, monitoring plans aligned with the Strategic Environmental Assessment (SEA) were produced by determining the water masses in 6 basins, i.e., Greater Meander, Akçay, Ergene, Susurluk, Sakarya and Konya Closed Basins. In 2015, monitoring plans were created and monitoring efforts initiated for 7 basins, i.e., Yeşilirmak, West Black Sea, West Mediterranean, East Mediterranean, Asi, Seyhan, and Ceyhan Basins. Following such activities, as of 2016, monitoring works have also initiated in 12 basins which are the Marmara, North Aegean, Gediz, Little Meander, Burdur, Antalya, Kızılırmak, East Black Sea, Aras, Çoruh, Euphrates, Tigris and Lake Van Basins.<sup>171</sup>

Within the framework of the Sectoral Water Allocation Planning carried out with the purpose of determining the future water potential and water use changes in the basins in Turkey, the first water allocation plan, targeting the year 2023, was prepared for the Seyhan Basin in 2017. In the “Sectoral Water Allocation Plan for Seyhan Basin” Project, the needs of drinking-utility water, environmental flow, agricultural irrigation, industry and energy sectors were taken into consideration and their social and economic relations were analysed. The Sectoral Water Allocation Plan for Seyhan Basin was prepared at an overall basin as well as a sub-basin scale (Göksu sectoral sub-basin). Having been completed in three main stages, the first stage of the project involved a baseline analysis and the examination of the basin’s water resources potential and sectoral status by taking into consideration the Seyhan Basin Master Plan of the General Directorate of DSI as well as other relevant plans. In the second stage, the basin’s water resources potential, sectoral growth, and sectors’ water demand projections were analysed based on population analyses, water quality assessment, drought analysis, and climatic evaluations. In the third stage, present and future scenarios and the Plan, which included the allocations for each scenario, were prepared on the basis of five main sectors which were drinking-utility, environment, agriculture, energy, and industry. As part of the project, supply planning works were carried out based on demand management, addressing the supply-demand balance of water resources as a whole. Modelling and allocation works for 4 periods covering 2017, 2022, 2027 and 2037 and four different climate conditions, namely normal conditions, mildly arid, semi-arid and extremely arid, for each period were also carried out under the project. In the 16 different scenarios that were produced, the changes in water potential and water use were evaluated in detail by using the *Water Resources Evaluation and Allocation Model*. Water potentials were evaluated for each of the prepared scenarios, the added values of sectors according to the allocated water quantity in each scenario were calculated and economically analysed.

The “Ceylanpınar Region Groundwater Modelling and Preparation of a Management Plan” Project, implemented between 2014-2016 under the responsibility of SUEN, aimed to conduct a physical and mathematical analysis of the present situation of the Ceylanpınar Region’s groundwater body, which is a transborder aquifer system in the Southeast Anatolia Region; evaluate the aquifer parameters and build numerical models through pressure factor analysis; produce forward-looking scenarios; and prepare a water management plan. The project contributed to establishing a foundation for the management of the transborder Ceylanpınar groundwater aquifer system in line with Turkey’s transborder water policies approach.

The “Establishment of a Country-specific Ecological Water Quality Evaluation System” project, implemented by the General Directorate of Water Management of the Ministry of Agriculture and

<sup>171</sup> Eleventh Development Plan (2019-2023), Water Resources Management and Security Specialized Commission Report, T.R. Ministry of Development, Ankara, 2018.



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Forestry between 2014-2016, aimed to work on establishing an evaluation system that is needed to determine water quality in ecological terms and involves biological indexes specific to Turkey and type-specific reference conditions. Handled under the EU Water Frame Directive, the project aimed to build an ecological water quality evaluation system in 8 pilot basins (Lower Euphrates Sub-basin, West Mediterranean Basin, Ceyhan Basin, Aras Basin, East Black Sea Basin, West Black Sea Basin, North Aegean Basin, Sakarya Basin). According to the results of an annual monitoring study to be conducted in the rivers, lakes, crossings and coastal waters in these basins and an inventory study to be conducted in 25 basins, it was planned to establish the frame of the ecological water quality evaluation system to involve biological indexes and reference conditions. The ultimate goal was to implement the said system in 25 basins.

The “Harran Night Irrigation Project”, which was initiated in 2014 by Nature Conservation Centre and Coca-Cola Turkey and supported by Harran University, Adiyaman University and Cullap Irrigation Union, aimed for the further efficient use of water in agriculture. As part of the project, night irrigation practices were carried out in a five-thousand-decare land where fifty farmers had planted cotton, ensuring a significant increase in product yields and savings on water consumption. It was experienced throughout the project that night irrigation increased the intake of water in the soil by plants as well as ensuring the use of less water. In 2018, over two billion litres of water were saved in the cultivated lands. The irrigation process, which took approximately ten hours during the day, was reduced to ten hours and the number of irrigation practices in a season were reduced from thirteen to eight by means of night irrigation. The highest yield increase of 50% was achieved for cotton.

The “Lake-Water” project (1,000 Ponds in 1,000 Days) of the General Directorate of DSI was implemented between 2012-2015. The goal of the project was to ensure a short-term transition to irrigated farming in rural areas outside of the scope of major irrigation projects and to mitigate the impacts of drought in agricultural irrigation. In line with the project goals, it was planned to irrigate, and protect approximately 600 million m<sup>3</sup> of stored water and approximately 1.7 billion decares of agricultural land from flood. By the end of the project, 1,001 ponds and irrigation facilities were made available to the public. The project caused to develop new job opportunities and contributed to the prevention of flood damages and soil erosion, conservation of groundwater, and mitigation of the adverse impacts of climate change. 1,071 artificial lakes were also planned to be completed by 2019 with the Lake-Water Project.

The project titled “Ensuring Adaptation to Climate Change in Ankara-Gölbaşı Region Through Efficient Water Use and Rainwater Harvesting” was implemented in 2012-2013 by **Ankara University Water Management Institute** with the support of UNDP/Every Drop Matters Programme. The aim of the project was to ensure the efficient use of Ankara’s water resources in irrigation and domestic consumption in the qualitatively and quantitatively problematic Gölbaşı region and making use of rainwater through rooftop rainwater harvesting. The project was applied in a 16-decare demonstration area, located in Ankara University Gölbaşı Campus, in Gölbaşı district. An automatic meteorology station was used in the trainings in the area. Rooftop Rainwater Harvesting System was applied in the Little Gardeners School of the University’s horticultural plants department. Furthermore, 400 farmers (including women farmers) from 10 villages in the district and the Gölbaşı Special Environmental Protection Area received training on efficient water use, drip and sprinkler irrigation, and rooftop rainwater harvesting under the project.

As part of the study titled “Climate Change Adaptation/Strategic Steps in Seyhan Basin” prepared for local policy determinations of the “National Climate Change Adaptation Strategy and Action Plan” that



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was completed in 2011, a strategy frame for climate change adaptation in the basin was produced and priority roadmap items were determined for five nested strategic steps, i.e., water resources management, agricultural production and food security, ecosystem services, biodiversity and forestry, natural disaster risk management and human health within the scope of vulnerability assessments in the basin (Talu and Özü, 2011).

The project titled “Adaptation of Forest Ecosystems and Forestry to Climate Change in Seyhan Basin: Ecosystem Services (Social), Biodiversity (Environmental) and Forest Products (Economic)”, implemented in 2010 by the then-Adana Regional Directorate of Forestry and Nature Conservation Centre (NCC) and supported by the United Nations Joint Programme on Enhancing the Capacity of Turkey to Adapt to Climate Change, yielded two outputs: (1) the changes and vulnerabilities in forest ecosystems during climate change were estimated, and (2) climate change adaptation capacity of the forestry sector was enhanced. This project was also a first and a model in Turkey in determining socio-economic demands (poverty, women farmers, forest ecosystems, public health issues) through “community-based” outputs of the projects<sup>172</sup> that had been implemented in that period to ensure adaptation to climate change in the basin.

With the “Turkey’s Future Project” (2010) implemented in cooperation with WWF-Turkey and ETİ Burçak, it was aimed to establish through scientific data and modelling studies the temperature, precipitation and evaporation changes caused by global climate change throughout the country and in Konya Closed Basin and the ways in which the water budget, agricultural production, and product patterns would be consequently affected within this century (covering the period until 2100 and particularly the years 2015, 2030, 2050) (WWF Turkey, 2010). The main purpose of the scientific study on the potential impacts of climate change on Turkey’s water resources and particularly agricultural production was to make the first step towards taking the measures to ensure that our country is affected at a minimum by adverse climate change impacts. Within the framework of the project and as the second step of the Agricultural Water Saving in Konya Basin Project (2008), studies were conducted in the basin and projections were produced for the potential productivity loss in agricultural production due to lack of rainfall and the consequent water shortage, and product pattern changes were identified.

The “Status of Water in Turkey and New Water Management Approaches: Environmental Perspective” study which was prepared in 2014 under the leadership of NCC, YADA Foundation and Business Council for Sustainable Development (BCSD Turkey) discussed various socio-economic factors brought on by global climate change such as drought, difficult access to water and consequently increased food prices, etc. throughout the country (BCSD Turkey, YADA & NCC, 2014). Prepared with the support of the Food and Agriculture Organization of the United Nations (FAO) and the General Directorate of Water Management, the report determined the elements of water resources management, which is deemed by the Turkish business community as a part of sustainable development, and the business community’s vision for water.

Various projects were implemented aiming to ensure the better understanding of the integrated basin management approach implemented by WWF Turkey and implement applicable models. Under the “East Black Sea Integrated Basin Management Project” (2006-2008), a regional collaborative non-

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<sup>172</sup> “Projects Supported Under the United Nations Community-Based Adaptation to Climate Change in the Seyhan River Basin Grants Programme”.



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governmental organization network was established, and a regional *Nature Conservation Plan* was made with the participation of all stakeholders.

Another GEF/SGP funded project serving to ensure climate change adaptation for water resources management and emission reduction is the “Wind Energy Used for Water Pumping and Irrigation in Edirne Kuzucu Village” (2006-2007) implemented by the Kuzucu Village Irrigation Cooperative. Using a wind collector to pump water through a piston pump with the power of wind energy, the project, although implemented in past years, was a model effort to demonstrate the adaptation & mitigation co-benefit and emphasize the importance of solidarity economy stakeholders (irrigation cooperatives).

Efforts for adaptation to climate change in Seyhan Basin have been continued by Çukurova University since 2005, when internationally collaborative extensive studies were also conducted (RIHN, 2007).





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### 3.5 Ecosystem Services, Biodiversity and climate change adaptation

- The climate change in Turkey already has visible impacts on ecosystems and variety of life (biological diversity).
- Nature conservation policies reduce climate adaptation costs.
- Ecosystems play an essential role in adapting to climate change by mitigating the impact of disaster risks (flood, drought, erosion etc.).
- While it is observed in Turkey that nature-based solutions are considered in policies and practices for protecting ecosystems and biodiversity, nature-based solutions must be a priority choice in adapting to climate change.

The most important factors determining the type of ecosystem is temperature and precipitation regime. In this case, changes on climate cause changes on the structure and functions of each ecosystem. Greenhouse gas emissions mitigation and climate change adaptation is possible by protection and improvement of the current situation of forests, wetlands, peatlands, marine, terrestrial and coastal ecosystem, grasslands, agricultural lands and steppes each of which have the feature of carbon capture and store. Salt marshes, mangroves and seagrass beds are also significant carbon stores. Peatlands are the most important terrestrial ecosystems on the world in terms of carbon sequestration.

#### 3.5.1 Impact of climate change on ecosystems

Scientific studies show that meteorological and climatic conditions such as atmospheric instability, rise in temperature, increase in drought, heat wave cause serious increases in the number of forest fires. The studies show that fire seasons will extend and there will be serious increase in the number of forest fires in hot climate conditions in the future. To predict forest fires better beforehand, this situation has revealed the need of better understanding of the fire-climate relationship and developing more reliable models.

Impact of climate change on species and ecosystem has started to be felt more and more. It is estimated that especially the species with restricted habitats and the sensitive ecosystems will be affected considerably by climate change. The protected areas which have biodiversity and are declared for the purpose of protecting sensitive ecosystems and rare species will play an important role as being shelter areas for species in climate change process. Moreover, it has not known yet how changing climates will affect the range of ecosystem in the protected areas. Under climate change, the protected areas become important in the following respects.

Forests are the largest land-borne carbon stores of the world. Even if they grow older, they can keep storing carbon in atmosphere. However, this function of them has being lost in time because of the long term impacts of climate change along with deforestation as a result of land clearing for agriculture. Today, many of these systems are under pressure. In addition to the current protected areas, it is required to increase the number of them and their qualification and reduce the pressure. Otherwise, these areas turn into emission source from carbon store. Small changes which may occur in soil-carbon cycle have the potential to cause serious impact on a global scale (McCarthy et al., 2001). Not only trees but also soil is also very important. Carbon dioxide stored in soil emits into the atmosphere.

The protection of soil ecosystem is important to ensure climate change adaptation. To keep soil alive, it is required natural cycle of soil to protect, its water retention capacity not to decrease and the amount of organic matter in it not to lose. Today, circular economy models are applied in the nature based on high-diversity models whereby the output of a process is an input to another, and such models may serve as climate-friendly solutions that protect the ecosystem through production.



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According to scenarios of climate change in **Turkey**, rising winter temperatures, early spring and drying wetlands can be counted among the first signs of changes which it is foreseen that the climate has affected or will affect. They have already visible impacts on ecosystems and variety of life (biological diversity). These identifications are directly related to the current land degradation at increasing level which will be aggravated by climate change. However, climate change has not been included in regional natural resource management policies and land use practices in all its dimensions. Therefore, the impact of climate change on sink areas and the dimension of threats it creates are not adequately understood.

### 3.5.2 Ecosystems and climate change adaptation

In the United Nations Framework Convention on Climate Change, it is stated that climate change may damage habitats and island states, mountain ecosystems and drylands at risk of desertification are more vulnerable to damaging impacts of climate change. The Convention has also laid down to protect terrestrial and marine ecosystems as approaching them as carbon pool and sink.

In Kyoto Protocol, there are provisions regarding reporting greenhouse gas emissions/retentions as transparent and verifiable which arise from deforestation, afforestation, reforestation and changes in land use.

In Paris Agreement, it is highlighted the importance of securing the integrity of all ecosystems including oceans in combating climate change and the responsibilities are given to countries accordingly.

Although there are generally no direct provisions regarding climate change in laws related to ecosystems, natural assets and biodiversity in Turkish legislation (including the Constitution and international conventions), there are much legislation involving provisions related to climate change adaptation and five basic laws.

Turkey is a party of several international conventions (UN Convention on Biological Diversity, UN Convention to Combat Desertification, Convention on the Conservation of European Wildlife and Natural Habitats/BERN, Convention on Wetlands of International Importance especially as Waterfowl Habitat/RAMSAR and other) related to ecosystems and biodiversity (Tolunay, 2019). Some of these conventions directly and some indirectly are related to biodiversity and ecosystems.

Considering in terms of **legal and institutional regulations**, the relevant laws and institutions in respect of climate change adaptation in sink areas legislation on protection of ecosystems and biodiversity in **Turkey** are assessed below.

**Law No. 6831 of 31.08.1956 on Forests** is an important law in terms of protection of forests and sustainable forest management. Forests which have important function in combating climate change are exposed to interventions frequently for the purposes tourism and energy investments, developing new mine sites, housing and agricultural areas in Turkey.

In accordance with Forest Law, Burning stubble or similar vegetation in places which are four kilometers to forest or in its administrative borders or in villages where there is a forest is forbidden.

Some of the regulations issued based on Forest Law are as follows:

- Regulation on Private Forests and Forests Owned by Public Legal Entities (2016)
- Regulation on Designation and Administration of Preservable Forests (1984)
- Regulation on Designation and Administration of Summer Quarters in State Forests (2013)
- Regulation on Forest Arrangement (2008)
- Implementation Regulation on Forest Cadastre and 2/B (2012)



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- Regulation on Places To Be Removed Off Forest Boundaries By Article 2/A of Forest Law No. 6831 (2007)
- Regulation on Utilization of Trees and Small Trees in Places Not Classified as Forests (2012)

Duties in the context of Forest Law are executed mainly by General Directorate of Forestry (GDF) in the status of “affiliated” agency of Ministry of Agriculture and Forestry. GDF is an institution with special budget and legal entity. There are elements of combating climate change in Strategic Plan of General Directorate of Forestry (2017-2021).

Among the duties of GDF is to combat disasters and fires in respect of climate change adaptation: “Considering its ecological, economic and socio-cultural benefits, to govern forest resources in integrity of ecosystem with plants and animals, to plan as participatory and multi-purpose, to protect against irregular interventions, **natural disasters** and **fires**, to combat and cause to combat miscellaneous damages...”<sup>173</sup>

The provincial organization of GDF has 28 Forestry Regional Directorates and a great number of Forestry Operations Area Directorates and Forestry Operations Precincts which are affiliated to regional directorates. 12 Research Institute Directorates are active under GDF in different regions of the country. 9 of these research institutes were established as representing geographical regions (Western Mediterranean, Western Black Sea, Central Anatolia, East Mediterranean, East Black Sea, Eastern Anatolia, Aegean, Marmara, Southeast Forestry Research Institute), and other 3 of them was established as subject-based (Poplar and Fast Growing Forest Trees; Forest Trees and Seeds Improvement and Forest Soil and Ecology Research Institutes). A part of studies done by forestry research institutes are directly or indirectly related to impact of climate change on forests. For example, the research “Morphological and physiological responses to drought stress of European provenances of Scots pine (*Pinus sylvestris* L.)” made by Research Institute for Forest Trees and Seeds Improvement in 2010-2013 analysed the origin of Scots pine in Turkey in conditions of drought arising from global warming.

Furthermore, it is necessary to state Law No. 4142 of 23.07.1995 on **National Afforestation and Erosion Control Mobilization** which regulates studies on afforestation and erosion control to be conducted for the purposes of increasing forest land and growing stock in state forests and other lands or lake or river sides owned or managed by the state or lands owned by legal persons, establishing and improving the balance among land, water and vegetation which has been deteriorated and preserving environmental values.

Turkey adapted/became a party to “Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)” in 1994. The Convention for the protection of wetlands and its plant and animal community aims to consolidate the coordinated international activities through foresighted national policies.

According to Ramsar Convention, wetlands are defined as swamps, marshes, billabongs, peat bogs-whether natural or artificial, permanent or temporary, still or running, fresh, brackish or salty, all waters. Wetlands covering seas, lakes, rivers and ground waters and coasts and more is significant for balancing climate as reservoirs which accumulate and collect carbon substantially. Wetlands which serve as preventive against natural disasters by organising water regime store the water when precipitation is excessive and reduce the impact of floods; become a solution for drought and water scarcity by releasing the water when precipitation is rare; prevent inflow of sea water on the coast; protect the coastline. Wetlands, which are ecosystems allowing characteristic plant and animal community, especially waterfowl, to shelter and producing high organic matter, have important

<sup>173</sup>Presidential Decree No. 4 (Official Gazette of 15 July 2018 issue 30479).



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function in protection of biodiversity. Alongside being water resource of drinking, using and watering, wetlands have a high economic value due to the opportunities they provide for fishing, agriculture, livestock breeding and recreational activities.

**Regulation on Conservation of Wetlands** issued firstly in 2002, renewed under the same title in 2005 and finally in 2014. The management of wetlands is subject to duties and powers of Ministry of Environment and Urbanisation-General Directorate for Conservation of Cultural Assets; Ministry of Agriculture and Forestry, General Directorate of Water Management; General Directorate for Nature Conservation and National Parks and General Directorate of State Hydraulic Works. The objective of Regulation on Conservation of Wetlands published on Official Gazette of 04.04.2014 issue 28962 based on Environmental Law No. 2872 of 09.08.1983 is to determine the principles of protection and wise use, management and development of wetlands and related habitats.

In Turkey, there are 135 wetlands of international importance and 14 of them are in the list of Ramsar. Especially, the coastal wetlands are the most important of ecosystems which are most affected from climate change. Wetlands, which are rich in diversity such as the Greater Menderes Delta, Yumurtalik Lagoon, Göksu Delta, are more vulnerable to drought risk because they are the coastal wetlands.

Law No. 2873 of 09.08.1983 on **National Parks** aims to designate and protect national parks, nature parks, natural monuments, and nature reserve areas. That the areas, which the Law protects, functions as the sink is important in terms of combating climate change.

**Regulation on National Parks** (1986) covers the acts and actions regarding separation, planning, development, protection, management and promotion of national parks, nature parks, nature monuments, nature reserve areas and resting areas in forests.

**Regulation on Principles and Procedures of Designation, Registration and Approval of Protected Areas** (2012) specifies the principles and procedures for registration, approval and declaration of national parks, nature parks, nature monuments, nature reserve areas and wetlands and for designation, registration, approval, amendment and announcement of natural assets, natural protected areas and environment protection areas.

Natural assets under Law No. 2863 of 21.07.1983 on **Conservation of Cultural and Natural Assets** are exceptional places and assets in protected areas, reserve areas and natural protected areas, wetlands and natural characteristics of which are required to protect. In this respect, the Law is important as a climate-friendly legislation to the extent it can be enforced effectively in line with its purpose. In the Law, it is prescribed to do conservation development plan and management plan for areas to be protected; principles and procedures regarding protection and use of these areas are specified.

The Law is prescribed that High Council of Conservation of Cultural Assets affiliated to Ministry of Culture and Tourism and Regional Board of Conservation of Cultural Assets in the regions determined are established to conduct the services regarding immovable cultural assets to be protected scientifically. The relevant unit of the Ministry is General Directorate of Cultural Assets and Museums.

The authorised and mandated ministry regarding natural assets, natural protected areas and protected areas related to these places except for movable natural assets is Ministry of Environment and Urbanisation. Establishing Central Commission for Conservation of Cultural Assets under the Ministry and Regional Board for Conservation of Cultural Assets in province is implied in this Law.

Some of the regulations issued based on Law on Protection of Cultural and Natural Assets are as follows:

- Regulation on Replacement of Immovables subject to Ban for Construction in Natural Assets, Natural Protected Areas and Special Environment Protection Areas with Treasury Immovables (2013)



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- Regulation on Plans for Protected Areas (2012)
- Regulation on Establishment and Working Principles and Procedures of Commission For Protection of Natural Assets (2011)
- Regulation on Administration of Places Under Ownership and Control of the State in Natural Assets, Natural Protected Areas and Special Environment Protection Areas (2013).

The Management of national parks, nature parks, nature monuments and nature reserve areas is subject to duties and powers of the **Ministry of Environment and Urbanisation, General Directorate for Conservation of Natural Assets**, Ministry of Agriculture and Forestry, and General Directorate for Nature Conservation and National Parks.

The duties and powers of **General Directorate for Conservation of Natural Assets** by Presidential Decree No. 1 on Organisation of Presidential Office published in the Official Gazette of 10.07.2018 issue 30474 are declared as follows:

*“To take the policy decisions regarding the use and construction of national parks, natural parks, natural monuments, nature protection areas, natural protected areas, wetlands, special environmental protection zones and other areas with similar protection status, and environmental order in all types and scales, and also to undertake, draw up, change, approve, apply or implement the same accordingly,*

*Regarding natural assets and natural protected areas and special environmental protection zones, to have the existing maps obtained, to implement the necessary projects, to put them in practice and to approve the same, to implement all kinds of research and examinations, to have them fulfilled accordingly, to monitor them, to implement educational and awareness-raising studies, to ensure that the areas where the usage is banned are expropriated or similar means, to control and audit, to invest in the protection of areas and to prevent pollution, or to support the investment projects of the relevant administrations...”*

The duties of the **General Directorate of Nature Conservation and National Parks** which is main service unit of the Ministry of Agriculture and Forestry include the determination of national parks, nature parks, natural monuments, nature reserve areas and wetlands and the protection, development and management of those registered by the Ministry of Environment and Urbanization; studies related to the protection and development of areas concerning wildlife, forest water resources, streams, lakes, ponds and wetlands and sensitive areas, and areas and plant and animal species protected by international conventions; registration and announcement of nature parks, natural monuments and nature reserve areas, wetlands and other similar protected areas in forests and places subject to forest regimes.

Law No. 3621 of 04.04.1990 on **Coastal Protection** has been enacted to determine the utilization and protection principles of sea coasts, natural and artificial lake and river banks and the coastal stripes effected from, and as continuation of, those locations by considering the natural and cultural features and towards the benefits of the society and for public good. According to this Law, where public good necessitates and with the resolution of the application structure plan, lands can be acquired through filling and desiccation by considering the ecological features of seas, lakes and rivers.

With the amendment on Coastal Law by Law No. 7153 of 29.11.2018, it has been enabled to construct renewable power plants on the areas that are announced as renewable power plant area by Ministry of Energy and Natural Resources by the decision of the development plan on seas.

Law No. 3402 of 21.06.1987 on **Cadastre** aims to determine the legal status of immovable properties by setting their boundaries on the land and map. The importance of Cadastre Law in terms of climate change relates to especially forest cadastre, soil and water resources management and land use planning. Cadastre Law is important for protection and development of forests which are main carbon





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sinks. It is required to delineate the boundaries of forest for sustainable forest management. This is only possible with the forest cadastre. Even if the forest cadastre is carried out in accordance with Cadastre Law, with the amendments on Cadastre Law and Forest Law, in cases where there is a forest without cadastre in the areas in which cadastral work is carried out, it has been regulated to conduct the forest cadastre in accordance with Cadastre Law. The tasks under Cadastre Law are performed by Directorate of Land Records and Cadastre affiliated to the Ministry of Environment and Urbanisation.

In Article 3 of Environmental Law No. 2872, general principles regarding protection and improvement of environment and prevention of environmental pollution are listed. The prominent ones in the context of climate change adaptation among these principles are as follows:

- Observing the sustainable development principle in land and resource utilization
- Evaluating the benefit of economic activities and their impact on natural resources as long term in the framework of the sustainable development principle
- In any kind of activity, for the purpose of efficient utilization of natural resources and energy, using environment friendly technologies which ensure the reduction of waste generation and waste recovery at source

In Article 18 “Collecting environmental contribution, other revenues and budget appropriation” of the Environmental Law; studies on combating desertification and climate change are considered among studies to be prescribed appropriation in the budget of the Ministry.

In the amendment by Law No. 7153, with the provision laid down in Article 24 regarding authority for administrative fines, it has been clarified that the Ministry of Agriculture and Forestry will impose sanctions on those who destroy biodiversity and who act in contravention of procedure and principles of protection and utilization of wetlands.

In Article 8 “Practices on Acquisition of Land” of Law No. 5346 on Utilization Of Renewable Energy Sources For The Purpose Of Generating Electrical Energy, it has been regulated that immovables with the nature of forest will be permitted and utilized for energy transmission line up to the facilities, transportation roads and network connection point for the purpose of generating electrical energy from renewable energy resources. It is stated in the article that it will be permitted to establish power generation plants based on renewable energy resources provided that affirmative opinion of the relevant Ministry in national parks, nature parks, nature monuments and nature reserve areas, protection forests, wildlife improvement areas, special environmental protection areas and of the relevant regional conservation board in natural protected areas is received (Kocaman and Talu, 2019).

The **National Biodiversity Coordination Board** created in August 2019 was designated in the context of Term Presidency of Convention on Biological Diversity by the President of the Republic.<sup>174</sup> According to Presidential Circular, the National Biodiversity Coordination Board will be assigned to execute Biological Diversity Conference effectively which will be held in the last quarter of 2022 and where Turkey will be host with title of Presidency of Convention on Biological Diversity it will undertake in 2022-2024. The secretariat services and coordination works of the Board will be executed by the Ministry of Agriculture and Forestry. The Board consists of high-ranking representatives who are authorised to decide on behalf of Presidential Science, Technology and Innovation Policies Board, Presidency of Strategy and Budget, Ministry of Agriculture and Forestry, Ministry of Environment and Urbanisation, Ministry of Foreign Affairs, Ministry of Energy and Natural Resources, Ministry of the Interior, Ministry of Culture and Tourism, Ministry of National Education, Ministry of Health, Ministry of Industry and Technology, Ministry of Trade, Ministry of Transport and Infrastructure, Scientific and

<sup>174</sup> Presidential Decree No.2019/15 (Official Gazette of 02 August 2019 issue 30850).





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Technological Research Council of Turkey, Union of Chambers and Commodity Exchanges of Turkey, Foreign Economic Relations Board, Turkish Union of Chambers of Engineers and Architects, and Chamber of Forest Engineers.

Considering in terms of **development policies and strategic planning**; as one of the goals of Eleventh Development Plan (p.714), for the purpose of strengthening climate risk resilience of the economy and society by ensuring capacity building for climate change adaptation, one of the policy measures specified in the Presidential Annual Program 2020 relates to protected areas and demonstrates in Table 17:

Table17. Climate change adaptation and protected areas

Policy/Measure	Responsible/ Cooperating Institutions	Activities and Projects To Be Undertaken
<b>Measure 714.2.</b> Planning, implementation and capacity building activities including national and regional adaptation strategies for increasing adaptation capacity to negative impacts of climate change will be undertaken.	Ministry of Environment and Urbanisation (S), Climate Change and Air Management Coordination Board, Local Authorities	Activities for the detection of negative impacts of climate change in protected areas and the development of national and regional strategies to increasing the capacity climate change adaptation will be initiated.

The climate change adaptation goals laid down regarding the conversation of nature in NCCS are explained below and may be summarized as follows:

- To accelerate the prevention of forest fires which will increase due to the negative impacts of climate changes, protection of sink areas decreasing due to deforestation, protection and development of natural forests, and reforestation activities
- To take efficient measures against insects, fungi and similar pests which are possible to increase in forestlands
- To continue the development of scientific studies related to the sustainable use of natural resources
- To identify the impacts of climate change on water resources (in terms of quantity and quality) and to develop implementation proposals for adaptation of sensitive areas
- To identify the negative impacts of climate change which are possible to occur on sensitive ecosystems, urban biotopes and biodiversity and to conduct their vulnerability assessments and to take measures for protection of them
- To accelerate the studies for development of varieties and species of plant and animal which are resistant to heat, drought, diseases and pests
- To identify the varieties which are high drought tolerant of grains and to ensure their seed production (MoEU, 2012).



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CCAP has been prepared in line with the objectives of NCCS and covers the matters specified above generally. In CCAP, there are also the objectives to identify and monitor the impacts of climate change on the species in general.

The prominent objectives of Turkey's National Climate Change Adaptation Strategy and Action Plan are as follows;

- i) to integrate and extend climate change adaptation into the current plan in the selected or priority protected areas
- ii) to prepare the regional strategy and plans according to the characteristics of regions on climate change adaptation in the protected areas.

The **“Protected Areas and Turkey National Climate Change Strategy (2010-2012)”** which is the first national strategy **in respect of the subject** identifies the risk management in global climate change and the necessary activities the objectives desired to achieve in Turkey. It is aimed that the Strategy prepared in cooperation with the Ministry of Forestry and Water Affairs, United Nations Development Programme (UNDP) Turkey Office and WWF-Turkey will be a guide in the adaptation process to mitigation and effects of climate change. This strategy has been prepared under “Strengthening Management of Forest Protected Areas Project” supported by Global Environment Facility (GEF) which is implemented in cooperation of the Ministry of Forestry and Water Affairs, UNDP Turkey and WWF-Turkey. The important priorities of this strategy has been in National Action Plan for Climate Change. In the strategy, there are a range of objectives to include the impacts of climate change on planning and management of the protected area into the protected areas system in Turkey. The prominent objectives in **The Protected Areas and Turkey National Climate Change Strategy** are as follows:

- To include climate change into the works (works such as gap analysis, Key Biodiversity Areas (KBA), Important Bird Areas (IBA), Important Plant Areas, Pan European Green Corridor Network) implemented to specify priority areas in terms of nature conservation
- To evaluate the management effectiveness of the protected areas in the framework of climate change
- To prepare sample of climate change adaptation plan in the protected areas
- To ensure that climate change is included in economic assessment studies of the protected areas
- To prepare plans of the protected areas without a management plan and to ensure that climate change included in this process
- To specify parameters and dynamics of the relevant ecosystems (physical, chemical and biological conditions, including combined dynamics) to create necessary templates for the management plans in the protected areas and to monitor their change in the process of climate change
- To include adaptation measures into climate change in planning, management and implementation activities.

The document of **Lakes and Wetlands Action Plan (2017-2023)** has been prepared in coordination of the then Ministry Of Forestry And Water Affairs and General Directorate of State Hydraulic Works. Considering in terms of the impacts of climate change on the lake ecosystem in Turkey, the changes in Lake Van mentioned in scientific studies currently may be an example. In Lake Van level of which changes periodically depending on climate change and weather conditions, water loss has been experienced at significant level in recent years. In the coastal area of Lake Van in Edremit district, there has been horizontal retreat over 200 meters in September 2020. It is stated that this problem in Lake Van does not relate to reduction in precipitation or its main reason of retreat in Lake Van is not low



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precipitation, but excessive evaporation. In the region where the lake water has retreated, flamingos and tens of different migratory bird species come to the land arisen and accommodate (NTV, 2019).

“National Biological Diversity Strategy and Action Plan” which is other relevant documents of strategic planning was prepared in 2007. The strategies and actions plans based on the subject and/or regions are prepared as outputs of some projects in Turkey. For example: Şanlıurfa Steppe Conservation Strategy and Action Plans; The Impacts of Climate Change on Ankara and Habitats with Endemic Species and Adaptation Action Plan.<sup>175</sup>

Nature-Based Solutions to Climate Change Adaptation- The ecosystem approach encourages the conservation of the nature and its sustainable utilization and accepts that natural resources and people with cultural diversity are an inseparable part of the ecosystem. Therefore, it is important to understand function and services of the ecosystem. Ecosystem services are contributions or benefits people obtain from ecosystems. Studies to evaluate these services has been continuing since 1970s.

The importance of conservation of ecosystems and biodiversity for adaptation to the impacts of climate change is known enough. The benefits ecosystems provide to the humanity are not only evaluated in a wide range, but also are related to adaptation directly with carbon sequestration (sequestration potential of the soil), microclimate regulation, retaining precipitation water, water decontamination, water production, water regime regulation. Ecosystems play a fundamental role in adaptation to the impacts of climate change by reducing disaster risks (flood, drought, erosion etc.).

Nature-based solutions underlie in reflecting ecosystem services to all planning processes (development planning, managerial planning, spatial planning etc.) (EEA).

Nature-based solutions is a concept that gathers together the current various approaches such as Ecological restoration, ecological engineering, green infrastructure, ecosystem-based management, forest landscape restoration, ecosystem-based adaptation, ecosystem-based impact mitigation and reduction of ecosystem-based disaster.

Giving that climate change not only affects ecosystems, but also economies and societies, “Nature-Based Solutions (NBS)” are considered as a key approach. However, the call to invest in this field by turning towards the nature-based solutions and to give importance to the role of ecosystems in combating climate change has been continuing at international level for over ten years. Policies encouraging solutions provided by the nature in the contribution to climate change and disaster risk reduction related to it has been on the agenda for a long time (Tolunay, 2019).

While nature-based solutions provide benefits for biodiversity and human welfare, they also provide important opportunities to respond to difficulties of climate change. At the same time, they represent an alternative that is economically viable and sustainable, lower cost than investments in the long term or in respect of creating infrastructure. It is important to integrate nature-based solutions to climate change adaptation strategies from this respect.

Paris Agreement also has accepted clearly the role of forests, oceans and other natural ecosystems in absorbing carbon emissions and ensuring support for climate change adaptation. The Agreement also reveals once more the importance of protecting all ecosystem integrity and conserving the biodiversity while combating climate change.

IPPC and IPBES<sup>176</sup> reports support to implement ambitious actions for combating climate change and biodiversity loss. The IPCC Fifth Assessment Report included the nature-based solutions as one of the

<sup>175</sup> It is a project which was funded by Ankara Development Agency and implemented by Ankara Branch, 9th Regional Directorate of the now-defunct Ministry of Forestry and Water Affairs, and lasted for 3 months. The Project contributed to the measures to be required to take against the impacts of climate change and to overcome the related deficiencies in Ankara.

<sup>176</sup> Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.



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adaptation options. While the Report highlights that nature-based solutions are essential for the role of protected and functional ecosystems, mitigation of the impacts of climate change and adaptation, disaster risk reduction and conservation of biodiversity, it emphasizes that investment in the Nature-Based Solutions provide important opportunities to achieve these objectives. It requires to integrate the nature-based solutions into climate change and action plans at all levels from global level to local level. Policy planning steps for this purpose may be listed as follows:

- Each nation must unite the nature-based solutions that are in the plans of climate change and disaster risk reduction and in INDC document.
- Local authorities must integrate and support the nature-based solutions in the framework of the local climate plans and the documents of land use plans.
- In the innovative entrepreneurship works of private sector, there must be the nature-based solutions and they must be developed.
- Civil society organizations and nature conservation centres/ institute must support to implement the nature-based solutions at regional and local levels.
- Decision makers must ensure to actualize, invest in and encourage functional and proactive policies for promotion of the nature-based solutions nationwide.

It is considered that investing in natural capital expands options related to economic growth and sustainable development while supporting a wide range of economic sectors. For example, these investments may be a cost-effective measure for combating climate change, offer value for money, support local economies; create job opportunities and maintain ecosystem benefits for the long term (TEEB, 2009). The ecosystem-based adaptation is explained in Box 1.

### Box 1. Ecosystem-based Adaptation Approach

In project designs, an ecosystem-based adaptation which uses biodiversity and ecosystem services in a general adaptation strategy can be used. This approach involves the sustainable management, conservation and restoration of ecosystem to provide services which will help people for adaptation to the negative impacts of climate change. Examples for activities of ecosystem-based adaptation: coastal defence through maintenance and/or restoration of mangroves and other coastal wetlands to reduce the coastal flood and erosion; sustainable management of floods for maintenance of flow and quality water; conversation and restoration of forests to stabilise land slopes and regulation of water levels; establishment of diverse agro-forestry systems to cope with increased risk from changed climatic conditions and conservation of agro-biodiversity to provide specific gene pools for crop and livestock adaptation to climate change.

The importance of healthy biodiversity and ecosystem in primary production fields such as Agriculture, forestry and aquaculture has been long known. However, much more economic sectors are dependent on natural capital (CBD, 2016). Natural capital also contributes to manufacturing and service economy. Biodiversity provide protection against disasters and reduce risk regarding food security and health. Managing natural capital well needs to identify availability, namely condition of ecosystems. Decision making processes in the framework of narrow GDP concept may cause not to understand the importance of ecosystem services enough (UNEP, 2009).

The first formal decision on inclusion of ecosystem-based adaptation approach in states' national adaptation planning and development plans at international level is the meeting conclusions of the UNFCCC Subsidiary Body for Scientific and Technological Advice in 2017.



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When examined the report “Nature-based Solutions for Climate Change Adaptation & Disaster Risk Reduction” published in 2019 by French National Committee of International Union for Conservation of Nature (IUCN), it is seen that it provides comprehensive overview on the concept of nature-based solutions and its importance in climate change adaptation. In the report, the boundaries and intersections between the concepts (including Ecosystem-Based Adaptation, Ecosystem-Based Impact Mitigation, Ecosystem-Based Risk Reduction) related to the concept of “Nature-Based Solutions” are described and the related definitions are provided. Moreover, the report implies the intersecting points of the nature-based solutions with policies and focuses on opportunities to scale up in practices. The report defines the following three main factors to increase implementation of the nature-based solutions aiming to guide decision makers and other stakeholder on climate change adaptation:

- Existing projects must highlight the benefits for climate change adaptation of Nature-based Solutions in order to raise the awareness of stakeholders.
- Nature-based Solutions are interdisciplinary. Adaptation to climate change, disaster risk prevention and biodiversity issues are often addressed in the same project.
- Due to the long-term nature of projects addressing climate change adaptation, various financial resources must be mobilised. The goal is to guarantee the sustainability of the projects focused on Nature-based Solution.

The report assesses that that nature-based solutions can respond to important problems such as human health, food security, water security, or sustainable socio-economic development. Today, investing in nature capital is a strategic approach for climate change adaptation. Assessing and reviewing nature (natural) capital are adopted as implementation supporting tools to ensure the UN 2030 Agenda for Sustainable Development Goals (SDG). In the Eleventh Development Plan, Turkey has followed a long term vision in line with UN 2030 Agenda and SDGs. When considered from this aspect, the approach of assessing and reviewing nature capital is important for climate change adaptation and facilitation to achieve SDGs at national level.

It is observed that the nature-based solutions have been taken into consideration in policies and implementation related to the conservation of ecosystems and biodiversity in which progress has been made at a certain level in Turkey. In the context of sustainable forest management approaches in Turkey, there is Communique on Principles and Procedures for Regulation of Ecosystem-Based Functional Forest Arrangement Plans regarding how to execute “Determination of Carbon Balance Sheet in Forests” for ecosystem-based solutions. The General Directorate of Forestry has explained in detail which method will be used for determination of the current carbon amount in forests by the Communique issued on December 10, 2014. Thus, the forest carbon stock is determined and the condition of carbon accumulated in forests is revealed.

*Sink Areas of Turkey, LULUCF<sup>177</sup> and Adaptation - Adaptation action to impacts of climate change in Turkey must be supported by increase in sink areas, prevention of land degradation, and sustainable management policies and implementation of forest. In this framework, activities of Land Use, Land-Use Change and Forestry (LULUCF) Sector must be monitored closely. In Turkey, the progress has been made in expanding forest cover that is an important sink for carbon dioxide emissions by National Forestation Mobilization.*

*Turkey National Forestry Programme (2004-2023) is a comprehensive policy for forestry sector, but a special measure related to climate change adaptation is not mentioned in the Programme. Combating*

<sup>177</sup> Atmospheric CO<sub>2</sub> can accumulate as carbon in vegetation and soils in terrestrial ecosystems. Under the United Nations Framework Convention on Climate Change any process, activity or mechanism which removes a greenhouse gas from the atmosphere is referred to as a "sink". Human activities impact terrestrial sinks, through land use, land-use change and forestry (LULUCF) activities, consequently, the exchange of CO<sub>2</sub> (carbon cycle) between the terrestrial biosphere system and the atmosphere is altered (Source: <https://unfccc.int/topics/land-use/workstreams/land-use--land-use-change-and-forestry-lulucf>)





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climate change has taken place in Strategic Plan (2017-2021) under the General Directorate of Forestry. Turkey has set a number of objectives related to land degradation balancing in United Nations Convention to Combat Desertification National Report (2016-2030) and works in this field have included objectives to prevent climate change. Thus, Turkey has taken the first steps to scale up climate change adaptation activities in LULUCF sector (OECD, 2019). Works in this field will contribute to mitigate the impacts of climate change as well as allow to reach the relevant SDGs related to desertification, degraded lands and soils.

Ecosystem services and mitigation & adaptation contradictions- “Carbon sequestration, microclimate regulation and water cleansing services are regulating services; water production is provisioning service (England et al., 2017). When the subject is addressed in the context of combating climate change, carbon sequestration service is in the context of mitigation and water production is in the context of adaptation. Carbon sequestration services provided by ecosystems or, in limited scope, forests are linked to other services. This linkage may be either coherent or contradictory. Hence, other services must not be ignored while aiming maximum carbon sequestration in a carbon project. For example, if a conservation-oriented approach is adapted in carbon storage, this situation may conflict with water efficiency. Since the purpose of conservation oriented carbon sequestration is to achieve the highest biomass per unit area, keeping administration period long and maximize the biomass. While such a forest management approach shows parallelism with soil conservation and flood prevention services, it conflicts with water production to some extent since it requires to keep interception (evaporation from plant surface) and transpiration (plant sweating) at minimum, namely to open out a forest so that a forest ecosystem may produce at high level (Serengil et al.,2007). On the other hand, opening out forest ecosystem for water production is a risky implementation. Because if dead vegetation and trees left from opening out are damaged, erosion risk may occur. In the cutting implementation which is not proper for its technical or where dead vegetation is ignored, forest floor, that is dead vegetation, living vegetation and soil are damaged seriously” (Serengil et al., 2018).

### 3.5.3 Work by Stakeholders

The Ministry of Agriculture and Forestry aims to create biodiversity map of Turkey through “National Biodiversity Inventory and Monitoring Project” conducted by General Directorate for Nature Conservation and National Parks since 2013. The works has been conducted based on province at three level; species-population, habitat-ecosystem and regional. Storage of biodiversity data to be received from all provinces has been planned under the Project and approximately 1 million 800 thousands data in 73 provinces has been stored as of 2019 (Duran, 2019). At the end of the Project, “Biodiversity Map of Turkey” will be prepared.

“Conservation and Sustainable Management of Turkey's Steppe Ecosystems” Project is conducted by Food and Agriculture Organization of the United Nations (FAO), General Directorate for Nature Conservation and National Parks under Ministry of Agriculture and Forestry (MoAF), General Directorate of Plant Production and General Directorate of Forestry with financial support of Global Environment Facility (GEF). In the context of this Project, “2018 Ecosystem-Based Adaptation Strategy” has been prepared (Erdogan, 2018).

The Project “Water management modelling of Kızılırmak Delta Project within the scope of Samsun’s Adaptation Process to Climate Change” was worked on during 2018 in the context of “Enhancing Required Joint Efforts on Climate Action Project/IklimIN Project” supported by UN grant funds. The Project was implemented by Samsun Metropolitan Municipality; and Ondokuz Mayıs University, Samsun Provincial Directorates of Environment and Urbanisation, Agriculture and Forestry and National Education and Samsun Kızılırmak Delta Protection and Development Association participated in the works. In the context of the Project, 'Water Footprint' of the Delta was measured and activities





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to build institutional capacities of particularly Samsun Metropolitan Municipality and other local stakeholders were undertaken.

“Promotion and Protection of Central Anatolia Region's Forest residues” Project implemented by Rural Environment and Forestry Problems Research Association with support of UNDP/GEF/SGP and the General Directorate of Forestry in 2016-2018 covered Ankara, Çankırı, Kırıkkale, Kırşehir and Konya. In the Project, the activities to create awareness regarding the concept of forest residue (forest residue, forest leftover, relic forest, fossil forest, fragmented forest ecosystem etc.) was undertaken. In the project, forest arrangement plans were examined in the selected regions and regions which could be evaluated as “forest residue” were detected through map and satellite images. Structural and ecological features of 44 forest residues detected, forest residue-human relationships and factors threatening the forest residues were specified and proposed solutions were submitted (Rural Environment).

The project “Development Of A Software For Climate Change Ecosystem Services to Support Sustainable Land Planning Works” was implemented with support of TUBITAK in 2016.

The project “Integrated Approach to Management of Forests in Turkey, with Demonstration in High Conservation Value Forests in the Mediterranean Region of Turkey” was implemented with the support of GEF/UNDP in 2013-2020. Executing entity of the project which is multi-stakeholder is the General Directorate of Forestry under the Ministry of Agriculture and Forestry. Other stakeholders are TMMOB Chamber of Forest Engineers<sup>178</sup>, the Central Union of Turkish Forestry Cooperatives<sup>179</sup>, Nature Conservation Centre<sup>180</sup>, WWF Turkey<sup>181</sup>, GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH/ German Society for International Cooperation)<sup>182</sup> and Gold Standard<sup>183</sup>. The Project was implemented in 5 forest areas (over a total area of 450,000 ha) in the Mediterranean. The main aim of the Project is to demonstrate multiple environmental and socio-economic benefits in high conservation value forests in the Mediterranean forest region through promoting an integrated approach to management of forests in Turkey. The focal areas of the Project were specified as climate change, biodiversity and sustainable forest management and the activities related to climate change focused on emission mitigation/carbon sequestration. The activities undertaken for the purpose of sustainable forest management and biodiversity conservation in the Mediterranean Region comply with the principles of climate change adaptation. A range of benefits such as integrated forest management and adaptation to the impacts of climate change as well as water quality improvement, biodiversity conservation, combating pests and diseases, contribution to the regional economy, employment and tourism opportunities are able to be provided.

The “Climate Change Adaptation for the Sea and Coasts of Antalya” Project was worked in 2017-2018 in the context of “Enhancing Required Joint Efforts on Climate Action Project/IklimIN Project” supported by UN grant funds. In the Project where the grant beneficiary was Antalya Metropolitan Municipality and the grant co-beneficiary was Turkish Marine Research Foundation (TÜDAV), the

<sup>178</sup> It was responsible for capacity building activities.

<sup>179</sup> It was active on implementation of activities related to forest villagers. The Union's local branches played a vital role for encouraging engagement of local communities and women during activities where forest villagers needed to be a part of decisions to be taken and/or implementation to be carried out such as designation of Protected Forests and integration of biodiversity into the forest management plans.

<sup>180</sup> It was responsible for biodiversity conservation, protection forest management, integration of climate change scenarios on forest arrangement plans and social development activities of the Project.

<sup>181</sup> It, through its global network, brought in know-how, technical experience and innovative approaches on sustainable forest management, forest and climate change related issues.

<sup>182</sup> It is a supporting institution to improve existing regional cooperation focused on 'Forests and Climate change', and to support capacity enhancement activities at national and regional level.

<sup>183</sup> It took place in detailing the MRV (Monitoring, Reporting and Verification) to be prepared under the activities undertaken at five pilot sites in the mechanism of income sharing and carbon projects, and in works related to carbon. In this framework, it prepared MRV document for forestry sector on the area selected in the project.



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impacts of climate change on marine ecosystem in Antalya was worked and proposals regarding preparation of risk management strategy against climate change in some sectoral fields (tourism, fishery, biodiversity) of Antalya in this framework were prepared. Furthermore, various awareness and capacity building activities were undertaken during the Project.

The Endangered Landscape Programme which has been launched in April 2019 and will continue until 2024 aims to restore more than 500 km of coast lines between Muğla and Antalya and to take protection measures against the impacts of climate change. The Endangered Landscape Programme is conducted under the lead of Mediterranean Conservation Society, in cooperation of Fauna & Flora International organisation, in coordination of the Ministry of Agriculture and Forestry, the Ministry of Environment and Urbanisation, the Turkish Coast Guard Command and Ege University. The Programme has been created with the financial support of Cambridge Conservation Initiative under Arcadia Fonuue Cambridge University. Research and activities for research and protection of marine species (endangered species such as Mediterranean monk seal, epinephelus marginatus, posidonia oceanica, Carcharias taurus) and habitats in Kaş-Kekova Specially Protected Area and its surrounding have been planned during the Programme. In the region identified by this works, decline in marine species, habitat destruction and socio-economic condition of coastal fishers and tourism managers who have affected negatively from the impacts of climate change and that of local people who provide the livelihoods from sea will be evaluated and proposals for the future will be developed in this regard. At the same, the Programme is expected to serve in implementation of Marine Management Plan under Kaş-Kekova Specially Protected Area prepared by WWF Turkey and Ministry of Environment and Urbanisation.

The project “Proposals for Climate Change Adaptation and Mitigation/Forest Ecosystems/Case of Ankara” researching the expected impacts of climate change in terms of black pines in Ankara and surrounding through modelling was worked by the Nature Conservation Centre in 2012. Partners of the Project are the Ministry of Agriculture and Forestry, General Directorate of Combating Desertification and Erosion, the now-defunct Ministry of Forestry and Water Affairs and Foresters' Association. The Projected was supported by Ankara Development Agency. Based on information regarding that the expected impacts of climate change in Central Anatolia differed in North and South and while amount of precipitation was expected to decrease in the South, an increase in both temperature and precipitation was expected in the North, it was foreseen that the current reforestation activities would become difficult and land degradation would increase in Ankara and the region due to climate change. In this framework, the forward-looking priority works that might be done in terms of forestry were identified in the region in the project. In this identification, there are important warnings such as following up the course of changes in the forest ecosystems and reforestation works, protecting especially forest residues in Middle and South region of Ankara and considering species selection and habitat suitability for reforestation works. In the context of the Project, modelling studies were conducted and thus, changes to be experienced in terms of suitability for black pines in the region during climate change were explored and black pine forest stands which would become sensitive were specified. Furthermore, black pine forests in the region were evaluated in terms of sink capacity in the project.

Kızılırmak Delta which is one of the important wetlands ecosystem in Black Sea Coast of Turkey covers approximately area of 56,000 ha. At the same time, a part of the Delta that has various conservation status (Wildlife Improvement Area; Natural Protected Areas at I., II. and III. level) is Ramsar Site.<sup>184</sup> The elements that enable the Delta to have rare biodiversity are; to have habitats which have different

<sup>184</sup>21,700 ha of the total area of the Delta is Ramsar Site. This Site is in conversation status in line with provisions of the **Convention on Wetlands of International Importance especially as Waterfowl Habitat/ Ramsar Convention** in which Turkey is a party.



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ecological characters (such as sea, lake, river, pasture, reed bed, dune, meadow, forest, marsh and agricultural area) and nutrient-richness.

The work area of “Climate Change and Peatlands” Project conducted by the Nature Conservation Centre in 2012 was Yeniçağa Lake-Bolu and Akgöl-Konya; and the main purpose of the project was to identify response potential of measures taken for conservation of wetlands in Yeniçağa Lake and Akgöl that are two important peatlands of Turkey. This work is a part of “Climate Change Adaptation and Biodiversity Conservation through Protection and Sustainable Utilization of Wetlands in Turkey” by GIZ Turkey in partnership of the current Ministry of Forestry and Water Affairs. A range of activities for conservation and restoration of wetlands in Yeniçağa Lake and Akgöl that include two important peatlands of Turkey were undertaken during the work process. The technical evaluation for the impacts of these activities on response potential against climate change in these two peatlands was conducted by the Nature Conservation Centre. In this framework, the amount of carbon and greenhouse gas sequestered in two pilot sites was calculated taking account of global indexes and other works of the Project; and to what extent conservation works and implementation, which were undertaken by using this information, mitigated greenhouse gas emissions and economic value of this criteria were revealed. This work demonstrated the impacts of conservation and restoration of wetlands in Turkey on combating climate change.

“The Adaptation of Forest Ecosystems and Forestry to Climate Change in the Seyhan Basin” supported by MDG Achievement Fund (MDG-F) in 2011 was conducted by the Nature Conservation Centre. Models explaining the present distribution of tree species (calabrian pine, black pine, cedar and fir) deployed in Adana Regional Directorate of Forestry were created with considerations of environmental factors; the maps of areas and suitable habitats to be expected to become sensitive due to the impact of expected climate change were prepared; and some proposals in respect of adaptation of tree species to climate change were submitted.

Prof. Dr. Meryem Beklioğlu, a faculty member of Ecosystem Implementation and Research Center under Department of Biological Sciences of Middle East Technical University (METU) is hosting “Climate Change and Impacts of Saline Lake Ecology” Project to be conducted under the lead of award-winning scientist Prof. Dr. Erik Jeppesen and supported under TUBITAK 2232 International Fellowship For Outstanding Researchers. In the project, a faculty member and ecologist Dr. Korhan Özkan at METU Institute of Marine Sciences and Prof. Dr. Zuhar Akyürek, a faculty member of METU Department of Civil Engineering will work together. The project was launched in July 2020.

“GEF/SGP Turkey” community-based nature conservation projects related to climate change adaptation- Global Environment Facility/Small Grants Programme-GEF/SGP has been active also in Turkey as one of the implementation programmes of UNDP Turkey since 1993. The approach of combating climate change of SGP Turkey which has been active for 30 years in Turkey is to create effective solutions for climate change, which is essentially a global problem, through small grants it provides for local and civic initiatives and small programs which are lasting on the base and complementary; and to shed light on development of policies. In these local works, the multisectoral character of combating climate change is taken into consideration and a grant is awarded to the projects in this regard. The one of the main approaches in supported projects is to accentuate the efforts looking out for livelihoods of people.

The main purposes of SGP projects are; i) to develop land planning and landscape implementation that ensure agricultural biodiversity management which is compatible with climate change and/or resistant to climate change and/or sustainable in traditional agriculture areas and ii) to create and scale up samples for climate change adaptation in light of traditional knowledge and approaches at local level.



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A large number of project regarding adaptation to the impacts of climate change through conservation of ecosystem until today have been supported by “SGP Turkey”. In this framework, a grant has been awarded to the works on conservation and improvement with contribution of local people in 22 national parks, 19 wildlife conservation sites, 11 nature reserve areas and numerous natural protected areas; and it has been contributed that the first wildlife corridor of Turkey has created in area of 23,500 ha. The contribution of civil society has been supported in conservation of forestlands of 42,325 ha and restoration of forest area of 8,850 ha; and the works of 900,000 nature conservation volunteers has been supported to plant over 4 million trees. The civil society-based works have been undertaken for 32 endangered species on a global scale in a total area of 59,300 ha; and the species action plans have been developed. Moreover, through SGP Turkey projects, generations of 28 indigenous agricultural species and over 40 subspecies have been taken under protection and 16 of that have reached to sustainable markets and 9 of those have organic certificates. Some current works related to conservation of ecosystem and biodiversity from GEF/SGP Turkey are as follows:

- A Living Open Air Classroom: Ayvalik Islands Nature Park Project (Ayvalik Another School is Possible Association, 2019)
- The Effective Management of River Coastal Ecosystem in Sustainable and Land Use Project (Tohum Association, 2019)
- Sustainable Use of Biodiversity and Cultural Landscape Areas in Karabağlar Plateau (Muğla Karabağlar Association, 2019)
- Kazdagi Biodiversity Knowledge Management Project (Kazdagi Nature and Cultural Assets Conservation Society, 2019)
- Strengthening Marine Ecosystems Against Climate Change in Fethiye Gulf Project (Mediterranean Preservation Association, 2019)
- Nature Conservation with Nomads in Bolkar Mountains (Kızılkaya Yenidünya Association, 2019)
- Kura Basin Ecological Atlas Project (İMEÇE Association, Kars, 2018)
- Sensitive Coastal Areas/publishing (Underwater Research Association, 2018).
- Promotion and Protection of Central Anatolia Region's Forest residues (Rural Environment and Forestry Problems Research Association, 2016-2018).



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### 3.6 Disaster Risk Management

- The priority goal in Turkey should be to prepare disaster hazard and risk maps that take into account the scenarios on the impacts of global change across the country.
- The meteorological and hydrological disasters that will be caused by climate change should be given equal weight in the existing earthquake-oriented planning processes in Turkey's disaster management.
- Each sector should have its own strategic planning and action plans for the management of disasters caused by climate change.
- GIS and remote sensory technologies are not used sufficiently in the management of disasters caused by climate change in Turkey.
- It is required to enhance AFAD's capacity in terms of climate change-induced disaster risk mitigation and adaptation.

#### 3.6.1. Impacts of Climate Change

In the last 25 years, Turkey's temperature regime has significantly shifted towards more temperate and warmer conditions and the frequency and intensity of heat waves have considerably increased. This situation manifested itself with an increase in the number of summer and tropical days as well as a significant decrease in the number of frosty and snowy days. It is a matter of fact that extreme weather events such as excessive precipitation, floods, landslides, lightnings, whirlwinds as well as problems caused by the climate crisis such as forest fires, desertification and drought have begun to gain further prominence on Turkey's agenda (Karakartal, 2019). According to the 2019 Meteorological Assessment Report prepared by the General Directorate of Meteorology, 936 meteorological natural disasters, 332 of which were in the form of heavy rainfall and floods and 257 in the form of storms, have occurred in Turkey in 2019.

#### 3.6.2. Disaster Risk Management and Climate Change Adaptation

The common outcome of the research that has been done so far indicates that it is necessary to act now to prevent, mitigate, and adapt to the impacts that have been experienced in various sectoral areas in Turkey due to decreasing precipitation, the combined impact of increasing temperatures, and frequent extreme weather events.

In **legislative** terms, laws on prevention of disasters have been in force in Turkey since the middle of the last century. The "Law No. 7269 of 15/05/1959 on Measures and Aids in Cases of Disasters Affecting Public Life" regulates the measures to be taken and the aids to be provided in places where buildings and public facilities have been or may possibly be damaged to the extent that affects life in general in the event of earthquakes, fire, floods, landslides, rockfalls, avalanches and similar disasters.

The regulations introduced on the basis of the Law on Measures and Aids in Cases of Disasters Affecting Public Life and that can serve to adapt to climate change include the Regulation on Ground Rules regarding the Effectiveness of Disasters on General Living (1968), Regulation on Buildings to Be Constructed in Disaster Zones (2007), Disaster Regulation for Infrastructures (2007), Regulation on In-service Training in Provincial Directorates of Disaster and Emergency (2013).

The Law No. 2090 of 20/06/1977 on Aids to Be Provided to Farmers Affected by Natural Disasters, which is concerned with the natural disasters experienced/to be experienced in agricultural production, is another climate change adaptation-related law that discusses the reimbursement of the damages suffered by farmers due to disasters caused by climate change-induced extreme weather events.





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The aim of this Law is to determine the principles and procedures regarding the aids to be provided to farmers suffering a loss due to fire, earthquake, storm, flood, frost, hail, drought, pests, and disease. The General Directorate of Agricultural Reform is responsible for the implementation of the Law.

The 2006 Regulation on Aids to Be Provided to Farmers Affected by Natural Disasters, which was introduced on the basis of the Law on Aids to Be Provided to Farmers Affected by Natural Disasters, specifies that the producers who are not covered by agricultural insurance for the risks for the implementation year under the Law on Agricultural Insurance cannot benefit from the aids.<sup>185</sup>

The prominent measures mentioned in the Circular (Circular of 22.01.2019 on “Climate Change and Disaster Measures”) sent by the Ministry of Environment and Urbanization to all governorships and municipalities in 2019 are as follows:

- Accelerating the works for stream and canal rehabilitation
- Carrying out the works for building bridges and culverts to ensure waterflow at the lower elevations of the land and allow for the construction of infrastructural facilities
- Determining the structures under risk and taking necessary actions in line with the legislation
- Rehabilitating the existing structures that fall short in the removal of overflows and rainwater.
- Causing to conduct land works and evaluations when determining new settlement areas and preparing sensitivity maps by determining the areas exposed to landslides and other disasters and may potentially suffer other disasters, and taking such maps into consideration in the preparation and approval of land development plans
- Providing the necessary incentives and information to ensure that the citizens in areas affected by disasters do not return to disaster zones
- Developing early warning mechanisms against disasters.

From an **institutional** perspective, the **Disaster and Emergency Management Agency/AFAD**, an affiliated entity of the Ministry of Interior, stands out in terms of national and local/regional responsibilities in risk management for climate-based disasters in Turkey.

The key duty of AFAD, which has been continuing its policy planning works to prevent climate change-induced meteorological disasters since 2014, is to undertake services related to disasters and emergencies and civil defence in Turkey. In this framework, AFAD is responsible for;<sup>186</sup>

- Taking necessary measures for the effective nationwide implementation of services related to disasters and emergencies and civil defence
- Ensuring coordination among institutions and organizations that undertake works related to preparedness and risk reduction before incidents, responses during incidents, and recovery efforts after incidents
- Carrying out and coordinating domestic and overseas humanitarian aid operations
- Formulating and implementing policy recommendations on all of the abovementioned issues.

Turkey’s higher board for disaster management is the **Disaster and Emergency Board**.<sup>187</sup> Having its secretariat affairs executed by AFAD, the purpose of the Disaster and Emergency Board is to determine the risk factors for potential disasters and emergencies in Turkey, provide recommendations and guidance to institutions on the protective and preventive activities to be undertaken beforehand and the efforts to be undertaken after disasters and emergencies, and determine policy and priority recommendations regarding disasters and emergencies.

<sup>185</sup> An in-depth evaluation regarding agricultural insurances is given in the “Agriculture Sector and Climate Change Adaptation, Sectoral Impact of Climate Change” chapter of the report.

<sup>186</sup> Presidential Decree No. 4 (Official Gazette of 15 July 2018 issue 30479).

<sup>187</sup> Presidential Decree No. 67 (Official Gazette of 18 September 2020 issue 31248).





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Chaired by the Minister of Interior, the Disaster and Emergency Board comprises the relevant deputy ministers from the Ministry of Family, Labour and Social Services, Ministry of Environment and Urbanization, Ministry of Energy and Natural Resources, Ministry of Treasury and Finance, Ministry of Health, Ministry of Agriculture and Forestry and Ministry of Transportation and Infrastructure as well as representatives from the Turkish Red Crescent Society and Kandilli Observatory and Earthquake Research Institute of Bosphorus University. If deemed necessary by the Minister of Interior, representatives from other ministries, public agencies, universities, and non-governmental organizations and subject matter experts may be called to the board meetings. The board convenes biannually and may hold extraordinary meetings pursuant to the call of the Minister of Interior if needed.

According to the **Eleventh Development Plan (2019-2023)**, Turkey is among the countries to be affected most by climate change due to its geographical location and will be impacted by increasing sudden rains, flood, and drought. The plan aims for the preparation of climate change action plans for 7 geographical regions, particularly for the Black Sea Region, and disaster hazard and risk maps by taking into account scenarios regarding the impacts of climate change throughout the country.

As one of the goals (g.723) of the Eleventh Development Plan, the subject of preparing disaster and hazard risk maps by taking into account scenarios regarding the nationwide impacts of climate change was also mentioned in the 2020 Presidential Annual Programme as a policy measure.

From the perspective of **strategic planning**, Turkey's Disaster Response Plan was prepared for the first time in 2014 in order to provide a basis for the preparation of provincial disaster response plans by AFAD. While the Plan did not contain any direct goal regarding climate change, the 'TDRP event type' classification consisted of i) floods, ii) forest fire, iii) drought, iv) biological disasters and epidemics, and v) mass population movements.

Based on TDRP in general, Turkey's need for a long-term national strategy on disaster management and a new and single legal infrastructure to support this strategy becomes even clearer. Another important need identified in the TDRP is for the planning processes in disaster management to be no longer focused only on earthquakes but redefined to address all threats by taking Turkey's disaster-proneness into consideration. A country like Turkey that is exposed to natural and human-induced disasters clearly needs an applicable plan that defines the country's national response strategy. It is also important to clarify the duties, powers and responsibilities of AFAD, which is the institution that prepares and is responsible for implementing the TDRP, within the identified issue areas. From the lens of combating the climate crisis, AFAD needs to embrace its role as the senior organization for Turkish disaster management and heavily engage in the strategic planning and coordination processes in relevant sectors in terms of the management of meteorological disasters caused/will be caused by climate change (Şahin, 2020).

The "Roadmap Documentation for Climate Change and Related Disasters (2014-2023), which is directly related to climate change and disasters, was prepared by AFAD in 2014. The document draws attention to the interactions of climate change with soil, conservation, erosion, and desertification as well as drought disasters. Although the title of the document is suggestive of some policy recommendations for the future, the study does not include any economic and social policy recommendations that are/will be caused by climate change, and more importantly, makes no mention of municipalities, which are among the most important actors in local disaster risk management recommendations, in the roadmap. In its current form, the Roadmap Documentation is not sufficient in terms of climate change and disaster policies and practices. The study does not include any recommendation on the necessity of addressing the disaster risk management strategy and climate change adaptation strategies in an integrated/combined fashion in all plans, policies, and programmes in Turkey



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(Kadiođlu, 2018). Another problem related to the impacts of climate change that unavoidably comes to the forefront after climate-induced disasters is the issue regarding the losses and damages and the ways in which they may be determined, prevented, prioritized, and indemnified.

In 2014, AFAD also prepared the “Technological Disasters Roadmap Documentation (2014-2023) which determined various actions including efforts to facilitate the management of climate change and related disasters (floods, forest fires, epidemics, etc.). These actions call attention to the need to enhance the inter-agency cooperation in this area, prescribing for the establishment of a community-based disaster management in combating disaster risks caused by climate change. The Technological Disasters Roadmap Documentation contains recommendations on maintaining the training efforts to increase social awareness and engagement on the subject of the disaster and risk impacts that may be caused by climate change in Turkey.

The **Turkish Disaster Management Strategy Paper and Action Plan (TDMSP)** prepared by AFAD in 2017 covers all existing and new disaster risks, all types of disasters and emergencies, and all processes of disaster management. Presenting a model that is based on systematic integrity, efficient resource use, and division of responsibility for an effective disaster management, the TDMSP refers to the society extending from all public entities, academic institutions, private sector, non-governmental organizations (NGOs), media to families and individuals, and international organizations as stakeholders of disaster management. Since the entire content of the plan was unavailable, the information that may be related to climate change risk management could not be examined; the information that TDMSP shall be approved by the Disaster and Emergency Board was acquired verbally (AFAD).

### 3.6.3. Work by stakeholders

A “Disaster Resilient Urban Service Guide for Municipalities”, which is known to include sections to guide municipalities in combating climate change-induced disasters, has been in preparation by the Institute of Urban Research under the auspice of the Presidential Policy Board of Local Governments<sup>188</sup> (March 2020).

AFAD’s ongoing “Technical Assistance to Enhance the Capacity of AFAD in the Adaptation and Reduction of Disaster Risks resulting from the Climate Change in Turkey (Disaster Adaptation)” project, funded by the EU/IPA II, was initiated in April 2020. Throughout the project, it is planned to enhance the institutional capacities and technical/personnel infrastructures of national AFAD and provincial organizations and create GIS maps for each disaster type, establish a disaster database, and prepare the necessary legislation in this framework. The target audience/stakeholders of the project are metropolitan cities, provincial municipalities, governorships, universities, NGOs, and citizens.

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<sup>188</sup> <https://www.idealkentdergisi.com/>



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### 3.7 Insurance sector and climate change adaptation

- In terms of the insurance sector, the most important impact of climate change is the possibility that, depending on the number and intensity of disasters, the damages covered by insurance may reach very high amounts, leaving insurance and reinsurance companies in a difficult financial situation.
- Extreme weather events, the frequency and intensity of which have been increasing with climate change, is expected to impact various insurances. Accordingly, property insurance is the most vulnerable type and other insurances are expected to be widely affected by natural disasters, as well.
- Insurance indemnities in Turkey do not respond to climate and lost revenue in products.
- The Agricultural Insurance Pool (TARSIM) has begun efforts to include the agricultural products that have been damaged by excessive heat under insurance coverage in 2020.

While the climate change debate has focused on scientific, environmental and social responsibility until recently, lately it has been under discussion that socio-economic development and risk management is an extremely important subject that may be considered as the key driving force. With socio-economic costs increasing in relation to the physical risks of climate, it is observed that there has been a paradigm shift, or at least a change has started, in the approach of governments from 'non-action' or 'post-disaster response' towards a more comprehensive and integrated risk management framework. Such a change involves *preventive risk reduction, risk financing and risk identification, and risk transfer supported by quantification*.

The insurance sector serves as a guidance in covering the damages caused by climate change impacts in addition to the efforts undertaken in such fields as risk management and awareness-raising in combating climate change. The European insurance and reinsurance sector, in particular, has assumed a key role in combating the impacts of climate change (Turkish Association of Insurers and Reinsurers, 2010).

#### 3.7.1 Sectoral impact of climate change

The greatest impact of climate change is the meteorological and hydrological disasters. The cost and economic impact of disasters, the number and intensity of which have been increasing due to climate change, may reach severe dimensions. The main impact suffered by developed countries in the first stage involves real estate damages, production losses, and increased operating costs; other impacts have already started to be seen in the fields of agriculture, food, water, healthcare, energy supply, infrastructure, and tourism. Underdeveloped or developing countries, on the other hand, are more vulnerable to the consequences of climate change. The interruption of industrial and service activities and the adverse events in the agriculture sector in such countries may affect the entire supply chain, disturbing the stability of the world economy.

The costs of climate change-related disasters have already started to impose significant burdens on economies. According to EM-DAT (Emergency Database- The Centre for Research on the Epidemiology of Disasters (CRED)) data, 396 natural disasters occurred in 2019; 95 million people were affected while 11,755 individuals lost their lives, and the estimated economic loss amounted to 103 billion USD. Flood and high temperatures are among the leading causes of death (with 43.5% and 25%, respectively). It is estimated that the annual natural disaster averages between 2009-2018 account for 343 natural disasters, 45,212 deaths, 184,7 million affected individuals, and 176 billion USD financial loss.

The insurance sector is directly affected by climate change, as insurers and reinsurers bear responsibilities related to the consequences of climate change. In terms of the insurance sector, the most important impact of climate change is the possibility that, depending on the number and intensity



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of disasters, the damages covered by insurance may reach very high amounts which creates a major risk that may significantly increase the risks of insurance and reinsurance companies, leaving them in financially difficult situations. The risks that emerge as a result of climate change may be described as follows:

*Physical risks* include economic risks that may arise from direct (e.g. destruction of real property and critical infrastructures) and indirect (e.g. business interruption, affected labour force, interconnected supply chains) effects (Golnaraghi, 2018). The main insurances that will be affected by physical risks are specified below.

- **Property Insurance:** Cities are expected to face with sudden floods caused by changes in precipitation densities that will affect their infrastructures. Residential and industrial properties located near rivers or coasts are expected to be exposed to the risk of more frequent and stronger floods due to rising sea levels.
- **Life and Health Insurance:** Recent unprecedented heatwaves in Europe have demonstrated that the impact of climate change on health insurance will be much greater than anticipated. Climate change is expected to have various direct (skin cancer, respiratory diseases, cardiovascular problems, etc.) and indirect (water or vector-borne infectious diseases, food shortage, etc.) impacts on public health. It is estimated that the health-related problems resulting from climate change will be suffered more severely by vulnerable groups.
- **Agriculture Insurance:** The risks related to agriculture insurance include losses in agriculture and livestock due to extreme weather events, reduced productivity of agricultural lands, increasing forest fires, and various risks detailed in the agriculture sector chapter of the report.
- **Motor Insurance:** Accident statistics are not only affected by natural disasters such as storms but also changing weather conditions. Hail is currently the costliest natural disaster in terms of motor insurance. Vehicles may also sustain significant damages due to storms (falling trees and rocks, blown off roofs), floods, landslides, and avalanches.

*Liability risks* include the impacts that may arise in the event that the parties suffering a loss or damage due to climate change impacts claim compensation from those whom they hold liable. Main liability risks involve professional indemnity and business interruption insurances.

- **Professional Indemnity Insurance:** Professional indemnity damages are expected to increase as a result of the increasing frequency of accidents and faults.
- **Business Interruption:** In some cases, extreme weather conditions may also lead to business interruption that affects turnover and operating results. While large businesses can afford such circumstances, small and medium-sized enterprises, which are much more common, remain vulnerable to the impacts of climate change. These enterprises are blindsided by risks without poor risk assessments or adequate insurance and continuity plans. 60-80% of SMEs that do not have adequate insurance coverage in this area go bankrupt within 1-2 years after major disasters.

*Transitional risks* are financial risks that may arise from the period of transitioning to a lower carbon economy. Emerging changes, costs, and opportunities in political, technological, market, and physical risks may lead to the re-evaluation of a wide range of assets which may reduce their value. The fact that some resources have become obsolete due to technological developments is an example of transitional risks. Fossil fuels may be faced with such a change of value during the transition to low carbon economy, in particular.

In addition to the direct impacts on damages, climate change also has indirect impacts that will threaten the profitability and business model of the insurance sector. The insurance coverages provided for expected damages may fall short against unexpected major losses, and a certain amount



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of capital will be required to close the gap (protection gap & underinsurance) between anticipated damages and such excessive amounts of damages (Temelli, 2016). The profitability and business model of the insurance sector are threatened by this situation, which makes it important to review the aforementioned ways of doing business and adopt additional and integrated risk management approaches. The profit-oriented, financial structure of the sector only increases the concerns in this regard. On the other hand, a potential increase in premiums involves the risk of a decrease in the number of insureds. As the increasing number of natural disasters due to climate change may bear heavy consequences for insurers, it will also increase the likelihood of uninsurability of risks.

It is indicated that the economic loss caused by extreme events related to weather and climate change in the European Economic Area (33 countries) between 1980-2017 accounted for 83% of the overall losses in the period. The rate of those covered by insurance, which shows great variety from country to country, was 35% in overall losses. **Error! Reference source not found.** shows the overall losses of the 33 countries as well as examples from some countries (EEA). As seen in the table, the rate of insured losses was 14% in Turkey.

Table 18 Extreme weather and climate event damages suffered by European Economic Area countries (1980-2017, based on 2017 prices) (EEA, 2017)

European Economic Area Countries (33 countries)	Economic Losses (mil Euro)	Per Capita Loss (Euro)	Loss/Km2 (Euro)	Insured Losses (mil Euro)	Insured Losses (%)	Death
Belgium	4,308	415	141,125	2,531	59	2,168
Bulgaria	2,452	302	22,217	129	5	205
Czech Republic	10,533	1,018	133,551	3,554	34	220
Denmark	10,336	1,936	240,838	6,307	61	42
Estonia	108	76	2,387	33	31	9
Finland	1,959	380	5,789	397	20	4
France	62,059	1,026	98,011	30,961	50	23,415
Germany	96,494	1,271	270,008	45,188	47	9,856
Greece	7,319	693	55,424	113	2	2,431
Poland	15,057	397	48,155	1,027	7	1,217
Portugal	6,869	672	74,475	584	9	3,108
Romania	11,065	508	46,414	60	1	1,310
Spain	37,106	889	73,341	4,508	12	14,611
Turkey	4,405	70	5,622	635	14	1,682
United Kingdom	50,504	848	203,208	35,106	70	3,535
Other Countries	132,018			26,747	20	26,512
<b>Total</b>	<b>452,592</b>	<b>24,452</b>	<b>3,336,015</b>	<b>157,880</b>	<b>933</b>	<b>90,325</b>

The expanding protection gap demonstrates that risk transfer measures such as insurance are not used at their full potential. On the other hand, countries with lower insurance penetration levels suffer greater declines and more significant financial losses in economic output after a major disaster. Furthermore, post-disaster financial aid is sometimes ineffective and inadequate and other times deters individuals, enterprises and local governments from taking proactive measures to manage their physical risks (Golnaraghi, 2018).



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Extreme weather events, the frequency and intensity of which have been increasing with climate change, is expected to impact various insurances. Accordingly, property insurance is the most vulnerable type and other insurances are expected to be widely affected by natural disasters, as well. The insurance protection gap for losses related to weather conditions are presented in **Error! Reference source not found**. The green parts of columns represent the amount of loss.

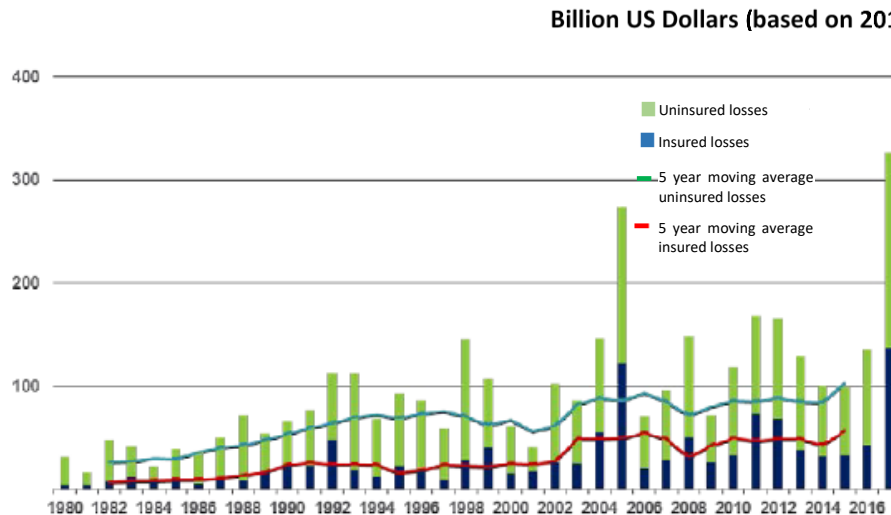


Figure 16 Insurance Protection Gap for Losses Related to Weather Conditions (UNEP FI, 2018)

#### Climate Change Opportunities for Insurance Sector

Taking into consideration the role of insurance in ensuring protection and risk transfer, the insurance sector can have a clearly important role in supporting climate change adaptation. The opportunities related to the climate change vulnerability of the insurance sector as well as its potential to impact climate change adaptation are specified below:

- Providing expert recommendation in order to raise awareness on climate change risks and prevent and mitigate risks and losses. With the guidance of insurers, an opportunity may be created to improve building regulations, enhance the measures against floods, or otherwise influence the regulations in force to reduce climate hazards.
- Developing innovative risk transfer mechanisms as part of broader risk management solutions may provide an opportunity to help underinsured or uninsured communities and economies overcome the challenges of climate change.
- Insurance companies also have opportunities to develop new products. These opportunities in particular are related to transitioning to a lower carbon economy in fields such as renewable energy project insurance. Performance risks such as the increased demand for insurance coverage for design and construction risks as well as insuring income deficiencies from solar farms due to changing weather conditions may be an example for such new products.
- Existing environmental insurance proposals (green products) can also provide insurees with opportunities to encourage a change of behaviour to reduce carbon emissions. Best examples in this field include “pay as you drive” motor insurance policies that encourage further energy efficiency in addition to reducing car use.
- Automobile manufacturers that prepare special insurance products for electric vehicles will seemingly increase over time. The US electric car manufacturer Tesla has announced to offer its customers a price advantage of up to 30 percent in insurance premiums. The service, which was





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named 'Tesla Insurance' is currently only applicable to Tesla customers in California (Insurance Media, 2019).

- The insurance sector is a traditionally important and active institutional investor. Following the example of other institutional investors, particularly investments in "Green Bonds" i.e. investments in debt instruments financing the projects with benefits for environment and/or climate change, may play a role shaping and guiding the growth of such products as well as seizing new business opportunities.

### 3.7.2 Sectoral Adaptation to Climate Change

Potentially contributing to reduce the sector's financial vulnerability, European policies are interested in establishing a single insurance market and for this purpose, the EU has published an action plan, the "Financial Services Action Plan", for a single financial market. The EU also published the "Solvency II"<sup>189</sup> Directive for insurance companies, setting rules that require insurance institutions to have the adequate capital to reduce the risk of bankruptcy, including the risks arising from natural events. The aim of the Directive is to reduce insurers' risks of inability to meet the demands of policy holders and also reduce the potential damages to be suffered by policy holders when insurees' demands are not fully met. In 2020, the European Commission plans to revise the Solvency II Directive and has requested technical advice from the European Insurance and Occupational Pensions Authority (EIOPA) on various matters including the revision of the Solvency Capital Requirement Standard Formula.

The role of insurance now reaches beyond risk sharing, because insurance is an integral component of the risk management cycle that extends from the identification to the transfer and disposal of risks. Insurance also helps insurees in adapting to climate change; nonetheless, insurance can neither replace other adaptation measures nor serves as a tool in providing resources for adaptation measures.

Risk transfer methods were developed in some markets in order to close the gap between anticipated and realized damages and increase the financial capacity of the sector. Catbonds (catastrophe bonds), which can be described as "securities through which insurance and/or reinsurance companies transfer the natural disaster insurance risk to institutional investors", became an alternative to the transfer of risk to the reinsurer or the public.

In 2012, Mexico prepared a 315 million USD **disaster bond** that ensured protection against earthquakes and hurricanes. The Pacific Alliance countries (Chile, Mexico, Colombia, Peru) have already formulated a disaster bond with the potential of covering primarily earthquake risks, in addition to other risks (OECD, 2017).

Thus, it became possible for insurers and/or reinsurers to transfer major natural disaster risks to the capital market. It has been voiced by the insurance sector that insurers must transfer a portion of their assumed risks to the State in order to issue insurance policies with a natural disaster coverage, in the event that transferring risks to reinsurers or the capital market is not possible.

Insurance also helps insurees to adapt to climate change through information sharing and guidance. Particularly the European Insurance and Reinsurance sector supports private-public cooperation and plays a significant role in such matters as risk assessment, mapping, risk transfer, funding, alignment, and mitigating and preventive measures.

Insuring the new technologies and projects developed to reduce greenhouse gas emissions is an opportunity for insurance sector and will support the development of such technologies and projects. Some examples on this issue can include the pay as you drive motor insurance, low motor insurance

<sup>189</sup> Adopted in December 2009. Directive 2009/138 / EC.



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premiums for hybrid vehicles (electric/internal combustion), and reduced home insurance premiums for climate-friendly dwellings or liability policies for carbon sequestration and storage projects.

Companies that are able to define the possible impacts of climate change on insurees and their own activities and include them in their institutional risk management plans and company policies will reduce the unfavourable impacts of climate change as well as using the new increase in demands positively by developing new products, thus staying one step ahead.

In the second half of the 2000s, some projects were implemented by the Association of Insurers in Germany and Northern European countries to determine the points of response and contribution regarding the impacts of climate change in the medium and long term. These studies mainly covered subjects such as the following;

- Researching the products, services and incentives that should be developed by the insurance sector
- Integrating climate change measures and risks into investment strategies
- Investigating the ecological, socio-economic, and political consequences of climate change
- Investigating the potential contribution of the insurance sector to global climate change adaptation
- Examining the prevention of natural disaster in political and technical terms.

The climate change-related legislation of the insurance sector in **Turkey** is discussed below.

The objective of the **Catastrophe Insurance Law** No. 6305 of 09/05/2012 is to determine the procedures and principles for the compulsory earthquake insurance to cover the financial losses which may arise in buildings due to earthquakes and for the insurance and reinsurance coverages to be presented in order to cover the material and physical damages which may arise as a result of various disasters and risks which cannot be covered by insurance companies, or which bring about challenges with regards to offering coverage. Pursuant to the Law, in case coverage cannot be given by insurance companies, if required for the public good in cases of earthquakes, floods, landslides, storms, hail, frost, avalanche, and similar natural disasters, insurance or reinsurance coverage may be given by the Turkish Natural Catastrophe Insurance Pool (DASK) taking into account the principles of insurance. The decision as to which among these coverages may be given by the Pool shall be determined by the President. The Ministry of Treasury and Finance and its affiliated entity, the Natural Catastrophe Insurance Pool, is authorized for the implementation of the Law. The Regulation on the Working Principles of Natural Catastrophe Insurance Pool (2012) was issued pursuant to the Law.

**Agricultural Insurance Law** No. 5363 of 14/06/2005 is one of the laws that must be addressed within the scope of climate change adaptation. The Law aims to compensate the losses suffered by producers due to risks including climate events such as drought, hail, frost, floods, storms, cyclones, and landslides. The significance of the Law in terms of adapting to the impacts of climate change is clear vis-à-vis the increasing frequency and intensity of extreme weather events and the major damages suffered by producers. The actions related to the implementation of the Law are carried out by the General Directorate of Agricultural Reform of the Ministry of Agriculture and Forestry and the General Directorate of Insurance of the Ministry of Treasury and Finance. The Regulation on the Working Principles and Procedures of Agricultural Insurance Pool and the Implementation Regulation for Agricultural Insurance were issued in 2016 on the basis of the Law.

The insurance sector activities in Turkey are subject to the **Ministry of Treasury and Finance**. The **General Directorate of Insurance** of the Ministry is liable for preparing the legislation on insurance and monitoring and steering the practice in addition to implementing Compulsory Earthquake Insurance (DASK) practices. The Agricultural Insurance practice is exercised in coordination with the Ministry of Agriculture and Forestry.



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The **Insurance Information Centre (IIC)** was commissioned pursuant to the regulation published in the Official Gazette of 9 August 2008 issue 26962. Information sub-centres such as the Traffic Insurances Information Centre (TRAMER), Health Insurance Information Centre (SAGMER), Life Insurance Information Centre (HAYMER) and Insurance Damage Tracking Centre (HATMER) were established under the IIC. A similar tracking centre can also be established for climate change.

Insurance companies expect planning policies and regulations that guarantee the consideration of different climate risks, as with earthquake risks, from public authorities. Public policies and regulations are very important for providing the necessary prerequisites for the insurance sector and for the practice setting. In particular, government policies that regulate prevention and risk reduction practices constitute the critical foundation of insurability.

As an investor, the insurance sector must make informed decisions, which is why the availability of systematic and transparent data on climate risks is critical for the sector. Meta data must be available that explains adaptation measures, including the costs and anticipated benefits of specific adaptation measures such as the economic aspect of climate change risks and reducing the likelihood and/or damage of a future incident; the correlation between climate change risks and impacts and adaptation measures; methodologies, shared references, and geographical positioning functions.

Institutions that can take an active role in determining risks and contribute to the production of data and knowledge based on the degree of climate risks are the Ministry of Environment and Urbanization, State Hydraulic Works, Ministry of Agriculture and Forestry, Ministry of Health, and Ministry of Industry and Technology, as mentioned in some of the other sectors. The General Directorate of Insurance can serve as a catalyst in accelerating the efforts in this regard by establishing a common working ground with relevant Ministries.

Insurers have significant experiences in risk identification and analysis, formulating financial solutions, and supporting risk-reducing courses of action. Sharing such experiences with the public within the frame of a public-private sector cooperation will undoubtedly create an important synergy. European public institutions can establish a suitable legal framework for insurers, making it easier for insurers to develop new products that mitigate the impacts of climate change. This requires cooperation on matters such as awareness raising, risk mapping and documentation, knowledge sharing, and analysis of risks.

In addition to the corporate social responsibility projects implemented by some insurance companies in Turkey, they have also started to develop products related to climate change; yet there is not an integrated, systematic study regarding the subject and the existing studies are old-dated. Insurers and public officials should expand the possibilities of cooperation in gathering and publicly sharing information on natural disaster risks and implementing the acquired awareness in real life.

According to the data of the Insurance Association of Turkey (IAT), flood insurances under the fire and natural disaster branch produced 57.3 million, catastrophe insurances other than natural and flood disasters produced 25.4 million, and landslide insurances 28.1 million TRY premiums in the first 7 months of 2020, amounting to a total of 110.9 million TRY premiums. The numbers and amounts of premiums produced each year are increasing.

One of the most important technological advancements in agriculture is forecasting and early warning systems that make significant contributions to local farmers, townspeople, and consequently the national economy. Furthermore, producers can take various measures to reduce or prevent loss of life and property and for protection against the impact of natural disasters while sustaining their agricultural activities. For example, damages that may occur can be prevented and reduced to a certain extent by hail nets and cover systems for 'hail' and frost fans, fogging and sprinkler systems for 'frost' risks. As for greenhouses, environmental concrete is known to reduce to a certain extent or eliminate



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the impact of a damage and measures are taken accordingly. The goal of TARSIM (Agricultural Insurance Pool) is to insure farmers against natural catastrophes and production risks; it has been making it convenient to encourage producers to take such measures and providing discounts in insurance premiums to those who do. Greenhouses and outdoor grown citruses were affected in Antalya due to the recent cyclone and storms; various products and mainly spinach, wheat, and citrus in Mersin, Izmir and Hatay due to flooding; apricot in Malatya due to frost; grapes in Manisa due to hail followed by frost; peach, nectarine and plum in Mersin due to hailing (Mocu and Bostanoğlu, 2020). In 2020, TARSIM announced that it began efforts to include citrus fruits that are damaged by excessive heats in insurance coverage (Yıldırım, 2020). The application is expected to be implemented in 2021.

Insurance system has been under development, and a detailed system has been built against earthquake resilient disasters in Turkey. In terms of agriculture-related insurance, important steps were taken with the establishment of TARSIM. With that said, when considering the Turkish insurance system as a whole, the pre-disaster protection principle has not yet been fully implemented. It is often reflected that depending on the range of catastrophe risks, participation in the insurance system is below the level in further developed economies and trust in the system has yet to be fully established (TUSIAD, 2016).

#### 3.7.3 Work by stakeholders

Taking into consideration the examples based on increasing international efforts in the last decade, the primary to-do list of insurance sector businesses include institutionalizing climate change as a core business problem, stepping up contributions towards establishing financial resilience to climate risks, and supporting the low carbon economy transition by cooperating with governments and other key stakeholders.

Various insurance companies indicate in their Sustainability Reports that they have adopted the Responsible Growth Strategy which introduces environment-friendly innovations in their internal transactions and products. In their institutional works, some companies raise awareness through activities undertaken for greenhouse gas emissions reduction and reducing their environmental damages while others provide various facilities to their clients that have taken action in this regard. For example, some companies grant clients who hold ISO 140001 Environmental Management Systems Certification a discount in fire insurance and clients who own hybrid vehicles a discount in motor vehicle insurance. It is expected that similar products will soon be offered for electric cars, as well. Products related to sectoral climate change have also begun to be created, examples of which are provided below.

**AXA Insurance** has been offering parametric insurance<sup>190</sup> products, which differ from standard insurance products by covering losses of profit resulting from climate change impacts even in the absence of physical damages, to their clients in Turkey through AXA Corporate Solutions. In this context, the loss of profit originating from out-of-coverage physical damages in standard products are covered through parametric products even if there is no physical damage. For example, the financial loss suffered by a ski resort that failed to attract as many clients as expected due to less snowfall than anticipated can be compensated through this product. Client risks are analysed using various indicators such as precipitation shortages, high/low air temperatures, crop yield, wind speed, wave height, and their frequency and volume are calculated; in the event of occurrence of a risk after calculating their financial impacts, the damages are compensated based on documented data. This stage involves the

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<sup>190</sup> Parametric insurance is a type of insurance that offers payment upon the occurrence of a pre-determined parameter in the policy even if there are no financial losses.



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use of various technologies including satellite imaging. Supporting the fight against climate change with an *Earth-friendly Insurance* approach, AXA Insurance initiated a project named 'Be Active for the World' with expert support from the Active Living Association and WWF-Turkey (IHA, 2020). Based on research establishing the baseline and perception about physical activity, health and climate change, which was conducted by ADHOC and IstanbulON Urban Mobility Lab ITU across Turkey, the project focuses on creating value in two points: i) ensuring that leading a more active life is included among the options towards reducing our carbon footprint at a time when it is essential to do so, and ii) reducing the negative impacts of an inactive lifestyle on human health, and the unmanageable risks, costs and environmental impacts it will create on the health system

**Sompo Insurance Turkey** took its 'Respect for the Earth' corporate social responsibility project started in 2019 one step further to develop its 'Climate Insurance' product. This policy covers all risks related to global climate change, guaranteeing against disasters such as hail, storms, floods-inundation, tornadoes and snow weight, landslides and fallen trees, which are the indirect effects of these disasters, and all assets (housing, workplace, motorized land vehicles and boats) including buildings and assets, against the risks that are under the coverage of the Personal Accident on the basis of first-loss insurance (Haber Turk, 2019).

**Anadolu Insurance Company** also announced the renewal of their risk assessment methods based on new requirements in order to manage the climate change risks of their clients more efficiently. One of their most important practices was updating the risk maps used in the management of flood and landslide risks. Cooperating with universities to produce risk maps based on scientific methods, the institution aims to enhance the geographical scope of the maps to include 80% of the portfolio by 2020.

**Yapı Kredi Insurance** has been working to reduce the adverse impacts of climate change and inform policyholders on the subject for many years. As part of their efforts, they developed special pricing and insurance approaches based on risk assessment in some regions in Istanbul, Bodrum, Alanya and Bursa where there were frequent floods with destructive impacts.

The Geneva Association recommendations for insurance sector institutions will apply to the institutions in Turkey, as well:

- Expand underwriting products and services for addressing the protection gap to natural hazards and physical risks of climate; reduce business risk associated with the complex green and clean tech value chain, and incentivise preventive measures and GHG reduction.
- Reduce carbon footprint for all aspects of business.
- Institutionalise climate change as a core business issue.
- Establish governance mechanisms to address long-term climate risks and promote such approaches as the norm.
- Stay abreast of latest developments in stress testing and 2°C Scenario analysis.
- Integrate climate risks into investment decisions.

**Turkish Insurance Institute (TSEV)** has adopted an Environmental Policy as a first step towards raising climate change risk awareness. Under this policy, TSEV has committed to conducting research, organising conferences and seminars, preparing publications and keeping environmental problems on the agenda of the insurance sector. Their efforts include:

- Complying with environmental legislation and approved codes of practice and improving them. It is committed to ensuring that international agreements, such as the Kyoto Protocol, and standards are adopted in Turkey.





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- Communicating with relevant bodies such as the United Nations Environment Programme (UNEP) and UN Global Compact and adopting the principles set by these organisations.
- Raising staff awareness of environmental issues.
- Taking measures to reduce electricity and water consumption and to recycle. It also aims to calculate greenhouse gas emissions, take measures to reduce them and plant trees to offset it.

**Turkish Association of Insurers and Reinsurers** has been working to raise awareness by following up on international studies on the issue, most of which are old-dated. While various vetting and investigation committees have been established within the organizations, the issue of climate change has yet to become a current issue to the extent that it requires a separate committee.

Although not having established a separate unit, various publications are prepared and sectoral research is conducted with climate change working groups by similar international organizations, primarily the Geneva Association, German Insurance Association (GDV), British Insurance Association (ABI). ABI is one of the founders of the European Climate Wise Initiative, which is an organization established to guide communities on preparing for climate change.

In consideration of such deficiencies, institutions such as the Turkish Association of Insurers and Reinsurers need to include climate change adaptation works in their work plans and annual activities in order to ensure more sectoral adaptation efforts are undertaken at the civil society level. Potential works include the following:

- Working with the government to enhance the sectoral contributions to build socio-economic resilience to climate risks;
- Supporting the development and advancements in catastrophe risk models with a forward-looking approach;
- Promoting the need for the systematic collection and availability of publicly-funded environmental and socio-economic data;
- Investing multilaterally in climate adaptation research;
- Promoting the need for clear and consistent climate change policies and regulatory frameworks;
- Promoting the need for 'green' and 'infrastructure' asset classifications, expansion of pipeline of investable opportunities, standards and methodologies, reliable data and transparency and regulatory stability for long-term investments;
- Staying abreast of latest developments in stress testing and scenario analysis.

Insurance companies state that they conduct various climate change and risk analysis studies with **universities**. These studies are effective in product diversification and determining premiums.

Two organizations that have recently brought universities and sectoral employees together stand out, as no similar formation has appeared other than the workshops held in 2018 and 2020. In February 2018, the "Workshop on Global Change and Disaster Impacts on the Insurance Sector" was held as a preliminary work of the "International Symposium on Global Climate Change, Environment and Energy" by Istanbul Aydın University in April 2018. Under the leadership of the Istanbul Aydın University Disaster Training Application and Research Centre and Energy Policies and Markets Research Centre as well as the Turkish Association of Insurers and Reinsurers, the workshop brought the academia together with various private insurance companies (Aydın University, 2018). The event involved detailed discussions regarding action plans against climate change and actions to raise awareness. The workshop was attended by the Turkish Association of Insurers and Reinsurers, insurance company representatives, academics, and students (Elçi, 2020).





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UNDP Turkey, TURKONFED (Turkish Enterprise and Business Confederation) and Connecting Business Initiative Turkey (CBI<sup>191</sup> Turkey) have been engaging in efforts towards enhancing the risk analysis, risk management and business continuity capacity of enterprises against natural disasters and emergencies in order to devise new solutions for the changing risk profile in Turkey and ensure that the private sector is more knowledgeable and efficient before, during and after disasters. CBI Turkey's report "Resilience in SMEs: New Risks, New Priorities" published in December 2019 contains recommendations on "making our enterprises more resilient", "improving joint responsibility" by creating multi-stakeholder networks of cooperation, and preparing the private sector against events of earthquakes, as well as natural disasters resulting from climate changes such as floods and overflows (TURKONFED and UNDP Turkey, 2019). The report also includes information on enhancing the risk analysis, risk management and business continuity capacity of enterprises against natural disasters and emergencies in order to devise new solutions for the changing risk profile in Turkey and to ensure the private sector is more knowledgeable and efficient before, during and after disasters, highlighting the significance of the insurance sector in meteorological disasters caused by climate change (e.g. according to estimated cost calculations for the flood/hail disaster in Istanbul in 2017, the Turkish insurance sector paid 1 billion TRY for this single event whereas it generally made an average annual payment of 150 million TRY for flood disasters).

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<sup>191</sup> Connecting Business Initiative is led by the private sector and supported by the United Nations. The United Nations Development Programme (UNDP) and the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) provide the initiative with operational and technical assistance. Additionally, the United Nations Office for Disaster Risk Reduction provides technical consultancy in reducing the risk of disaster.



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### 3.8 Finance sector and climate change adaptation

- It is inevitable that financial institutions such as institutional investors, insurance companies and banks that operate in a broad range of sectors and undertake the risks of various sectors will be affected by climate change.
- The risks caused by climate change in the finance sector in the world have first started to be taken seriously by insurance and reinsurance companies.
- There are very few research/studies, most of which are not current, that examine climate change risks in the finance sector in Turkey.

In international climate negotiations, the financing of climate change response has been a primary point of discussion since 1990s, and the finance sector's relationship with climate change was shaped by this unilateral perspective. Climate finance is a leading issue on which governments cannot fully reach a consensus and discussions focus the most. Current finance resources still concentrate on the financing of mitigation actions. Details of the financing target and its main distribution channel, the Green Climate Fund, were regulated in the Paris Conference (2015) pursuant to UNFCCC's decision no. 1/CP.21. In line with the decision, the common goal of mobilizing 100 billion USD of annual climate finance by 2020, to which developed countries had committed in Cancun (COP16, 2010), was extended until 2025 (Mazlum, 2019).

The climate finance that has been mobilized by developed countries is given in **Error! Reference source not found..**

Table 19. Climate Finance mobilized by Developed Countries (billion USD) (OECD, 2018)

	2013	2014	2015	2016	2017
<b>Bilateral public climate financing (1)</b>	22.5	23.1	25.9	28.0	27.0
<b>Multilateral public climate financing attributed to developing countries (2)</b>	15.5	20.4	16.2	18.9	27.5
<b>Subtotal (1 + 2)</b>	<b>37.9</b>	<b>43.5</b>	<b>42.1</b>	<b>46.9</b>	<b>54.5</b>
<b>Official export credits related to climate (3)</b>	1.6	1.6	2.5	1.5	2.1
<b>Subtotal (1 + 2 + 3)</b>	<b>39.5</b>	<b>45.1</b>	<b>44.6</b>	<b>48.5</b>	<b>56.7</b>
<b>Private climate financing mobilized (4)</b>	12.8	16.7	N/A	10.1	14.5
<b>Total (1 + 2 + 3 + 4)</b>	<b>52.2</b>	<b>61.8</b>	<b>N/A</b>	<b>58.6</b>	<b>71.2</b>

According to a report by multilateral financing institutions, the climate finance that had been mobilized reached 62 billion USD in 2014 and 71.2 billion USD in 2017 (OECD, 2018 report). Still, the subject of greenhouse gas emission reduction is given priority, a main reason for which is that greenhouse gas emission reduction investments are easy to monitor and calculate. As the financial return can be seen more clearly, this approach is considered to be more profitable.



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Figure 17 gives the distribution of public climate financing by areas of solution in developed countries.

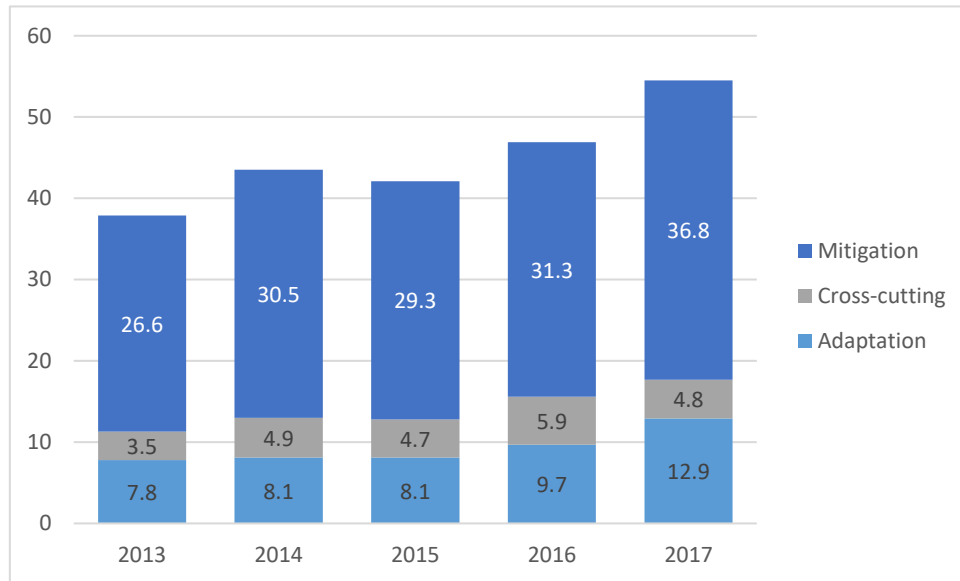


Figure 17. Distribution of developed countries' public climate financing by areas for which it produces solutions (billion TRY)

Nevertheless, the impacts of climate change adaptation investments depend on various parameters and range from areas such as human health and crisis management to reducing losses and damages rather than having a direct monetary equivalent; as the measurement of such parameters show great variety based on the circumstances of their respective regions, it is quite difficult to make valuation calculations for finance facilities. However, the awareness of governments and adaptation-related sectoral unions have been increasing in the recent years.

Although there is a significant flow of finance in the international framework that was established in relation to the funding of mitigation and adaptation measures against climate change, evaluating the risks and opportunities faced by the finance sector from the perspective of its vulnerabilities is important in terms of examining the steps that need to be taken on the matter in the finance sector.

Information and views about climate change having significant impacts on various sectors are discussed in other chapters of the report. It is inevitable that particularly financial institutions such as institutional investors, insurance companies and banks that operate in a broad range of sectors and undertake the risks of various sectors will be affected by climate change. The direct impacts of climate change or the impacts of the regulations introduced and measures taken to reduce greenhouse gas emissions will be closely felt by financial institutions.

When considering the climate change adaptation efforts of the financial services sector, the insurance sector, which will be affected the most by climate change adaptation and make greater contributions to mitigating the impacts, is further examined in another chapter.

### 3.8.1 Sectoral impact of climate change

Funding the radical transformation of economies to combat climate change will require financial flows to be rechannelled to a substantial extent, yet the rechanneling will not be adequate without significant contributions from public financing -which is conventionally at the centre of climate finance- and capital markets. This role of the financial system was mentioned in Paris Agreement Article 2.1,



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emphasizing the need for “making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development” (UNFCCC, COP21, 2015).

With regard to the finance sector, the climate change related risks may be divided into two groups as **direct risks** such as i) physical risks, activity risks, reputational risks, operational risks, legal/regulatory risks and **indirect risks** such as ii) credit risks, market risks (Alper and Anbar, 2008).

**Direct Risks-** One of the direct impacts of climate change on the finance sector is **physical risks**. A physical risk is the impact of weather events such as flood and hurricane, the frequency and intensity of which increases due to climate change, on the buildings and other properties of banks.

Another risk with which banks are faced, although lower compared to other businesses, is **activity risk** which is the probability of extreme weather events related to climate change causing the disruption or interruption of bank activities (due to power outages, broken communication lines, internet disconnection, etc.).

**Reputational risks** that may arise due to the policies and practices of financial institutions against a climate change problem constitutes another risk group that is important for the sector. Banks and other financial institutions without credible and consistent policies and programmes related to climate change may be considered “incompetent” following inspections by relevant groups or non-governmental organizations, which may harm their reputation. Stakeholder, customer, and other groups’ pressures on the bank may increase over time, forcing banks to determine and implement more serious policies on climate change. For example, a bank providing a credit to projects related to fossil fuel types or to carbon-intensive businesses that did not take the necessary emission reduction measures will increase the reputational risk of the bank.

The probability of current or future legal regulations on climate change increasing the obligations of banks (introducing additional costs) or affecting markets unfavourably is called a **legal or regulatory risk**.

**Indirect Risks-** Another type of risk suffered by banks is **operational risks** arising from failure to accurately evaluate climate change impacts or climate-related risks as a result of inadequate internal risk assessment processes.

One of the most important indirect risks for the finance sector is credit risks. A credit risk refers to the probability of individuals and businesses that borrow from the bank failing to fulfil their obligations due to such reasons as additional costs brought by measures for reducing greenhouse gas emissions, or interrupted activities due to climate-related disasters. Banks may be exposed to further credit risk due to their customers operating in carbon-intensive sectors such as those involving cement, electricity, aluminium or in sectors that are vulnerable to climate change impacts such as agriculture, forestry, construction, insurance, and tourism.

Businesses that fail to comply with reduction policies or exercise due care in climate change response may suffer reputational risks. Certain non-governmental and consumer organizations may bring action against such firms on the grounds that “they do not fulfil their responsibilities or cause global warming by failing to take the necessary measures”. For example, some states and environmental organizations in USA have already started to file lawsuits against some energy companies on the grounds that they threaten public health by releasing carbon dioxide. Such risks faced by firms (reputational risks and the risk of paying substantial compensation) increase the credit risk of banks.

**Market risk** is another indirect risk faced by banks due to climate change. Market risk is the uncertainty in input and/or output prices based on climate change, i.e., market risks arise from the increase in input prices or the decrease in output prices. For example, increasing electricity prices due to greenhouse gas emission restrictions may adversely affect the credit quality of businesses operating



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in sectors in which electricity costs have a significant share in overall input expenses. The banks that provide credit to industries/companies that are exposed to high market risks due to climate change are also indirectly subject to a market risk.

Climate change associated risks increase with the extension of the maturity of bank credits or other financial products. Generally, banks will be less affected by the risks associated with climate change in any sector in which credits with a maturity or call opportunity of less than five years. Nevertheless, credits with a maturity of over five years carry greater risks due to the additional obligations brought on by new regulations or policies related to climate change.

In addition to credit maturity, the sector in which the business granted with credit operates should also be taken into account in assessing the risk. For example, credit facilities made available to such sectors as agriculture, tourism, automotive, energy that are further affected by the consequences of climate change or the regulations related to emission reduction are riskier.

Similarly, the impact of climate change on various financial instruments in bank portfolios such as commercial papers, business bonds, asset backed securities vary by the maturity of such financial instruments and the sectors to which they relate. As commercial bonds are short-term, they do not expose banks to any climate change risk; business bonds have most of the risks borne by business loans. In general, the medium and long-term (with a maturity of 10 years or over) business bonds issued by businesses that are faced with climate change risks may also be exposed to risks related to climate change.

Whereas asset backed securities issued based on consumer credits such as credit card receivables are subject to a very low climate change risk, those that are issued based on credits provided to businesses operating in sectors such as petroleum and gas, electricity, coal, and cement may be further exposed to climate risks (UNEP FI, 2006).

#### 3.8.2 Sectoral adaptation to climate change

This chapter discusses the strategic actions and steps for building the finance sector's resilience to climate change impacts.

Until 2010, climate variability for the finance sector was fundamentally limited to carbon markets and project financing, and the responsibility regarding greenhouse gas emission reductions was left entirely to the discretion of customers.

On the investors' side, climate variability began to be included in the most stable Socially Responsible Investment narratives and strategies that basically had no concrete effect on investment decisions and portfolio compositions as a result of the lacking nature of climate policies after the Kyoto Protocol, which served as a milestone in that period. The issue of risks arising from climate change first started to be included in serious discussions by insurance and reinsurance companies in the finance sector (Chenet, 2019).

Relevant milestones in the finance sector are listed in chronological order in **Error! Reference source not found.:**



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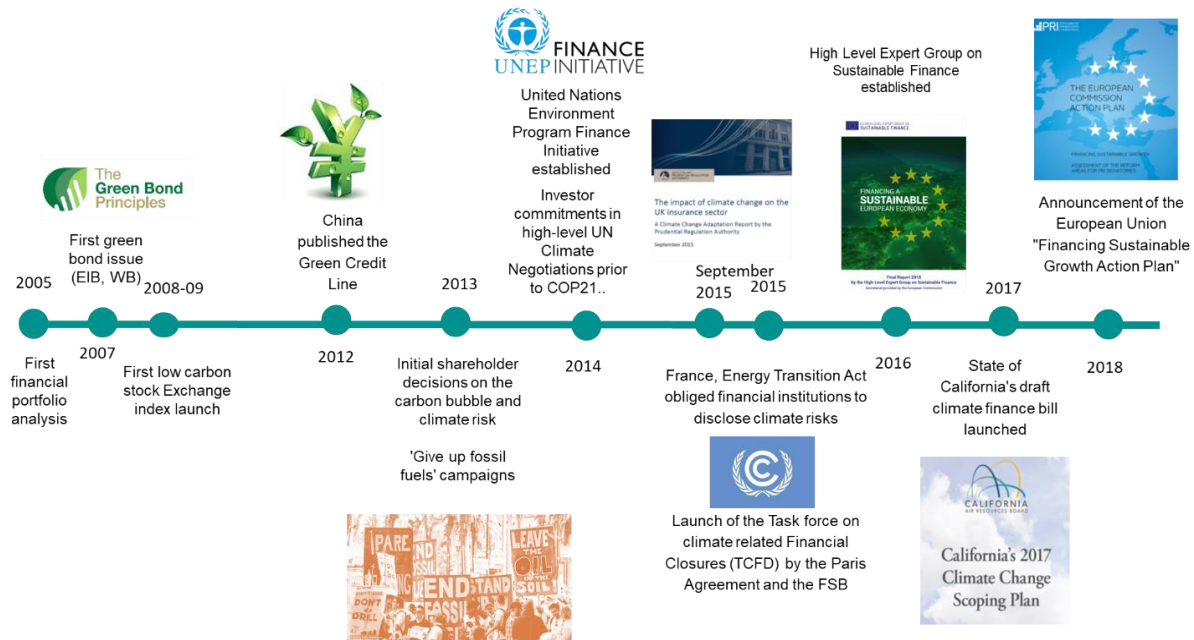


Figure 18. Milestones in the sustainability journey of the finance sector

As is seen, climate change risks related to the finance sector started to become an important part of the efforts of finance sector managements of countries.

**Error! Reference source not found.** lists examples of the practices by relevant legislators, banks, or unions in the finance sector in some countries.

Table 20. Global Finance Sector practices related to climate change

Country	Relevant Authority	Regulations
Australia	Australian Prudential Regulation Authority	2017- Climate Change Financial Risk Working Group established
Brazil	Central Bank of Brazil	2014- Socio-environmental Responsibility Policy for Financial Institutions issued
Canada	Central Bank of Canada	Climate change risk included in Canadian financial system analysis, Climate Change Scenario Analyses published in 2020
China	China Banking Regulatory Commission	2012- Green Credit Guidelines, 2014- Green Credit Statistics System and Key Performance Indicators published.
EU	European Commission and European Banking Authority	2018- Sustainable Finance Action Plan declared
Turkey	Banks Association of Turkey	2014- Voluntary Sustainability Guidelines issued
United Kingdom	Prudential Regulation Authority	2019- Climate change risk included in prudential supervisory framework analysis 2021- finance sector stress tests added





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The leading platforms and networks in the international arena related to the finance sector's approach to climate change are given in the chronological order above. In-depth information about the platforms and networks listed below may be found in Ziero's 2020 article listed in the resources part of the report and the "Sustainable Finance Progress Report" issued by the UN Environment Inquiry in March 2019.

- *Coalition of Finance Ministers for Climate Action*
- *International Platform on Sustainable Finance (IPSF)*
- *Network for Greening the Financial System (NGFS)*
- *International Network of Financial Centres for Sustainability (FC4S)*
- *United Nations Environment Programme Finance Initiative (UNEP FI)*,
- *Sustainable Banking Network (SBN)*, representing USD.
- *G20 Green Finance Study Group (GFSG)*,

Apart from the national and international developments mentioned above, various financial institutions in various countries have been carrying out certain practices in response to climate change risks and opportunities. While some practices aim to maintain the value of existing assets and systems, others try to create value through innovative applications to meet the new needs arising from climate change.

### Practices for Maintaining Asset Value

- *Business continuity planning through scenario modelling*; in the last 10-15 years, financial institutions started to analyse how resource shortages, sea level rises, temperature changes, and extreme weather events would affect their risks through scenario models that involve comprehensive maps to analyse the assets owned by them and their customers. According to CDP reporting, Royal Bank of Scotland Group, and Australia and New Zealand Banking Group were the primary companies taking a step in this direction.
- *Shifting institutional and customer investments to low-risk sectors and regions*; financial institutions carrying out efforts in this regard strive to maintain their financial assets through the risk assessment methods they formulate. The risk assessment criteria are included in business processes in a way that impacts seller and customer choices and environmental risk assessments.
- *Climate risk training for company employees and customers*; institutions that need to train their analysts and customers on climate risks include such efforts in their business processes through workshops, recommendation notes, and different training and evaluation tools.

### Practices for Creating New Value

- *Operational energy and sustainability investments*; financial institutions have started to invest in institutional energy reduction, employee training programmes at an increasing rate, striving to reduce their costs and environmental impacts and enhance their brand reputation through sustainable building certification and energy management programmes.
- *Formulating solutions for high-risk sectors in terms of climate change impacts*; with the awareness that many opportunities are available to ensure adaptation by enhancing the climate resilience of high-risk sectors such as agriculture, tourism and infrastructure, financial institutions are making investments on developing new financial instruments with regard to climate change impact preparation or post-disaster response. New markets that will be affected by agricultural changes and the physical risks of climate change including water and pesticide are actively determined by Citigroup. Citigroup identified an increasing need for product in the pharmaceutical sector due to spreading disease vectors. The Canadian Imperial Bank for Commerce invests in infrastructure and construction due to the increasing need for



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repairing or replacing the existing infrastructure including highways, docks, airports, sewer systems and buildings, to enhance their climate resilience.

- *Investments in developing financial markets;* in case of needing emergency financial support for adaptation, there are a few newly developing markets available in which financial service companies are interested and predict increases in market shares. Deutsche Bank has been investigating the future of agriculture in new locations based on the forecasted impacts of climate change, planning to guide customers who currently invest or are interested in investing in agriculture.
- *Supporting low-carbon practices;* certain pension funds have been increasing their allocations to their low-carbon and energy-efficient assets, thus playing a crucial leadership role. Some institutional investors particularly invest in renewable projects through private capital and infrastructure opportunities while some banks shift their credit portfolio towards financing renewable energy projects. Such actions directly impact the availability of capital for renewable energy projects.

Various partnerships are established among governments, development banks, and financial institutions to finance and make billions of dollars of investment in renewable energy and energy efficiency opportunities in developing markets.

Green bonds- There is a growing green bond market that is an integral part of providing the loan capital required to finance a low-carbon transition. Financial institutions have been applying new techniques to reduce the carbon emissions of credit and investment portfolios, which is seen to be an indirect but potentially strong mechanism for reducing global emissions. Additionally, new strategies and approaches are developed by institutional investors to manage the risks arising from exposure to fossil fuel companies.

Green bonds are explained in **Error! Reference source not found..**

### Box 2. Green Bonds

The key feature of **green bonds** is that bond yields are used in green projects. For this purpose, investors are provided with detailed information on the projects in which green bonds will be used, and the yields are transferred to a special account. Green bonds have the same characteristics and advantages in comparison to standard bonds and do not bring additional burdens to investors.

The green market bond went into a rapid growth in 2013 when green bonds were made available to investors. Reaching an amount of 258 billion \$ in 2019, green bonds (which amounted to 3 billion \$ in 2012) are expected to increase to 350 billion \$ in 2020.

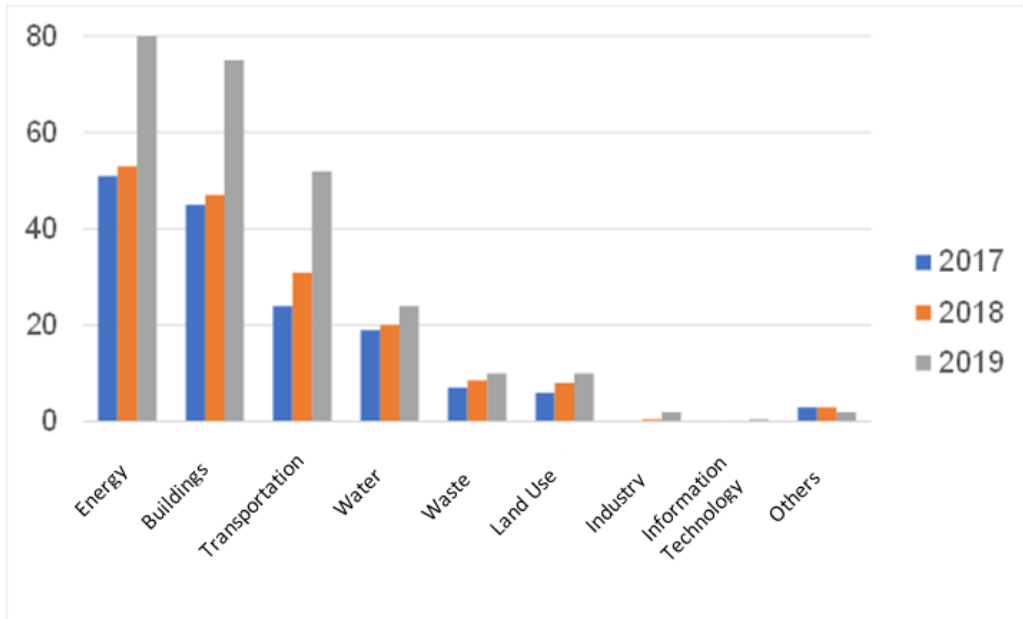
These bonds support low-carbon transition and climate resilient growth projects, which means that international finance institutions maintain their significance in the green bond market.

As of 2013, municipalities and local governments, with the State of Massachusetts being the first, to develop green bonds. Examples of local governments offering green bonds include Massachusetts New York and California in USA, Ontario in Canada, City of Johannesburg in Africa, and Gothenburg in Sweden.



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Source: Green Bonds Global State of the Markets, 2019, <https://www.climatebonds.net/>

The recommendations issued in international studies with regard to the finance sector's climate change adaptation are summarized below:

**1. Developing risk and opportunity assessment mechanisms:** Companies in the finance sectors must establish a process for a comprehensive risk and opportunity assessment for company and customer investments that clearly measure internal operations and climate change-related risks. Prominent companies have begun to formulate more holistic projects that integrate social problems as well as the layers of extensive environmental assessment aspects. Services, such as analyst training, and collaborations to determine the risks and opportunities resulting from insurance pricing and climate change are increasingly further integrated in company processes.

**2. Determining and joining strategic partnerships:** Uniting the sectors, geographies, and communities that are vulnerable to climate change with financing opportunities is among the key roles of the finance sector. The model partnership between Axa Re with the World Food Programme to provide weather derivatives in cases of drought emphasizes the sector's ability to protect vulnerable communities.

**3. Developing promotion products for climate change adaptation:** The sector has a distinct advantage in guiding the investments and development of climate resilient sectors and geographies. Through strategic investments and products complemented with promotions, finance companies can take the lead in ensuring innovation and climate change adaptation for a better prepared community (Finley and Schuchard, 2011).

As mentioned above, a pioneering policy in the world was formulated by the European Commission with their studies in 2018. After the Paris Agreement, in 2016, the European Commission established the High Level Expert Group on Sustainable Finance which declared its action plan on sustainable finance in March 2018 followed by the first adopted package of measures (action plan) in May 2018. The Action Plan consists of 10 actions under 3 main goals which are; i) reorienting capital flows towards sustainable investment; ii) mainstreaming sustainability into risk management; iii) fostering transparency and long-termism in financial and economic activity (European Commission). The framework of the European Commission's action plan is extremely broad and ambitious, ranging from establishing an EU taxonomy system for sustainable economic activities and creating standards and



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labels for green financial products to clarifying institutional investors and strengthening the duties, sustainability disclosure and accounting of asset managers.

The Plan clearly specifies the need to mainstream roadmaps, climate change costs and risks into financial frameworks for a new and more ambitious EU strategy on climate change adaptation.

In 2020, the European commission declared its intention to initiate a comprehensive strategy on the subject in the third quarter of 2020 within the framework of the ‘European Green Deal’ as a top priority in its new work schedule. Accordingly, the EU Adaptation Strategy will aim to orient private capital flows towards green investments (EEA).

Building Climate Resilience for the Finance Sector in Turkey- Developing sustainable finance approach and practices has a transformative potential for all sectors and the finance sector in particular. A significant investment is needed to achieve the Sustainable Development Goals (SDGs) and the 2030 UN Agenda. For funding institutions to pay attention to sustainability principles in their credit facility processes and for the companies that use the funding on their projects to conduct business in the framework of such principles lead to a better management of risks, increasing the investments in sustainable development.

The awareness on sustainability in the finance sector in Turkey started to increase with the Principles of Banking Ethics issued by the Banking Regulation and Supervision Agency (BRSA) and Banks Association of Turkey (BAT) in 2006. The aim of the principles is to determine a roadmap for growing the system, increasing service quality, and ensuring that the banks’ relationship with their stakeholders is conducted in line with ethical principles.

In 2014, a guide involving best practices were prepared by the Banks Association of Turkey, Role of The Financial Sector in Sustainable Growth Working Group within the scope of the contribution of the banking and finance sectors to sustainable development. In the Sustainability Guidelines for the Banking Sector, good sustainability practices in the banking and finance sector were built within the framework of seven principles which are:

- Management of the banking sector’s internal effects
- Human rights and employee rights
- Stakeholder engagement and communication
- Corporate governance
- Capacity improvement
- Monitoring and reporting.

Turkey is a member of only the Sustainable Banking Network among the international coalitions mentioned above (Henderson and Mancini, 2019). Some international institutions such as UNEP FI show a significant effort in increasing the environmental and social awareness of financial institutions and receiving a positive response from various financial institutions that have reached a certain gravity in the international arena. The most important indicator of this is that, as of October 2019, the ‘UNEP Finance Initiative Pledges’ have been signed by 278 financial institutions, 60% of which comprises banks (168 banks), 26% insurance companies (72 insurance companies), and 16% other financial institutions (38 other financial institutions). Among the banks that pledged to apply the United Nation Principles for Responsible Banking are Garanti BBVA, ING, Development Investment Bank, Şekerbank, Industrial Development Bank of Turkey, and Yapı Kredi from Turkey.

In terms of **strategic planning**, the stance of Turkey’s Climate Change Adaptation Strategy and Action Plan (2011-2023) with regard to the finance sector was to emphasize the issue of developing innovative



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finance mechanisms that will allow for climate change adaptation. However, it is seen when compared with international efforts that the subject of new finance mechanisms, which is important for the development of the financing sector, is not sufficient for climate change adaptation on its own. Another subject touched upon in the Strategy involves integrated cost-benefit analyses that take the mitigation and adaptation synergy into consideration in all relevant sectors, and particularly in climate-dependent sectors such as agriculture, energy, tourism, water, fishing, and industry. Yet, the efforts have not been given much depth as to determine adaptation costs; since carrying out these efforts requires examining the risks that will be faced by the sectors, they may be important in determining the own risks of the finance sector as well as its customers.

The “Sustainable Finance Programme” recently (2018) prepared by the European Union as a priority step should be examined, and efforts should be undertaken with regard to the actions that may align with Turkey’s national conditions.

### 3.8.3 Work by stakeholders

In 2014, Borsa Istanbul started to calculate the BIST Sustainability Index, aiming to create an index that will include companies with high corporate sustainability performances that are traded on Borsa Istanbul, and to enhance the understanding, knowledge, and practices on sustainability across Turkey and among Borsa Istanbul companies in particular. In this context, a “Sustainability Guide” for companies was issued. The index, which only covered 15 companies when it was first initiated, was expanded to cover 61 companies, 11 of which are from the finance sector (banking and insurance), by 2020.

Although sustainable finance has been long discussed in Turkey, until recently the subject of focus has involved the areas to which funds will be shifted. Other actors of the finance sector continue to undertake individual voluntary efforts on sustainable finance with various motivations particularly including reputation. Banks have been carrying out various institutional efforts to get one step ahead in the sector in which they compete. For example, Garanti BBVA declared that the concept of sustainability needed to be mainstreamed into decision-making mechanisms and business processes in order to create value for its stakeholders. Accordingly, the Sustainability Committee, which was established in 2010 to officially review and approve the Bank’s activities related to sustainability, is chaired by an Executive Board Member and convenes regularly to monitor and contribute to the progress of all sustainability efforts.

Albaraka Türk has been conducting various scenario analysis based on the Sustainable Development Scenario prepared by the International Energy Agency (IEA). Choosing this scenario based on the fact that it supports their commitment to meet the criteria determined by the Paris Agreement, the company announced that it has adopted TCFD’s standards with regard to their climate risk disclosure until 2024.

The private sector seems to be more active than the public sector and non-governmental organizations in sustainability efforts in Turkey. Based on the CDP reports, emission reduction efforts for energy and water consumption are at the forefront, particularly in sustainability efforts led by foreign capital institutions.

The first green bond, which was in the amount of 300 million USD, was issued by TSKB in **2016**. TSKB supported renewable energy and energy efficiency projects with the revenue acquired from the issuance, which received 4 billion USD from 317 institutions.

Isbank continues to help farmers be prepared against various risks by implementing technology-based innovative projects in the agriculture sector, which is greatly important for the national economy (Yıldız, 2019). Through the free “İmeceMobil” application that all farmers can download in their



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smartphones, the details of production plant related to fields, gardens and livestock are saved and the weather forecast reports for such areas can be displayed. This allows for farmers to receive early warning on instant weather events such as frost, hail, lightning, storm, and heavy rain as well as preventing the loss of revenue of farmers' customers.

Such experiences accumulated in the private sector are shared with stakeholders through various conferences, seminars and webinars with the contributions of NGOs.

The examples in Europe and across the world are the driving force in the guides and policies formulated by non-profit sector formations and unions. In addition to the "Sustainability Guidelines for the Banking Sector" published in 2014, the Banking Regulation and Supervisory Agency and Banks Association of Turkey have been organizing or joining meetings and workshops for increasing awareness.

The duties that can be assumed by **sector unions** include carrying out further systematic efforts in this area, compiling good practice models, examining the European Union Action Plan on Financing Sustainable Growth and what can be done in Turkey in this regard, and transferring information to legislators.

There are voluntary formations titled *Business Council for Sustainable Development (BCSD Turkey)* and *Sustainable Finance Working Group* in Turkey that are supported by the business world. These organizations play an active role in the periodic Sustainable Finance Forums. Most recently, the 6<sup>th</sup> Sustainable Finance Forum, organized in cooperation with BCSD Turkey and UNEP Finance Initiative (UNEP FI), was hosted by Borsa Istanbul on 31 October 2019 (Global Compact Turkey, 2019).

Another formation that carries out significant efforts on the subject in Turkey is the UN Global Compact which is the largest institutional sustainability initiative that encourages member companies to take action as part of their responsibility and the public to give support. UN Global Compact strives to ensure that institutions add value not only to their financial resources but also to people, communities, and the planet. With over 12,000 signatories in 162 countries, UN Global Compact is the world's most extensive voluntary institutional sustainability initiative. UN Global Compact Turkey, Sustainable Finance Working Group aims to disseminate the concept of sustainability across real sectors in Turkey, and particularly the finance sector, and to mobilize the private sector in creating the financial resources required to meet Sustainable Development Goals.

Priority subjects include developing financial instruments and products for low-carbon and inclusive growth as well as increasing collaborations focused on sustainable development. In line with such goals and objectives, the Working Group closely follows the international agenda and practices closely, determining and continuously updating standards for sustainability. The group also carries out activities to disseminate these standards and increase business and public awareness in this regard, organizes meetings and trainings in Turkey and abroad for sharing good practice models (Global Compact Turkey).

There are very few research/studies, most of which are not current, that examine climate change risks in the finance sector. Scenario studies on the impacts of climate change and impact assessments are conducted by universities in Turkey. The cooperation of finance sector representatives with universities will increase the credibility of risk analyses.





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### 3.9 Healthcare sector and climate change adaptation

- In order to enhance the capacity of Turkey's healthcare system to combat risks caused by climate change, it is essential to strengthen the institutional capacity of the Ministry of Health in this field.
- Monitoring, prevention, control and early warning systems for the impacts of climate change on human health have not been developed in Turkey.
- The impacts of climate change on human health are not taken into account with respect to vulnerable groups in Turkey.
- Healthcare sector's adaptation to climate change should be a priority goal for local governments.
- Deaths due to heatwaves in Turkey are not included in official health statistics.
- It should be considered that the COVID-19 pandemic can play a stimulating and motivating role in developing climate change risk management mechanisms in Turkey's healthcare sector.

Today, it is a scientifically acknowledged fact that climate change is a severe problem in terms of the health of individuals and communities, and the number of research on the link between the climate crisis and diseases are increasing. As with many research, a series of factors such as age, sex, population structure and distribution, socio-economic status, individual hygiene conditions, skin structure, etc. are taken into consideration when researching the impacts of climate change on public health.

#### 3.9.1 Sectoral impact of climate change

The direct impacts of climate change on human health (skin cancers, kidney diseases, diabetes and blood pressure conditions, cardiovascular diseases, respiratory diseases, etc.) result from extreme temperatures (heatwaves, floods, storms, hurricanes, extreme/excessive weather events, cold spells, etc.). On the other hand, the indirect impacts manifest through water and food borne diseases, lack of water and nutrition difficulties, reduced nutritional value (intestinal infections, etc.), air pollution, increased ozone and particulate matter (asthma, COPD, lung cancer, etc.) and infectious diseases (vectoral and zoonotic/animal borne diseases, malaria, Crimean-congo haemorrhagic fever, etc.). **Error! Reference source not found.** summarizes the direct impacts of polluting gases -including greenhouse gases- on human health (WHO, 2013).

Table 21. Polluting Gases and Direct Impacts on Human Health

Polluting Gas	Main Source of Pollutant	Impacts on Human Health
<b>Carbon dioxide</b>	Cement production, deforestation, burning fossil fuels such as coal, petroleum and natural gas	Headaches, dizziness, discomfort, difficulty in breathing, sweating, fatigue, increased heart rate, increased blood pressure, coma, central nervous system collapse, suffocation, seizures
<b>Methane</b>	Production, distribution and use of fossil fuel	Highly concentrated methane can replace the oxygen in the air. Nausea/vomiting, falling, seizure, coma, and risk of death
<b>Nitrogen dioxide</b>	Traffic, burning of fossil fuels	Respiratory problems, immune system disruptions, lung infections
<b>Nitrogen oxides</b>	Emissions from transportation, burning of fossil fuels	Necroses, poisoning or death as a result of mixing with blood



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<b>Sulphur dioxide</b>	Burning of fossil fuels	Respiration disorders
<b>Particulate Matter</b>	Industrial processes, burning of fossil fuels, specific chemical reactions in agriculture	Cancer, cardiac diseases, increased child death rates
<b>Ozone and non-methane volatile organic compounds</b>	Gases emitted through transport and traffic, distortion by sunlight	Respiration disorders, eye and nose irritations, asthma, immune system disruptions

The most important current and future health impacts of climate change are listed by the European Union as follows (European Commission):

- Increasing mortality (deaths) and morbidity (diseases) due to summer heat
- Decreasing mortality (deaths) and morbidity (diseases) due to winter cold
- Increasing accidents and impact risks caused by extreme weather events (floods, fires, storms)
- Changes in morbidity burden (e.g. vector-, rodent-, water-, or food-borne diseases)
- Changes in the range of viruses, pests, and diseases in the seasonal distribution of certain allergenic pollen species
- Animal diseases reappearing in Europe as a result of viral zoonotic (spreading from animals to humans) and vector-borne diseases
- Existing and re-emerging plant pests (insects, pathogens, other pests), and diseases affecting forest and crop systems
- Risks related to air quality and ozone changes.

### 3.9.2 Sectoral adaptation to climate change

**In terms of international climate regime,** the impacts of climate change on human health were first introduced to the global agenda as one of the commitments of the UNFCCC (UNFCCC, Article 1 and Article 4(f)). Although some studies and research were conducted on the relationship between climate and health under the umbrella of WHO (World Health Organization) and IPCC after the 90s, this issue was not given due importance in international climate negotiations. The relationship of climate and public health was discussed elaborately for the first time in IPCC's 4<sup>th</sup> Assessment Report (2007). The link between climate change and mass mortality events was brought up in climate negotiations for the first time in 2011 (COP17, Durban).

The health risks related to climate change in OECD member states are approached in 3 categories which are; i) general health, ii) infectious diseases, and iii) temperature-related diseases. In this framework, OECD prioritizes health and climate-related infrastructure works, drawing attention to early warning and observation systems in applications to ensure climate change adaptation (Kiraz, 2020)

The "Climate Change and Health: A Tool to Estimate Health and Adaptation Costs" was published by World Health Organization (WHO) in 2013. It was predicted that this instrument, which would provide guidance to decision makers for in policy planning, would help to evaluate the climate change and health relationship through standard economic data and to facilitate territorial/regional comparisons.

**Error! Reference source not found.** shows the steps to take for estimating the climate change a daptation costs of the healthcare sector (Kiraz, 2020).



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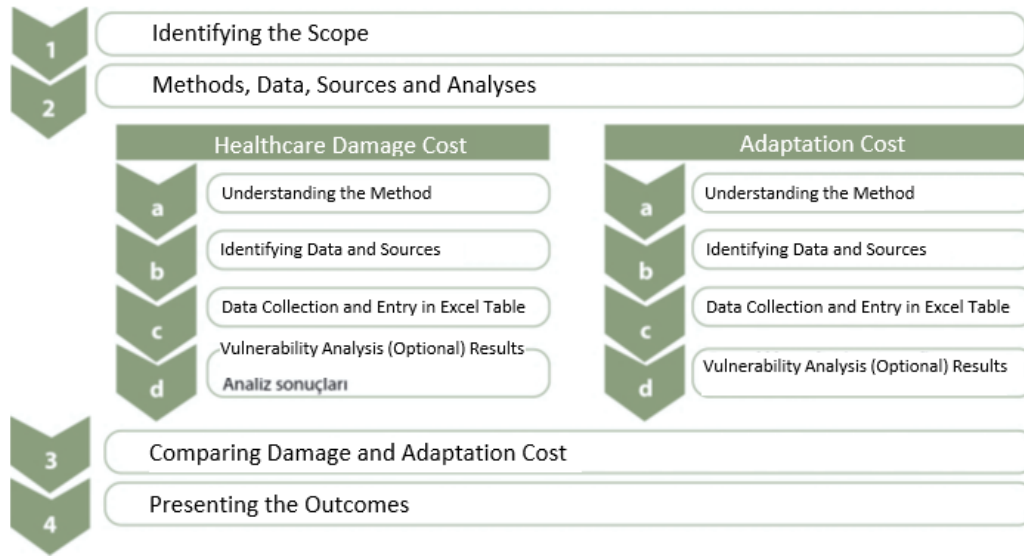


Figure 19. Steps for Estimating the Climate Change Adaptation Costs of the Healthcare Sector

A ministerial declaration on the impacts of climate change was published by WHO for the first time on November 15, 2016, immediately following the global adoption of the Paris Agreement on 4 November 2016. The Declaration was signed by over 20 environment and health ministers of most countries to date.

High level decision makers accepted that, with this declaration, combating climate change and its health impacts will make significant contributions to public health and more importantly, committed to take public health into account in governments' greenhouse gas emission reduction objectives and policy planning for ensuring climate change adaptation.

*"Acknowledging that climate change is a common concern of humankind, Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, **the right to health** ...".*

Paris Agreement, Preamble, 4 November

The "Special Report on Health and Climate Change" was presented by WHO at the 24<sup>th</sup> Conference of the Parties to the UNFCCC (COP24, Madrid) in 2018. In the report, the highlighted policy recommendations for *decision makers* with respect to adapting to the impacts of climate change on the healthcare sector were as follows; i) include the health implications of mitigation and adaptation measures in the design of economic and fiscal policies, ii) remove existing barriers to investment in health adaptation to climate change, iii) facilitate and promote the engagement of the health community as advocates for climate action, iv) ensure that central and local governments in particular as well as other relevant stakeholders accept that healthcare is a *preventive* policy rather than a *protective* one in their climate change policies, and v) systematically track progress in health resulting from climate change mitigation and adaptation.

Presently, WHO emphasizes that the climate crisis is the greatest global crisis in terms of public health. In this framework, global strategies are determined under the leadership of WHO.

The impacts of climate change on societies and the health of individuals have been studied more intensively since the beginning of this century; recently, the link between the climate crisis and diseases is investigated through climate modelling and predictions/projections are made on various



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issues. According to the “IPCC Special Report on Global Warming of 1.5°C” published in 2018, it is predicted that 250,000 people across the world will die from heat stress and epidemics.

At the international level, non-governmental organizations with a voice in healthcare, such as the European Respiratory Society and European Academy of Allergy and Clinical Immunology, as well as various universities and research institutes have begun to draw further attention to this risk and increased their studies as other stakeholders working in this field.

In **legislative** terms, **Turkey** has no direct law on ensuring adaptation to climate change in healthcare.

From the perspective of **institution building**, the Ministry of Health is directly responsible for the implementation of national health policies. Studies on the relationship between climate change and health are conducted by the General Directorate of Public Health and the Environmental Health Department under the Ministry of Health.

The “Health and Food Policy Board” was established as a higher board in the Presidential Government System.<sup>192</sup> The Board’s tasks and powers that are indirectly related to climate change adaptation signify that the health-agriculture-food sectors should be addressed in combination, and can be listed as follows:

- Developing policy recommendations for the improvement of the healthcare system, conducting research on food health and safety, developing policy recommendations for food health protection through risk analysis,
- Developing policy recommendations for the prevention and mitigation of increasing diseases in the society,
- Following international developments in healthcare services and technologies and reporting the results,
- Conducting research and making recommendations on reducing the burden of healthcare institutions and increasing their efficiency by enhancing preventive healthcare services,
- Making policy recommendations by conducting research on the efficient use of water resources and prevention of water waste,
- Conducting research and developing policy recommendations and supporting policies for the protection, rehabilitation and diversification of domestic gene resources in agriculture and livestock breeding.

Serving as a higher institution in the healthcare sector in Turkey, the Health Institutes of Turkey (HIT) has important responsibilities in terms of developing healthcare policies.<sup>193</sup> HIT has been granted extremely extensive powers such as increasing and perpetuating Turkey’s competitive power to serve the country and humankind in health sciences and technologies; meeting our country’s advanced technology and innovation needs by taking into consideration the development plan goals and the priorities determined by the President; ensuring the production of new products and the development of those that exist; providing researchers with a scientific atmosphere; carrying out and causing to undertake scientific research by cooperating with public law and private law bodies and coordinating and promoting such research; contributing to R & D; leading the development of health science and technology culture and ecosystems; and carrying out accreditation activities in healthcare services.

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<sup>192</sup> Presidential Decree No.1 (OG of 10 July 2018 issue 30474).

<sup>193</sup> Presidential Decree No.4 (OG of 15 July 2018 issue 30479).



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Institutions that focus on various subsections were established under HIT.<sup>194</sup> While the remits of these institutes are not directly related to climate change, the “National Public Health and Chronic Diseases Institute” -which the legislation allows for establishing science committees under institutes as needed- can possibly conduct scientific studies related to climate and health.

On the other hand, early warning systems play a major role in minimizing the health impacts of climate change. The “Health Hazards Early Warning and Response Department” was established under the General Directorate of Public Health of the Ministry of Health. The decision makers in healthcare should put on their agenda to enhance the current capacity of the Ministry of Health to manage data collection, analysis, evaluation, monitoring, early warning, and stakeholder mobilization processes in line with the climate change response standards of WHO. Additionally, fundamental subjects such as the disease burden of the health impacts of climate change as well as the impacts on health insurance and the urban poor should be considered in terms of healthcare economics.

From the perspective of **strategic planning**, Turkey’s first policy paper to guide decision makers on the impacts of climate change on public health is the “National Climate Change Adaptation Strategy and Action Plan (2011-2023)” prepared by the then-Ministry of Environment and Forestry. This policy paper sets objectives on various subjects under the main heading “Identifying the Existing and Future Effects and Risks of Climate Change on Public Health”, listing the responsible institutions in this regard.

The objective which directly states that “cooperating with countries and national and international organizations working in areas that may affect human health due to climate change such as migration movements, international trade and tourism” is extremely valuable in terms of taking the social signifiers of the healthcare sector in climate change response.

The “Action Plan on Heat and Heatwaves” was prepared by the Ministry of Health in 2010<sup>195</sup> and involves accurate and timely heat-health warning system; information plans on temperature; availability of special care, healthcare and social care services for vulnerable groups; real-time monitoring and evaluation. Since there have been many deaths caused by heart attacks, cardiovascular diseases, kidney diseases, respiratory problems and metabolic diseases particularly during heatwaves in Turkey, the Ministry of Health has been carrying out public information studies on hot spells and heatwaves, especially during summer, and keeping track of heat-related deaths and diseases.

As remarked in the Action Plan on Heat and Heatwaves, the issue that vulnerable groups are/will be exposed to the adverse impacts of climate change to a larger extent requires further focus. The main target group of climate and health issues is the whole society; however, it seems beneficial to address specific segments and diseases as a priority in the process of awareness raising on the health impacts of climate change in order to achieve immediate outputs in the short/medium term. For example, as it has been proven that extreme heat/heavy exposure to sunlight is risky in terms of skin cancers, it must be emphasized that especially construction workers, agricultural employees/workers, tourism workers, and those living in coastal settlements constitute a vulnerable group in this regard.

In 2015, the Ministry of Health published the “National Programme and Action Plan on Mitigating the Adverse Health Effects of Climate Change (2015-2019)”. The Plan was prepared with the contributions of the Turkish Public Health Institution (which currently operates as the General Directorate of Public Health as a main unit of the Ministry). The Plan categorizes the work on the adverse impacts of climate

<sup>194</sup> These are: National Cancer Institute, National Biotechnology Institute, Turkish Maternal Child and Adolescent Health Institute, National Public Health and Chronic Diseases Institute, National Traditional and Complementary Medicine Institute, and Turkish Health Care Quality and Accreditation Institute.

<sup>195</sup> The enforcement of this plan in 2010 by the Ministry was not specified in the National Climate Change Adaptation Strategy and Action Plan, and further information on the plan and its implementation was not available.



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change on human health in three main headings as; i) impacts of hot spells and extreme heatwaves, ii) impacts of severe weather events, and iii) infectious diseases/epidemics.

While the practices under the National Programme and Action Plan on Mitigating the Adverse Health Effects of Climate Change have been continuing, the activities under the Plan are not systematically monitored and evaluated. The Ministry of Health has founded a separate commission for investigating climate change-related diseases (OECD, 2019). It is aimed to integrate the results of the research that are/will be conducted in this framework with early warning systems.

Heatwaves, the frequency and intensity of which gradually increase, are expected to adversely affect the population, and particularly the young, the elderly, and cardiovascular patients. The Plan also involves measures to mitigate the impacts of climate change and extreme weather events on human health by increasing public awareness, since some extreme weather events such as floods can cause certain diseases to spread further. In this framework, training programmes were organized in various provinces by the Ministry of Health. For example, nearly 3,000 laboratory staff was trained between 2015-2017 to enhance the institutional capacity in order for the Ministry to monitor the incidence of climate change-related diseases (T.R. Ministry of Health).

There are no databases in Turkey to establish the relationship between climate change and health. It has been stated by experts that the harmonization of databases, such as the current ICD-10/11 disease classification systems used in the national healthcare system and the training of users, are the priority elements of decision making.

The Coronavirus Pandemic, which took the entire world by storm in 2020, was a tragic reminder of the fact of infectious diseases which are one of the indirect health impacts of climate change. Another important subject that is now discussed and investigated across the world is the need to take into account what the cost will be to the healthcare economy to make resilient the global community, whose physical resilience has been changed by COVID-19 (Kiraz, 2020).

Future objectives for the prevention of infectious diseases, which are indirect impacts of climate change at the national level, were included in all basic strategy papers on climate change (National Adaptation Strategy and Action Plan, IDES, IDEP). It should be considered that the COVID-19 pandemic can be a stimulant in developing climate change risk management mechanisms in the healthcare sector in Turkey, serving as a significant basis and time to address the health effects of climate change.

#### 3.9.3 Work by stakeholders

The report “Impacts of Climate Change on Human Health” prepared under the project “Enhancing Required Joint Efforts on Climate Action Project/iklimIN (August 2017-2020)” funded by EU IPA, of which the Ministry of Environment and Urbanization is a beneficiary, is a pioneering report published in Turkey (Kiraz, 2020).

The General Directorate of Meteorology published the “Impacts of Climate Change on Health” report in 2012. The report was prepared by the Climatology Branch under the Department of Research of the General Directorate within the framework of the internal institution building of that period.

In Turkey, the public health aspect is neglected in the climate change studies of **municipalities**. However, some municipality unions have been working on this subject.





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Between 2015-2016, the Healthy Cities Association<sup>196</sup> conducted a field research to determine and enhance the urban climate change adaptation capacities in member municipalities and to draw attention to the public health impacts of climate change (Türe and Ar, 2005).

Among the **unions of municipalities**, the one that directly works on climate change adaptation is the Healthy Cities Association established in 2005. With permanent offices in some municipalities, the Association has 74 member municipalities as of February 2020. A study titled “Determining Climate Change Adaptation Capacities of Cities” was conducted by the Healthy Cities Association in its member cities between 2015-2016. This study, which was conducted based on a comprehensive survey that involved 40 member municipalities and was prepared to determine cities’ climate change vulnerabilities, established the strengths and weaknesses of cities in terms of climate resilience, questioning the climate change vulnerabilities of cities based on the “urban health profiles” determined by WHO and basic criteria for Turkey. The study was based on ICLEI’s (Local Governments for Sustainability/ICLEI) principles with regard to local climate change. In this framework, the Research sought answers to the following questions that are directly related to climate change in 40 municipalities:

- Is there any time of the day when NO<sub>2</sub> levels are above the limits?
- Are there days in the year when the SO<sub>2</sub>, PM<sub>10</sub> amount in the air is above the limits in terms of health?
- Is the distribution of open-green areas in the city systematic and balanced?
- Are there residential areas located in flood zones?
- Are there industrial areas located in flood zones?
- Are there main transport connections that will be blocked for access in case of flood?
- Are there any disaster warnings in the city?
- Are there urban heat island effects in the city?

In the study, the data and information indicating that cities have different climate change vulnerability levels and therefore require different adaptation efforts were evaluated digitally with the support of the Information Technology Directorate of Eskişehir Tepebaşı Municipality. The results of this research of the Healthy Cities Association set forth the criteria based on which each city was under a risk of climate change. Another result of the research showed the inadequacy of the awareness and knowledge levels of urban administrators and the public on the ways in which they would be affected by climate change in the cities where the research was conducted. In general, this research can serve to guide in establishing a specific urban & climate & healthcare profile on the impacts of climate change in the cities in Turkey.

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<sup>196</sup> The Healthy Cities Association operates in line with the criteria of WHO Healthy Cities Network.



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There are very few non-governmental organizations in Turkey that work on the field of climate & healthcare by taking a hybrid approach. Those that are prominent in the medical community are the Society of Doctors for Environment, Turkish Respiratory Association, Turkish Thoracic Society, and Turkish Medical Association. One of the main objectives of the Health and Climate Change Association, which recently became operational and is directly concerned with the issue, is to increase and disseminate the scientific research in Turkey.

*“Recognizes the social, economic and environmental value of voluntary mitigation actions and their co-benefits for adaptation, **health** and sustainable development.”*

Paris Agreement, Decisions to Give Effect to the Agreement: Decision No: 109.

In climate change response, there has been increasing research on the adverse public health impacts (permanent damage to various organs and particularly brain and heart, headaches, respiratory difficulties, blood pressure problems, etc. due to fuel processes such as coal, petroleum and natural gas, high concentration of greenhouse gases, and lack of oxygen in the air) of carbon-fossil fuel investments particularly in thermal power plants. Mostly conducted by non-governmental organizations in Turkey, these studies focus on the fact that terminating such investments will have favourable impacts on human health as well as proving to be profitable for the Turkish healthcare sector through cost-benefit analyses, in order to guide decision makers. In other words, the key point is the economic vulnerability of the economic sector.

One of the sectors discussed in the “Cost of Inertia” sub-component of the “Low Carbon Development Pathways and Priorities for Turkey” project was healthcare. Completed in 2017 in cooperation with the Earth Association, WWF Turkey and E3G (Third Generation Environmentalism), the Project set forth that policies that prioritize climate change adaptation in numerous sectors are required in Turkey and analysed the healthcare sector in this framework.

The research “Women’s Solutions to Climate Change in Turkey” which was published by the Global Balance Association in 2018 approached the public health impacts of climate change from a gender equality perspective. According to the research, climate change has direct and indirect impacts on human health which vary among men and women. In line with WHO reports and data, the study emphasizes that climate change introduces an additional health burden on women. The results of certain studies from the world were shared on how the body resistance of women, and particularly pregnant women, were more vulnerable and affected further by climate change than that of men. The study also pointed out that there were no study or data on this subject in Turkey (Talu, 2018).

The Turkish Thoracic Society developed a mobile application named ‘Nefesiniz Cebinizde (Your Breath in Your Pocket)’ in 2017. The application, which is still available, allowed individuals to see the air pollution data in their region obtained through regional air pollution measurement stations, and the meaning of the values in the data (Damcı, 2018).

With regard to the healthcare adaptation studies of universities, the first remarkable study related to infectious diseases was the project titled “Infectious Diseases Monitoring and Control System” conducted in 2011 by Çukurova University, Tropical Diseases Research and Application Centre. As project was a sub-research of the National Climate Change Adaptation Strategy and Action Plan, a cold storage vector transport vehicle as well as real-time PCR molecular infrastructure investment were granted under the project in order to support the development of infrastructure facilities for climate change adaptation.

The study titled “Coal Report: Turkey’s Coal Policies Related to Climate Change, Economy and Health”, which was publicly shared by Sabancı University, Istanbul Policy Centre (IPM) in 2017, examined the health impacts of coal as a greenhouse gas resource in the instance of Turkey. In 2018, a scientific



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report titled “Çanakkale Status Report 2018” was prepared under the leadership of scientists and with the contributions of Çanakkale Onsekiz Mart University Faculty of Medicine, Department of Public Health; TUCEA Chamber of Agricultural Engineers Çanakkale Office, Foresters’ Association of Turkey Çanakkale Office, and İDA Solidarity Association. Within the scope of the report, modelling studies were conducted for the air pollution and acid rains caused by the fossil fuel thermal power plants that were planned to be built in the Çanakkale region throughout 2017. The adverse air quality and human health impacts (cardiac and respiratory diseases, premature deaths, lung cancer, etc.) of the planned power plants in and around Çanakkale were determined according to the results of the modelling study titled “Air Pollution Modelling of Thermal Power Plants: Çanakkale and Biga Peninsula” (Türkeş, 2019).

In Turkey, literature research on the existence of links between climate change and public health, although lacking in number, have been continuing since the early 2000s. A new journal focusing on the impacts of climate change on individual and public health is being published under the leadership of Aydın Adnan Menderes University Department of Environmental Health and Faculty of Medicine, Department of Public Health. The scientific journal titled “Climate and Health Journal” is a first in Turkey due to providing an international, peer-reviewed and open-access basis for research for academic articles related to climate change and health.

A climate change risk study for Turkey, which examined the market conditions to guide the business community for climate change adaptation purposes, was conducted in 2014 by EBRD, which is an international finance organization. The study titled “Climate Risk Case Study, Pilot Climate Change Adaptation Market Study: Turkey” referred to the adverse climate change impacts on the healthcare sector in Turkey as a risk category under the climate change adaptation of the private sector entities operating the healthcare sector (EBRD, 2014).



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#### 3.10 Manufacturing industry and climate change adaptation

- As much as industries are a part of the polluting components causing the climate crisis, they are also one of the components that are the most economically affected by the crisis.
- Implementation of effective adaptation actions in industries is based on carrying out rational risk analyses. The risk analyses should be applied across businesses and specifically for economic sectors, based on holistic approaches.
- The impacts of climate change on industries may be directly observed on plants or on a supply chain basis as well as through external stakeholders. In this context, it is also important to analyse the risks that have not been observed in the current scenario but will be seen in the short term (e.g. price risk).
- In Turkey, the climate actions of industries were largely built on the monitoring and reduction of greenhouse gas emissions. In that context, a national climate change adaptation plan/series of plans that takes Turkish industry as the target group should be introduced in cooperation with the public and private sectors, academia, and non-governmental organizations.
- When examining the climate change studies in which the industries in Turkey are the target group, there are only a few public policy papers and a few academic articles. In this regard, climate change adaptation efforts should be promoted throughout industries, with the engagement of sector representatives and associations.

With a share of 25.44% in gross global revenue according to 2017 data and a share of 5.6% in global greenhouse gas emissions according to 2016 data, industries are one of the most conspicuous sectoral components at the economic and environmental scales among all economic sectors. In that context, industries become a vital part of the operation of global economy as well as one of the greatest causes of global change which is the most severe environmental and economic crisis of this age (Statista, 2017 & Our World in Data, 2016).

Climate change introduces extremely daunting scenarios for all economic sectors. Guided by radical and unpredictable changes in global temperature averages, precipitation regimes and extreme weather events and other impacts, these scenarios force the economic sectors that are among the causes of the crisis to become a part of the solution. In that context, even the balance in the sectors which are not easily contemplated on a platform where climate change and its impacts are discussed has seemingly become quite devastating. For example, although Donald Trump, the president of USA which is the world's largest economy, withdrew his country from the Paris Agreement, he had to pass the 'Fiscal Year 2019 National Defence Authorization Act' which involved the constructive measures required in the defence industry in order for the Department of Defence to safely discharge its duties. The sports sector is also one of those affected by the climate crisis; according to a recent research, it is predicted that within the next 30 years, a quarter of the soccer fields of the English Premiere League will be damaged by sea levels that rise each year and the Winter Olympics will be extremely challenging to carry through due to increasing temperatures.

Although efforts to reduce emissions on both sectoral and company scales have started in certain industries, the strategic decisions and measures taken for industrial climate change adaptation cannot even proceed to the implementation stage in most of the developing countries, including Turkey (Pew Center on Global Climate Change, 2020). However, in order to solve the 12-year climate action for the climate crisis that is projected in the IPCC's 1.5 Degree Report within schedule, it is vital to design the climate actions to be implemented in industries with an integrated and holistic approach that harmonizes adaptation and mitigation efforts.

Taking into consideration that the Turkish industry has also been growing as with other developing countries, analysing the risks and effects of climate change on the manufacturing industry and



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developing strategic climate change adaptation plans in the light of such impacts will support Turkey's economic interests and environmental performance in the medium and long term. From this viewpoint, comprehending the ways in which the risks and impacts caused by climate change in industries can be successfully analysed, learning the strategies developed against global common impacts, and carrying out a gap analysis and a stakeholder roadmap for the current national scenario will support climate change adaptation actions to be planned for the industry in Turkey.

### 3.10.1 Sectoral impact of climate change

It was determined that industries were threatened by climate change through 6 different risks (**Error! Reference source not found.**). The climate risks, which are not considered independently from one another under the headings of Value Chain Risks and External Stakeholder Risks, were analysed in accordance with the article "How Can Businesses Adapt to Climate Change?" by McKinsey & Company (2018).

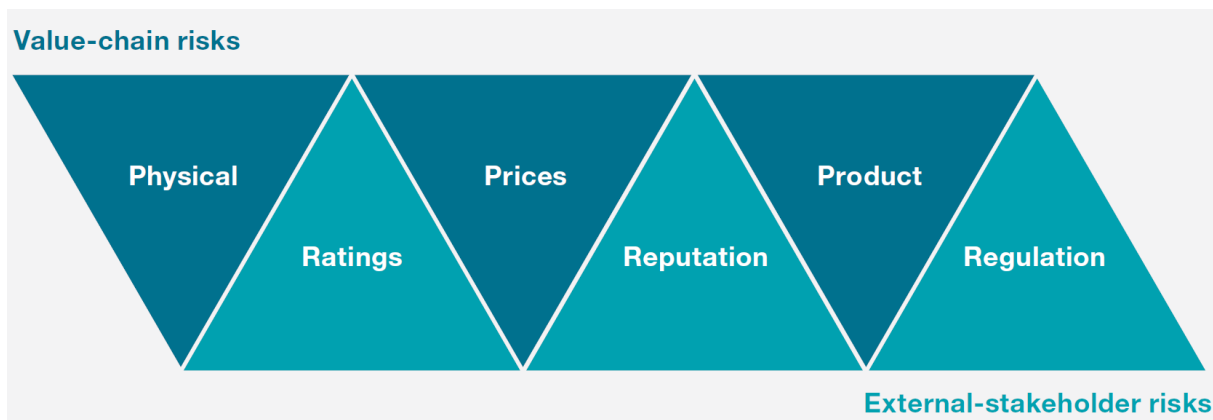


Figure 20. Climate risks identified at sectoral scale

**Value Chain-scale Risk Identification-** Risk identification on the scale of value chain involves physical risks, and the risks observed in prices and products/services.

*Physical risks* are related to the destructions caused by increasing and intensifying climatic events such as forest fires, floods or hurricanes on infrastructures and other assets (e.g. factories or supply chain businesses). The incidence of such radical climatic events has significantly increased since 1970s.

Physical stresses caused by climate change have begun to have concretely adverse effects on the productivity and performance of industries (sectors) at the global level, regardless of raw material or operation types. For example, Cargill, which is one of the world's largest multinational global agriculture and food companies, announced that it reported its worst quarterly earnings in the last twenty years due to the drought in the USA that took place in 2012. Furthermore, the productions of Western Digital Companies, which undertake most of their operations in Thailand, had a sharp decline due to the floods in Thailand in 2011. Such an economic turmoil that directly affected Western Digital Companies also affected various global computer manufacturing businesses whose raw materials and hardware supplies depended on this company.

Controlling such risks is extremely difficult and financially challenging in a scenario where necessary identifications and planning have not been made. Within this scope, industries should take the actions necessary for identifying and planning potential risks that are likely to occur in years and decades. Climate risk identifications, particularly in scenarios where the target group is industries, should be conducted under a holistic adaptation plan that must be made by climate modelers and take into account all climatic parameters such as floods, sea level rises, and temperature or precipitation



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regimes. Indeed, such studies are one of the most important propellants for identifying the climate vulnerabilities of relevant industries. Only after the identification of risks can building an institutional capacity for risk reduction, technical standard improvement or climate change adaptation be possible for industries.

*Price risks* arise from the radical fluctuations in raw material and other related asset prices. For example, a drought event in a specific region can cause the energy prices to increase through political and legal regulations in a certain country/region. This may trigger a catastrophic economic devastation on raw material dependent industries, which forces businesses to tackle climate change-related uncertainties in a “production, energy and insurance” triangle in the short term. Being prepared against such uncertainties requires the identification of medium- and long-term price risks.

On the other hand, there are also businesses that develop and implement rational adaptation strategies against price uncertainties. For example, IKEA, which has one of the world’s largest furniture businesses, models its short, medium and long-term energy prices for many of its establishments and accordingly, makes most of its production through on-site renewable energy plants that will reduce its dependence on electric network. Following a similar strategy, Volkswagen has also invested 1 billion Euros in on-site renewable energy generation based on its prediction that fossil fuel prices will increase.

*Product risks* are those that cause a product or service to lose its commercial popularity or activity due to climate change impacts. With the increasing incidence of heatwaves and extreme heats, alternative cooling technologies (smart air conditioning systems) replace conventional air conditioning systems (e.g. air conditioner), or coal prices go through a radical increase in some energy markets pursuant to carbon pricing mechanisms, triggering the coal impacts of economic fluctuation in the mining industry.

External Stakeholder-scale Risk Identification- Risk identification on the scale of external stakeholders involves price risks, legal risks, and prestige risks.

*Price risks* refer to the risks caused by direct and indirect potential climate change consequences such as carbon pricing, supply chain destruction or loss of product/service value. Although such risks may significantly vary based on the operations and target groups of industries, over 4,000 industries/businesses have been delivering a successful performance in identifying such risks, as seen by their responses in the Carbon Disclosure Project (CDP). Concordantly, certain petroleum businesses have started to apply *shadow carbon pricing* against the scenario where carbon prices create a risk for the sector in the medium term.

*Legal risks* are addressed in the literature as a reflection of the measures taken by governments under climate change response. Such sectoral risks may be seen due to the application of new climate laws or tax schemes, the bans on some operations of industries, or introducing new subsidies to certain sectors while removing certain subsidies of others. For example, the newly implemented national emission trading system in China causes severe stress to emission-intensive sectors, while the renewable energy quota that has become obligatory in some states in the US created risks that were previously unforeseen in the short term for electric supply and transmission businesses to build their portfolios.

With the European Union Carbon Border Adjustment (EU BCSD) that will be implemented under the European Green Deal formulated by the European Commission, a carbon tax will be imposed that will affect the commercial activities undertaken with countries that do not apply any compulsory carbon pricing (e.g. ETS, Carbon Tax). This modern carbon pricing mechanism designed by the EU to protect





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the competitiveness of its economy against the risk of *carbon leakage*<sup>197</sup> and promote the global climate action indicates a hybrid application of legal risk and price risk for industries that export to the EU and are not regulated by any carbon price.

#### Box 3. Adaptation to the New Climate Regime

The government of the Republic of Turkey is in the stage of completing the second phase of the “Partnership for Market Readiness (PMR)” project that has been implemented since 2014 under the leadership of the Ministry of Environment and Urbanization, and political decision making for a potential carbon taxation scheme to be implemented in Turkey through emission trade system. Below images taken from the “New Climate Regime from the Lens of Economic Indicators” report published by TUSIAD (2020) provide information regarding the economic costs that will be faced by the Turkish industry with the non-implementation of this political decision for carbon pricing. Indeed, failure to regulate the Turkish economy with any mandatory carbon pricing practice may cause the BCSD to bill Turkish industry for 478 million to 1.8 billion Euros. In this context, mitigation strategies, which will be developed against these potential developments by the Turkish industry (including energy producers and users) through market-based mechanisms, that are a reflection of the new climate regime will serve Turkey’s medium and long-term interests in adapting to the new global climate economy.

In the event that the European Union Emission Allowance<sup>198</sup> is traded at 30 Euros, the economic burden that will be brought on by the BCSD to the Turkish industry are summarized in **Error! Reference source not found.** and **Error! Reference source not found.**

<sup>197</sup> As a side effect of the carbon pricing practice in a certain country/region, carbon leakage refers to the transfer of the greenhouse gas emissions in the target group of pricing in the relevant region/country to another country/region without an equivalent pricing policy. Such risk mitigation policies that have the potential to impair the market competitiveness of countries/regions where mandatory carbon pricing will be applied should be developed carefully in the stage of designing carbon taxes (Tosun, 2019).

<sup>198</sup> The allowance is a financial instrument for each tonne of CO<sub>2</sub> equivalent greenhouse gas emission right that is granted (given/sold) to entities subject to regulation under ETS.



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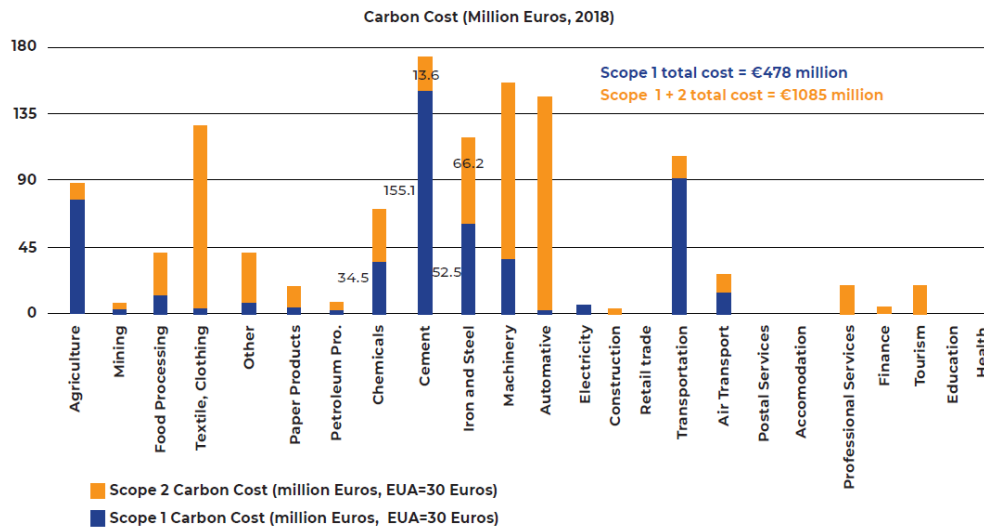


Figure 21. Economic burden that the BCSD will introduce to the Turkish industry if the EU Emission Allowance is traded at 30 Euros

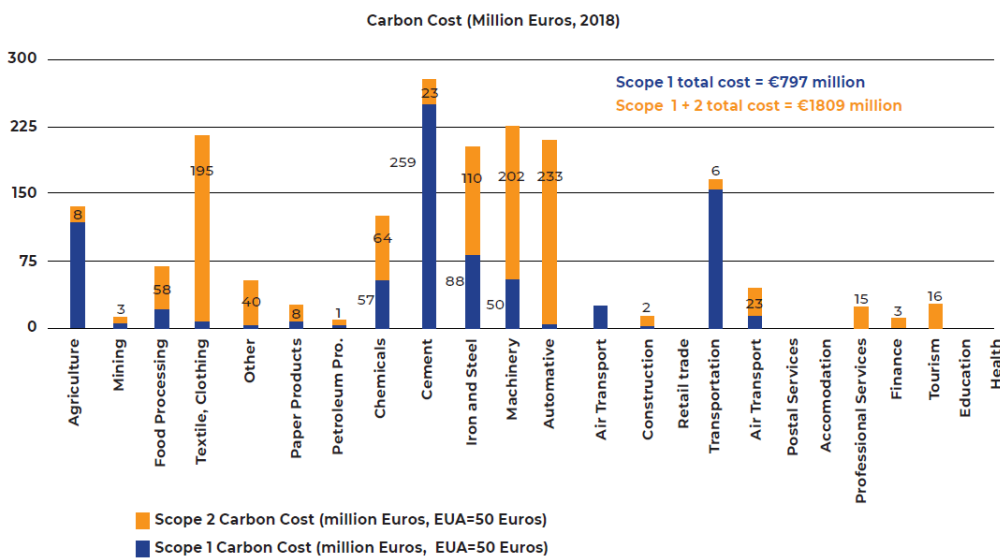


Figure 22. Economic burden that the BCSD will introduce to the Turkish industry if the EU Emission Allowance is traded at 50 Euros

*Prestige risks* may occur directly and indirectly; while the risks that a business will be exposed to as a result of one of its policies or actions are an example of direct risks, the perceptual and operational risks of a sector may be an indirect risk. In this context, the sectors and businesses with a poor status scorecard will become more vulnerable to the climate crisis with the increasing impacts of climate change.

Industries' "value chain" and "external stakeholder" risk identifications are demonstrated in **Error! Reference source not found.**



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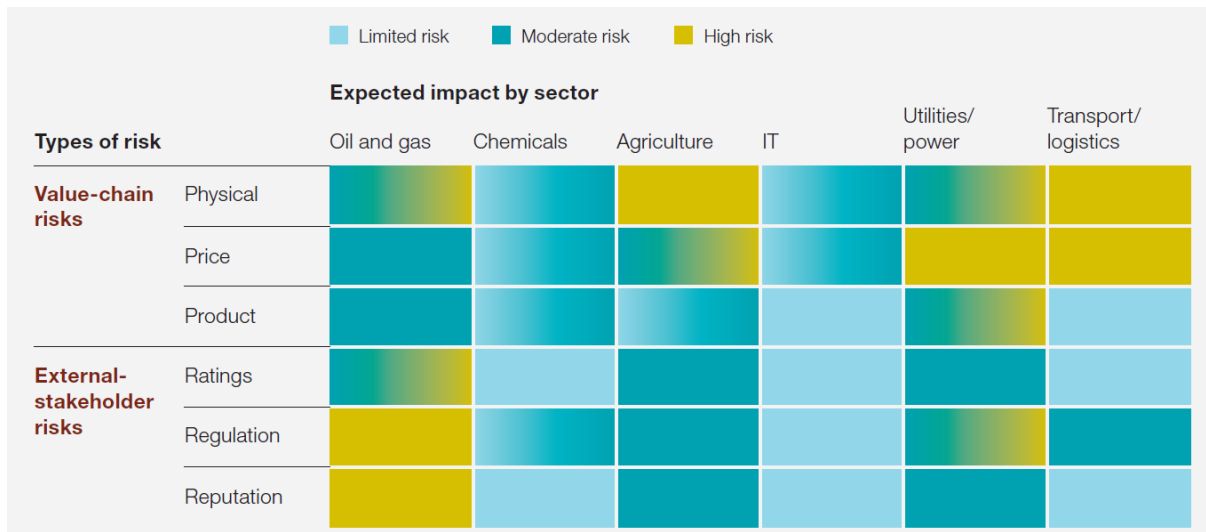


Figure 23. Climate risk identification by industry

In short, a holistic approach must be taken to understand the risks caused by climate change in industries. The industry- and business- scale stresses caused by the climate crisis consists of the physical changes directly resulting from climate change, and the unusual new impacts brought on by the new climate regime. In other words, the environmental and economic risks that are seen today and will certainly be seen in the future may be identified not with a conventional climate change adaptation perspective, but a holistic one.

Identification of the Physical Impacts of Climate Change on Industries- Various industrial branches, particularly in developing countries, have begun to make progress in analysing the physical impacts of climate change on their own value chains. In fact, climate change reporting has become an integral part of the development and activity plans developed for such industries. This thesis is proven by the fact that the number of businesses responding to the Carbon Disclosure Project (CDP) has globally increased by 190% since 2010. The change in the number of companies responding to the CDP over the years is visualised in **Error! Reference source not found.** (CDP, 2020).



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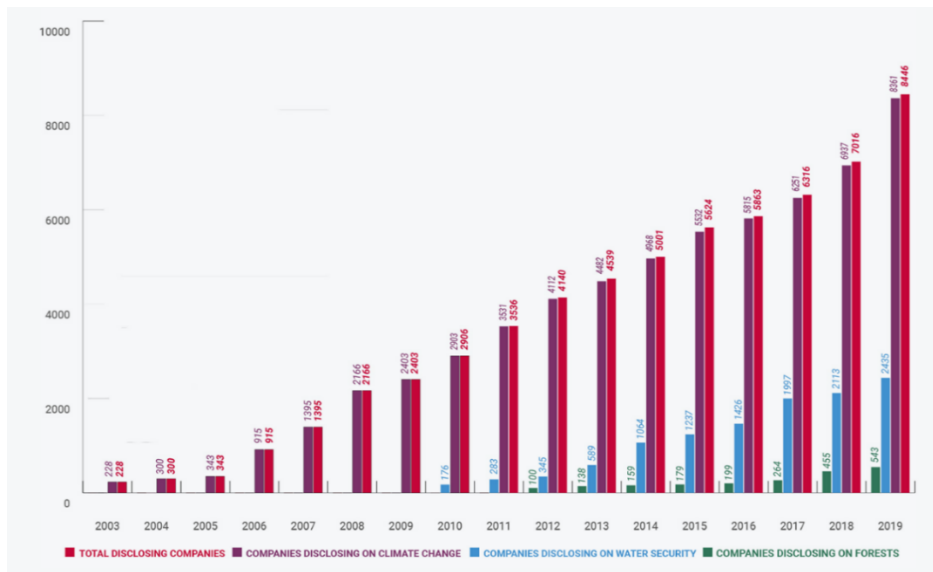


Figure 24. Number of companies responding to the CDP (2003-2019)

In line with the climate and water responses of industries to the CDP at the sector and business scale, it was determined that the climate change impacts listed in **Error! Reference source not found.** were globally common for industries (Pew Center on Global Climate Change, 2008).

Table 22. Climate change impacts on industries

Industry	Climate Change Impact
Mining	Extreme weather events such as floods destroy mines
Food, Tobacco, Beverage	<ul style="list-style-type: none"> <li>Food supply is interrupted and operations are damaged due to extreme weather events</li> <li>Long-term climatic changes harm the reliability and quality of fresh food</li> <li>Raw materials and water supply are endangered</li> <li>Increased animal diseases, insect invasions, plant diseases and wildlife destruction</li> </ul>
Construction	<ul style="list-style-type: none"> <li>Extreme weather events interrupt shipping operations planned for site deliveries, destroy working environments and limit the number of working days</li> <li>Extreme weather events destroy infrastructures</li> <li>Excessive heat in the summer interrupt some construction processes and on-site works</li> <li>Reduced new house sales due to increased insurance prices</li> </ul>
Insurance	<ul style="list-style-type: none"> <li>Increased need to develop disaster models to assess capital adequacy and overall disaster exposure</li> <li>Uncertainties in commercial activities reach radical levels</li> <li>Increased deterioration in public health</li> <li>Prolonged poor weather conditions or extreme events increase the costs of insurance claims</li> </ul>



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	<ul style="list-style-type: none"> <li>• Unforeseen increase in claim volumes</li> </ul>
Machinery	<ul style="list-style-type: none"> <li>• Deteriorations in supply chains</li> <li>• Shipping systems carrying high-value products become more vulnerable (e.g. a ship carries 60 million USD in freight)</li> <li>• Vehicles that are more resilient to climatic events such as extreme precipitation are built, and their spare parts are more expensive</li> <li>• Increased need for cooling in manufacturing and maintenance units</li> <li>• Reduced working productivity of employees due to increasing average temperatures in the working environments</li> <li>• Increased dry time for paint due to increasing humidity</li> </ul>

Climate Vulnerability of the Turkish Industry- Taking into consideration the visualized climate change impacts in Turkey and Turkey’s GDP distributed by cities and regions shown in **Error! Reference source not found.**, it may be inferred that a significant portion of the sectoral driving forces contributing to Turkish economy are vulnerable to climate change.



Figure 25. GDP distribution by provinces (TURKSTAT, 2018)

In fact, 45% of the companies participating in a study held in 2012 and 2013 for evaluating the private sector’s adaptation to climate change across Anatolia, and particularly in industrial capitals Istanbul, Ankara, Bursa and Gaziantep, stated that they had been significantly affected by the impacts of climate change. According to the feedback from participants, 45% of such impacts were excessive precipitation, 42% were drought and water outages, and 37% were reduced precipitation. Furthermore, participants were highly concerned by climate change as demonstrated in **Error! Reference source not found.** For example, 55% of the participants believed that climate change would cause radical unfavourable changes within the 10 years of 2013 (EBRD, 2014).



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How concerned are you about the impacts of climate change on your sector in the next 10 years?

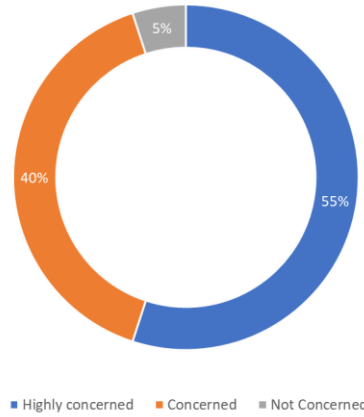


Figure 26 Distribution of climate change concerns of the private sector in Turkey

As shown in **Error! Reference source not found.**, the number of businesses responding to the CDP on climate change increased by 170% between 2011-2019. Although the responses were predominantly related to emission reduction measures, the “CDP Turkey Climate Change and Water Report 2019” results demonstrate that the Turkish private sector has been carrying out risk analyses in the context of the relationship between climate vulnerability and climate change adaptation. The analyses are examined in two groups which are “*Transitional Risks*” and “*Physical Risks*” (CDP Turkey, 2019).

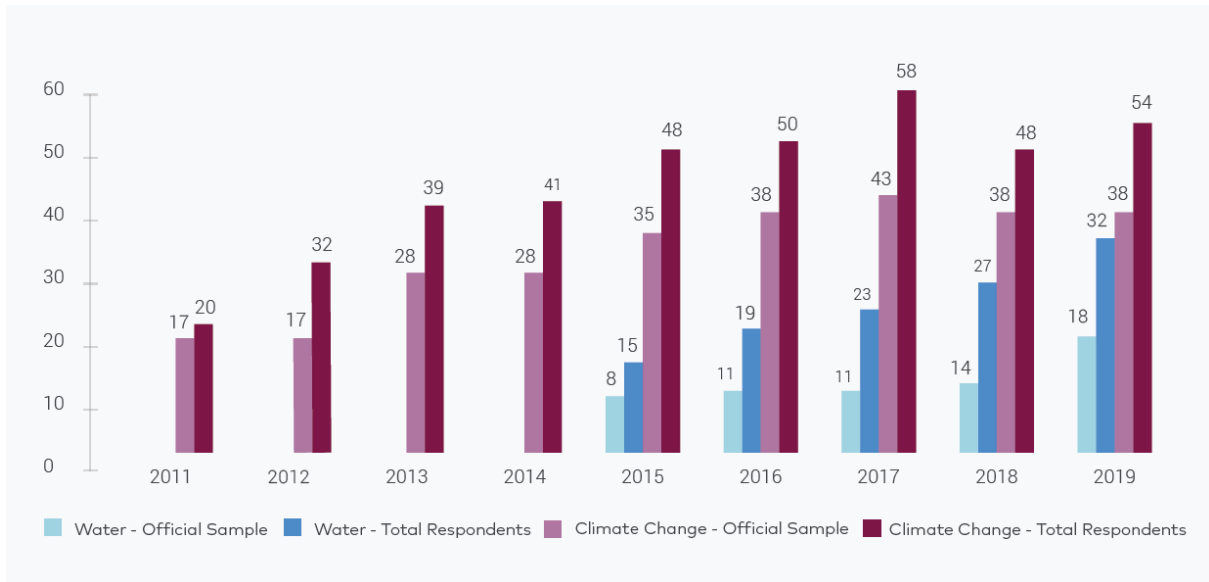


Figure 27. Number of businesses responding to CDP in Turkey (2011-2019)

*Transitional risks* are related to policy-based or regulator-based changes, development of new technologies and business models, or the public’s reaction to climate change based on evolving consumer demands. *Physical risks*, on the other hand, concern the changing climate and extreme weather conditions that may disrupt business operations and supply chains. The distribution of such





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risks by the climate change responses received from the private sector in Turkey at the scales of “customer, supply chain, and direct impact” are demonstrated in **Error! Reference source not found.**

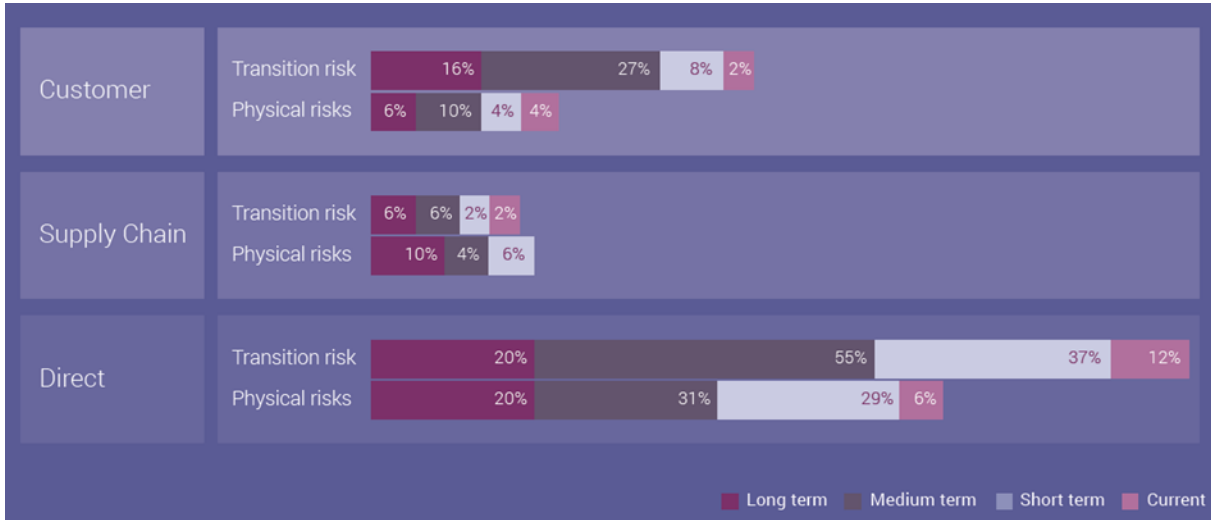


Figure 28. Climate risk analyses of businesses responding to CDP in Turkey

In line with the analysis in **Error! Reference source not found.**, the responses included specific risks seen in the private sector in Turkey. Additionally, businesses operating in Turkey declared that they were able to seize certain opportunities as a result of the adaptation measures which they developed in line with such specific risks. The specific risks and opportunities are visualized in **Error! Reference source not found.**

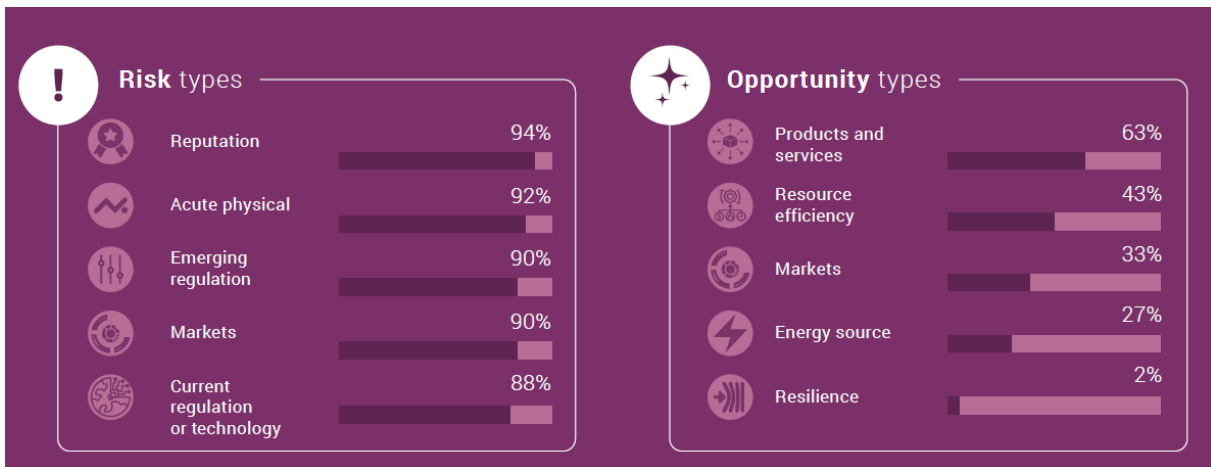


Figure 29. Specific risks and opportunities in the private sector in Turkey resulting from climate change impacts



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#### Box 4. Mitigation and adaptation Synergy

It was determined that 27% of the companies in Turkey that responded to the CDP in 2019 applied internal carbon pricing. Although the main reason for enforcing this practice was greenhouse gas emission reduction, it fosters the resilience of companies to the price and legal risks brought on by the climate crisis in the long term. In this context, designing a national carbon pricing mechanism that Turkey plans to implement with the concern of reducing its greenhouse gas emissions will also make Turkey's industry resilient to climate change. Also, the carbon border tax practice, which the European Union plans to implement to cover the short term as well, stipulates the introduction of a border tax to the exports from countries, such as Turkey, that do not practice carbon pricing. From this viewpoint, a national carbon pricing scheme (e.g. emission trade system) to be applied in Turkey will make companies climate resilient in the international market.

By taking into account a series of economic indicators and the distribution of Turkey's industry by regions, some priority sectors, which are listed below, were identified within the framework of the Turkish private sector's adaptation to climate change: (EBRD, 2014)

- Food
- Tourism
- Wholesaling (excluding motorized land vehicles and motorcycles)
- Textile
- Electricity generation, transmission and distribution

Justifications for prioritising sectors are evaluated in **Error! Reference source not found..**

Table 23. Sectors that should be prioritized in climate change adaptation in Turkey

Sector	Priority justification
Food	When considering the 'economic importance' and 'dependence on climate resilient infrastructures and systems' aspects, production of food products is described as the top priority sector. Although agriculture is not comparatively discussed in the current TURKSTAT data, it is the 5 <sup>th</sup> sector with the largest contribution to the GDP in Turkey. Since it has a clear and important link with agriculture in terms of supply chains and raw material needs, the climate vulnerability of the manufacturing of food products is compatible with the agriculture sector.
Tourism	Tourism is among the priority sectors due to the vulnerability observed in the 'accommodation' and 'food and beverage service' activities.
Wholesaling	Wholesale trade of houseware in Turkey accounts for 34% and 36% of national production value and employment, respectively. Within this scope, retail trade ranks second in terms of 'economic importance', which is why the interaction between retail and wholesale markets is an important priority parameter for climate risk management.



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Textile	The textile sector is a priority sector in terms of its ‘economic importance’ for introducing clothing products to the market.
Electricity generation, transmission and distribution	The sub-sector of electricity generation, transmission and distribution accounts for 91% and 90% of employment and production value, respectively, within the energy and air conditioning sector. Considering the increase in energy demand in Turkey as a developing country in the upcoming years, this sector is also one of the priority sectors (TEİAŞ, 2018).

### 3.10.2 Manufacturing industry’s adaptation to climate change

Industries have a very clear role in the United Nation’s 2030 Sustainability Agenda, which advises countries to plan their industries to be inclusive and resilient in line with the 9<sup>th</sup> Sustainable Development Goal titled “Industry, Innovation and Infrastructure”. Planning industries to be climate resilient will make direct and indirect contributions to almost all objectives of the 9<sup>th</sup> Sustainable Development Goal, and particularly goals 9.1 and 9.2, and the entirety of Climate Action, which is the 13<sup>th</sup> Sustainable Development Goal (Strategy and Budget Office of the Presidency).

Taking into consideration the dependence of the industry on various natural resources and raw materials, the production capacity of the manufacturing industry may be significantly affected by climate change unless the climate parameter is addressed appropriately and in due time. On the other hand, it is crucial to build a balance between mitigation and adaptation elements when taking the climate parameter into account. In fact, it has become more visible on the global scale that certain measures for emission reduction increase climate vulnerability in other frameworks. Similarly, it has also been experienced multiple times that some adaptation practices (e.g. maladaptation) lead to new greenhouse gas emissions unforeseen in the reference scenario. In this context, it is essential that industry-focused climate actions are implemented with a holistic approach. The holistic approach to be taken specifically for industries was discussed pursuant to the “Promoting Climate Resilient Industry” report published by the United Nations Industrial Development Organization in the triangle of technology, innovation, and cooperation (UNIDO).

**Building Blocks of Climate Resilient Industries-** Building the climate resilience of industries brings along certain difficulties for developing countries and economies in transition. The capacity development and information management programmes applied for such countries lead the efforts of countries to build climate change resilience. The implementation of such programmes under a rational roadmap and an interactive frame is based on the comprehension of certain building blocks that are centred around sustainability in industries. The building blocks may be summarized as follows:

**Using clean technologies and promoting technology transfer-** This building block is based on the foundations of socio-economic development. According to experimental studies, the most important force behind the increase in per capita income is technological advancements. Enhanced technology leads to an enhanced climate resilience and therefore an increased socio-economic performance. In other words, it makes the economically destroyed industries and socially destroyed social impact areas due to climate impacts resilient to climate, and ensuring technological advancement is vital.

**Promoting innovation and enhancing entrepreneurship-** This building block provides important opportunities throughout the industry and for active businesses to enhance prosperity levels while maintaining environmental performance. It is particularly important for the design of the climate action plans that will be developed by small and medium-sized enterprises (SMEs), small scale



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industrial estates, or specialized OIZ for climate change adaptation, and the balance relations they will built with regard to emission reduction in this framework.

Supporting international partnerships- This building block strengthens partnerships with organizations at the level of public institutions, including cities, businesses and regional networks, to attract investment and apply the best practices within the industrial framework. Different specialties and sources of experience play a significant role in creating a climate resilient industry. Therefore, multi-stakeholder partnerships are vital in terms of attracting investment and providing knowledge and expertise in the on-site application of climate resilient solutions.

Technological Integration and Climate Adaptation- Minimizing climate impacts requires the transfer and application of environmentally sensitive technologies. The Cancun Agreements of the United Nations Framework Convention on Climate Change (UNFCCC) highlights the importance of promoting and enhancing the transfer of technologies, which will be helpful in resolving the climate problem, to developing countries. In this context, it is of critical importance that such technologies are developed jointly with a broad range of stakeholders and promoted towards climate change adaptation actions.

Conventional development pathways previously followed by various fully industrialized countries resulted in environmental impacts, presenting a model that is unsuitable for developing countries to follow. However, developing countries have various opportunities to take climate-friendly development paths in the current scenario. For example, these countries have not based their development plans directly on technologies with an inadequate environmental performance, which signals a transformation that can be coordinated with the integration of clean technologies.

Through technology transfer, industrialized countries should support developing countries in designing and applying socio-technical structures that support climate resilient industrial development. In this context, integrating the successful climate-smart technologies and experiences in industrialized countries to the developing countries fosters innovation and significantly contributes to overcome the barriers in deploying climate resilient industrial technologies. At the same time, it is also important to identify the donor and donee countries in a fair and rational manner.

Innovation and Climate Adaptation- SMEs have significant representation in global economy by employing most of the labour force in the private sector. The greatest challenges faced by SMEs in carrying out climate friendly activities are their lack of financial capital and technical capacity, and the lack of the incentives required to overcome the barriers to adopting clean and climate resilient technologies. Supporting innovation and entrepreneurship can help in appealing to individuals as well as SMEs to overcome such barriers. In this regard, innovation and entrepreneurship must be supported to make SMEs an active driving force of climate change adaptation, which will be achieved through developing climate change adaptation facilities in a way that allows SMEs to benefit adequately from the share that is planned for the private sector.

Cooperation for Climate Adaptation- According to the Special 1.5 Degree Report and Fifth Assessment Report published by IPCC, the changes in climatic parameters also affect the reactions that the systems give/will give against climate change. In other words, harmonizing the practices to be developed for system-based climate change adaptation can support different practices that other systems can require in the medium and long terms, and even in the short term.

When reconsidering this situation through the filter of industrial development, it is imperative for the application of rational adaptation practices that industries cooperate with academic, public and financial authorities, and particularly other industries and various components of the private sector. In this scope, new bi-sectoral and multi-sectoral strategic partnerships in which knowledge is shared to facilitate the on-site adaptation efforts and eliminate the barriers to access to knowledge are required.



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### Box 5. What Paris Agreement Brought and What Turkey Missed

Turkey is still in the stage of growing its industry and is the world's 19th largest economy in terms of GDP. As discussed earlier, when taking into consideration the damage that the climate crisis will cause to the gross global revenue, Turkey must fight against the industry impacts of climate change in the most urgent ways possible. The conditions for the implementation of the Paris Agreement, which has the capacity to make direct financial and organizational contributions to all of the building blocks in discussion through the Green Climate Fund and other international partnerships, will play a significant role in mitigating the climate change impacts which the Turkish industry will face in the medium and long terms.

#### 3.10.3 Work by stakeholders

The top three responses to the question “What is your preferred source of knowledge on climate change?” asked to the private sector components in Turkey were “TV programmes and news, public institutions, and sector associations”; although none of the sources exceeded the rate of 27%.

**Error! Reference source not found.** demonstrates the climate change information sources of the private sector components in Turkey.

#### Which are the most important sources of relevant business information for your company? (n=110)

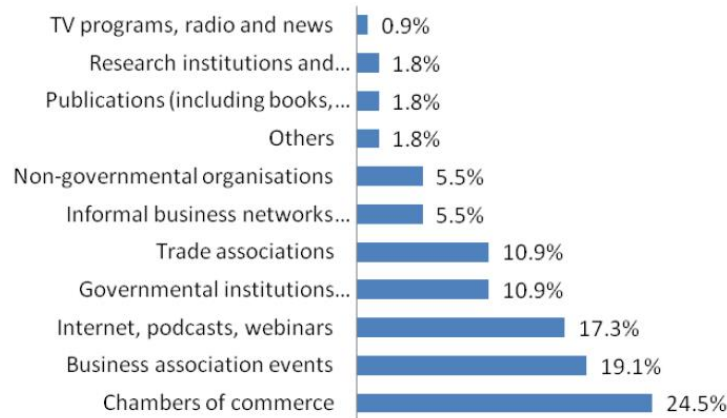


Figure 30. Climate change information sources of private sector components in Turkey (EBRD, 2014)

The rational and holistic planning of the Turkish industry's climate change adaptation strategies is based on determining the roles of relevant stakeholders and carrying out a gap analysis for the stages in which stakeholders are engaged in the current scenario. In this context, the sectors that play a role in making the manufacturing industry climate resilient are the public sector, private sector, civil society, and academia. The stakeholder responsibilities of these sectors were discussed pursuant to the Pilot Climate Change Adaptation Market Study: Turkey, prepared for Turkey by the European Bank for Reconstruction and Development and the International Finance Corporation (EBRD, 2014)

The leading public components in the climate change adaptation of industries/economic sectors in Turkey include the Strategy and Budget Office of the Presidency, Ministry of Industry and Technology, KOSGEB, and Ministry of Environment and Urbanization.



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**The Strategy and Budget Office of the Presidency** is an organization that carries out its activities with the mission of accelerating Turkey's economic and social development and maintaining the balance and sustainability of development, and coordinates the development of sectoral and thematic policies and strategies, preparation and implementation of the central government budget, and implementation of plans, programmes, budget allocations, budgets, policies and strategies, and the preparation of basic policy papers in particular.

In the study, the role of industries in the development plans<sup>199</sup>, which were prepared under the leadership of the Strategy and Budget office and the Former Ministry of Development, were analysed through the filter of climate change adaptation. As a result of the analyses, it was determined that the development plans contained the following impact analyses and partial actions with respect to industries:

- Developing plant and animal species that are suitable for the changing climate, giving weight to protecting the environment and biodiversity
- Prioritizing qualified labour force and technology to meet food demands with fewer resources
- Clarifying Turkey's opportunities to access climate financing with an industry-intensive growth trend
- Carrying out studies to identify the impacts of climate change on the tourism sector
- Building sports facilities at the national level by taking geographical location, climate, and demographic structure into account.

**The Ministry of Industry and Technology** is directly responsible for the activities, business volume, and short-medium-long-term planning of industries. The organization and duties and powers of the Ministry are regulated by Articles 389 through 409 of the Presidential Decree No. 1. Although the Ministry is not directly responsible for the development of climate change action plans and strategies, establishment of legal and institutional legislation and carrying out climate diplomacy processes, it has a critical responsibility in conducting climate change vulnerability analyses for sectors and including such vulnerability analyses in the planning processes to be made at the ministerial level. The **General Directorate for Industry and Productivity**, which is a Ministerial service unit, is responsible for "monitoring the developments in terms of environment and climate change, assessing the studies conducted for the purpose of establishing an industry policy, and providing assistance in taking the required measures" which are directly related to climate change.

The following strategic papers for climate change response in Turkey were prepared under the leadership of the Ministry of Industry and Technology, and analysed in detail with regard to the climate change impacts in industries and climate change adaptation measures:

- Turkish Industrial Strategy Document
- Turkish Industrial Strategy Action Plan
- Transformation of Organized Industrial Zones in Turkey Towards 2023
- Activity Reports published in the last 5 years
- Sectoral Reports published in 2018 and 2019.

As a result of these analyses, it was seen that the manufacturing industry's climate change response was largely based on limited mitigation targets. On the other hand, the targets set to enhance the

<sup>199</sup> The ninth, tenth and eleventh development plans were examined under this report.





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climate change resilience of industries were only intended to build human capacity and raise awareness in industries.

The 2018-2022 Strategic Plan of the Ministry of Industry and Technology contains evaluations regarding the Paris Agreement in the “Environmental Factors” chapter. The threats and opportunities in the manufacturing industry in line with the Paris Agreement are summarized in **Error! Reference s  
ource not found.**

Table 24. Threats and Opportunities in the Manufacturing Industry in Line with the Paris Agreement

Opportunities	Threats
The Paris Agreement contains elements that address the vision of “transitioning to a high-technology production system in Turkey” as stated in the Turkish Industrial Strategy	The likelihood of the anticipated cost of the transformation in the industry being high in the event of failure to obtain financial and technological support under the Agreement
Significant progress will be made in the event of receiving financial and technological support under the Paris Agreement	Increasing emissions due to the growth of the emission-intensive cement sector, in particular
Accelerating the R & D studies, which were put among the priorities of the Ministry after the strong message delivered by the Agreement on renewable energy and clean technology, with the creation of new and diverse policies	Failure to attach adequate importance to the subject of technology transfer, of which we are the coordinator under climate negotiations, when compared to subjects such as finance
Potential to increase international partnerships and collaborations particularly in the fields of R & D and technology transfer	The studies required to establish systems, such as carbon pricing (emission trade system, etc.) as specified in the Agreement, require a significant level of data and expertise
New policies (sectoral strategies, etc.) are prepared to include issues related to the environment	
The developments under the Agreement and the national contribution (emission reduction rate) commitment made by Turkey to the UN will contribute to increasing the awareness of the private sector on the subject	

**KOSGEB** (Small and Medium Enterprises Development Organization), which is an ‘affiliated’ entity of the Ministry of Industry and Technology, is one of the prominent organizations in Turkey executing the SME policy. KOSGEB supports SMEs in increasing their productivity by enhancing their technological and innovation capacities and improving their competitiveness. In this context, KOSGEB has important responsibilities in building the capacity that is required to analyse the climate change vulnerability of industries of all scales. On the other hand, according to the literature reviews on KOSGEB and the organizations with which it is associated, KOSGEB has not been carrying out efforts to directly analyse industries’ climate vulnerability or develop adaptation practices against potential vulnerabilities.

The policy papers (NCCS, CCAP, Turkey’s Climate Change Adaptation Strategy and Action Plan, National Communications) prepared under the leadership of the **Ministry of Environment and Urbanization** were analysed in detail in terms of the climate change impacts and climate change adaptation



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measures in industries. In the wake of such analyses, it was seen that the manufacturing industry's adaptation to climate change was largely discussed within the context of water management. In this scope, some impact analyses and partial actions, which are listed below, to enhance the climate resilience of industries were addressed in these documents.

- Impact identifications for water outages and water shortages in industries
- Revising the institutional and sectoral strategy plans of the organizations involved in water management in the context of climate change response
- Promoting the treatment of wastewater to be used in the manufacturing industry, through tools that are economic for the private sector
- Revising Turkey's Industrial Strategy Document (2014-2020) in terms of industrial water efficiency practices by taking climate change impacts into consideration
- Disseminating clean production (eco-efficiency) practices, which are among the most important instruments for industrial climate change adaptation
- Promoting the production and use of industrial equipment that consumes less water
- Supporting projects that aim for the recovery of production and cooling waters in water-intensive and priority sectors, increasing pilot actions, preparing "sectoral eco-efficiency (clean production)" guidelines for water efficiency in the manufacturing industry, and developing financial policies in this area in line with promoting model practices
- It is important to conduct integrated cost-benefit analyses that take the mitigation and adaptation synergy into account in all climate-dependent industries
- Supporting the use of processes that take water efficiency into account in agro-based industries
- Supporting the initiatives related to climate change adaptation in the industrial R & D studies of the private sector

Although the private sector depends on the public sector in the context of the climate action plans and legislative efforts required for carrying out climate change adaptation strategies, private sector components can play an active role in identifying risks and impacts within their own spheres of influence, and implementing new practices to adapt to such impacts. Indeed, the private sector's effective engagement in such stages of climate change adaptation that are independent from the public sector will ease the burden of the public sector, as well.

The water and climate change performances of responding businesses are publicly shared with the annual reports published by the CDP. The CDP performance evaluation methodology is based on a scoring system where the A+ is the highest and D is the lowest. As demonstrated in **Error! Reference source not found.**, Turkey was not among the 54 business that responded to the CDP that received an A+ score for water and climate change performance in 2019. While only 1 business among all businesses scored an A, the overall performances of businesses fell within the B to B- range. The water and climate change performances of the businesses in Turkey are summarized in **Error! Reference source not found.**



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Figure 31. Water and climate change performances of businesses in Turkey (CDP, 2019)

The climate change response practices, which were mentioned in the “CDP Turkey Climate Change and Water Report”, of the sectors responding to the CDP from among the cornerstones of the Turkish economy such as finance, food and energy, were evaluated through the filter of climate change adaptation. As a result of such evaluations, it was determined that certain practices could serve as a model practice across the private sector.

Arçelik, Inc. and Migros Trade, Inc. are among the companies that apply internal carbon pricing for their emissions arising from production and supply chain. The indirect carbon price determined by Arçelik for reducing emissions and the shadow carbon pricing applied by Migros support these private sector components in preparing for (1) a national carbon pricing to be applied in Turkey in the short term (through ETS), and (2) the period of transitioning to the carbon border tax practice of the European Union. At the same time, these practices, which are good examples of a mitigation and adaptation balance relationship, serve as an important driving force with respect to these companies adapting to the “price” risk which they may encounter in new carbon taxation regimes.

Arçelik, Inc. is also one of the conspicuous companies through the climate change adaptation filter with its water management strategies. While water cannot be added to the products of Arçelik as a raw material input, dishwashers and laundry machines lead to water consumption by consumers. From this viewpoint, Arçelik increases the awareness of its customers by broadcasting commercials and documentaries on water efficiency and producing the most water-efficient products. Arçelik also develops R & D projects to reduce the water consumption as well as the water access-related risks of consumers. For example, although Arçelik has the optimum performance and efficiency in the current scenario, it recently developed a new dishwasher that consumes seven litres less water per use.

Another company that draws attention through water management in the manufacturing industry’s adaptation to climate change is Ford Otosan, Inc., which declared in the final reporting period to the CDP that the use of third-party resources (including water) had been reduced by 17%. The most important driving force behind such a reduction in resources was the water efficient and use projects that were implemented in Sancaktepe facilities.

Another adaptation action in the manufacturing industry was practiced by Brisa, Inc. operating in the tyre and coating sector. Water is essential for the manufacturing process of Brisa, which has developed two main adaptation strategies to prevent water-related failures in their production. One of the strategies is the regular monitoring and reporting of the quality and volume of the water used in all of their production facilities; the second strategy is the supplier pool which presents users (customers)



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with multiple supplier options and evaluates suppliers based on their raw material and water performances. Brisa, which is also aware of the difficulty of controlling the quality of the drawn groundwater and the third party-sourced water, invests in new technologies that foster proactive behaviour to minimize their dependence on external resources. For example, Brisa included a Wastewater Recovery Plant that will start operating in 2020 in its CDP 2019 responses; this is an investment that will ensure that process waters are recycled and used for cooling, therefore reducing the amount of water to be drawn from natural water resources.

The energy and construction sectors also have conspicuous climate change adaptation practices. For example, ENKA Construction and Industry, Inc. has updated its climate change response methodology with new adaptation measures, building new buildings in line with green building standards and rehabilitating its power plants to ensure adaptation to the impacts of climate change. Additionally, ENKA also carries out water risk assessments and studies across the company and suppliers. In this scope, before the construction of the projects, Environmental and Social Impact Assessment Reports are prepared by external consultants to identify the potential impacts and water-related risks of the project.

On the other hand, Zorlu Energy prioritizes the availability and quality of water in every power plant under its operational control when assessing water-related risks. In this context, water-related risks in the scenarios where sufficient water is lacking are assessed throughout the life of each power plant. Zorlu Energy is one of the companies that uses the Aqueduct tool of the World Resources Institute when carrying out water risk assessment.

The Coca-Cola Company, a food industry giant, included the assessments for the climate risks related to precipitation and extreme weather events, which it conducted on subjects such as soil hardening, drainage and sewer systems, pollution of water resources, and destruction of water wells, in its CDP 2019 responses.

The climate risk identification, which was conducted by ETİ Food Industries and Trade, Inc. and mentioned in the “Pilot Climate Change Adaptation Market Study: Turkey” report by the European Bank for Reconstruction and Development and the International Finance Corporation, is also a conspicuous study. In cooperation with the WWF, ETİ provided 3,000 farmers with climate change adaptation training for developing a more sustainable system for the retention and use of water in the ETİ Konya Region. In this framework, climate projections were made based on 2015, 2030 and 2050 in order to enhance the effectiveness of the training content, which were enriched with modern water-efficient irrigation methods and technologies in line with the results and predictions of the climate projections.

The risk analyses practiced in the finance sector also contribute to the private sector’s climate change response. For example, Şekerbank regularly monitors the climate change risks faced by it by using various methodologies (1) based on physical operations, (2) through customer portfolios, and (3) through suppliers. Yapı Kredi applies the minimum potential financial impact approach in its credit payments for its irrigation systems; according to this approach, the Bank prioritizes the finance of the irrigation systems, which are based on water efficiency, within the scope of climate change adaptation measures. Halkbank declares its water policy and procedures on a regular basis in its annual environmental reports; in this scope, the water and environmental reports and studies prepared throughout the year are discussed in sustainable committee meetings and presented to the executive board once a year.

Other than the several works discussed above that were led by the private sector, the volume of works on the private sector’s adaptation to the impacts of climate change are quite limited in Turkey. In this regard, regular support from the academia and civil society in addition to promoting the private



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sector's cooperation with the public sector will render the private sector a powerful actor in responding to the impacts of the climate crisis and increase the national environmental performance.

Due to their institutional capacities, the Union of Chambers and Commodity Exchanges of Turkey (TOBB) and the Turkish Industry and Business Association (TUSIAD) are the non-governmental components with the greatest responsibility within the framework of industrial climate crisis response. In this context, the studies that have been conducted by TOBB and TUSIAD were evaluated through the filter of climate change adaptation.

TOBB coordinates its climate change studies through a sub-formation named "Climate Change and Environment Committee". TOBB's activities for climate change adaptation largely focus on awareness raising efforts. For example, TOBB held a workshop on "Adaptation, Risks and Opportunities in Turkey" was held in September 2010 in cooperation with the EBRD and IFC. Relevant public and private sector stakeholders attending this informative event discussed the impacts of climate change and examined the gaps and barriers in the adaptation action and the opportunities related to climate investments.

TUSIAD coordinates its climate change studies through a sub-formation named "Environment and Climate Change Working Group". In 2016, a report titled "Addressing Climate Change From An Economic Policy Perspective" was published by TUSIAD with the contributions of several academics studying climate and environmental economics. Containing some general sectoral assessments for climate change adaptation at the global level, the report mainly focused on macro-economic level emission reduction policies and reduction financing. Furthermore, the "TUSIAD Position Paper on Addressing Climate Change" published by TUSIAD in 2017 also involves reduction studies. According to the Position Paper, TUSIAD's rational action plans and strategies on climate change adaptation, apart the climate change adaptation work undertaken by several TUSIAD member companies, were lacking.

In addition to the sectoral components of civil society with a confederate status such as TUSIAD and TOBB, works by sector associations were also evaluated through the filter of climate change adaptation, but no direct studies on Turkey's climate change adaptation were found to have been undertaken by relevant sectors. In consideration of such deficiencies, the working plans and annual activities of such institutions as TUSIAD and TOBB should directly cover adaptation actions to undertake more sectoral adaptation efforts at the civil society scale.

Two main studies are conspicuous when examining the works of academic institutions in Turkey through the filter of sectoral climate change adaptation. The first of the studies is the article "Adaptation to Climate Change in Industry: Improving Resource Efficiency through Sustainable Production Applications" that was published in 2015 by Middle East Technical University Department of Environmental Engineering faculty members. The article looked at and analysed the physical and economic impacts of climate change on economic sectors on a large scale, as well as analysing the climate risks of certain pilot sectors such as food, metal industry, chemical industry, textile and overlay/painting in detail across the sector and for pilot companies. Furthermore, this analysis was merely an evaluation study based on the compilation of the global findings and failed to present an applicable methodology for climate change adaptation for the sectors in Turkey.

Another work undertaken on industrial climate change adaptation in consultation with the academia is industrial symbiosis<sup>200</sup> projects. So far, three industrial symbiosis projects have been implemented by the Development Agencies of Iskenderun/Hatay, Gaziantep, and Bursa, Bilecik, Eskişehir, which are among the important industrial centres in Turkey. These projects, the first of which was implemented

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<sup>200</sup> Industrial symbiosis (living together) refers to the exchange of material and energy between two close industrial businesses, similar to that in nature.



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under the leadership of the Middle East Technical University, aim for two or more industrial businesses that are preferably physically close but normally operate independently from one another to come together to establish long-term partnerships that allow them to increase their environmental performances as well as their competitive powers. From this viewpoint, industrial symbiosis projects makes industries resilient to the (1) physical impacts, and (2) price impacts of climate change by enhancing the (1) water and resource efficiency, and (2) market competitiveness of industrial activities (BEBKA, 2020)

Between 2011-2014, the Iskenderun Bay Industrial Symbiosis Project made the project beneficiary industries resilient to the impacts of climate change, and established a strong balance relationship which allowed such industries to take action on climate change mitigation by achieving:

- A reduction of 300,000 tons of waste
- A water-saving of 6,500 m<sup>3</sup>
- A natural resource substitution of 280,000 tons
- A labour-saving of 3,500 man/day
- An energy-saving of 34 million kilowatt-hour.

The ongoing Gaziantep Industrial Symbiosis Project and Investigation of Industrial Symbiosis Opportunities in Eskişehir Province Project aim to achieve outputs for participatory industrial activities that are parallel to and similar scaled with the Iskenderun Bay Industrial Symbiosis Project.

Climate Change Impacts on SMEs, Risks, and Adaptation- The main risks that small and medium-sized enterprises may face due to climate change are increasing costs, potential damages to structures, and revenue loss. Furthermore, it is estimated that insurance premiums, raw material and material and shipping costs will also increase, as well. As the climate changes, the risk of power outages and damages to property and stocks will increase due to floods and severe winds as a result of extreme weather events. For example, crop failure caused by drought will affect farmers, and the lack of snow in the winter will affect ski centres. These and other similar risks, which are addressed in further detail for other sectors, will affect small and medium-sized enterprises more than large businesses with a stronger capitalization.

SMEs are more vulnerable to disasters than large businesses due to their relatively limited risk management capabilities. For examples, the access of SMEs to insurance services and financial and political capital to implement disaster recovery programmes is more limited than that of large businesses; they also generally have less access to better emergency muster areas, capitals and plans to ensure business continuity during and/or after disasters. The ability of most SMEs to be resilient directly depends on the capability of suppliers, customers, and the neighbourhood and the city (Sands, 2019).

Another climate change related business risk for SMEs is customer preferences. Customers are becoming increasingly conscious of climate change impacts, which may lead them to opt for businesses that are environmentally friendly and help reduce their costs. In this way, risks may become opportunities for businesses that pay regard to climate change.

SMEs can take advantage of climate change as an income-generating opportunity by developing technologies, products and services that help them reduce the greenhouse gas emissions of others and enhance their resilience to climate change impacts. Governmental and large industrial initiatives for emission reduction will create new markets for such products and services. The outcomes for SMEs taking action may include increased customer loyalty, new customers, cost savings, and additional





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sources of income whereas the consequences of non-action may include increased operating costs, job losses, and even shutdown of business.

As SMEs help to restore the economic and social structures through the provision of post-disaster employment, goods and services, they are of critical importance in saving societies from disasters. Additionally, they can reopen after disasters generally to provide spaces for social connection, motivating the displaced population to return to home while also attracting new investments to recovery areas. At the national level, the SME sector is key to building resilience to disaster shocks by expanding and diversifying local economies. The sector also reduces dependence on several large firms or specific sectors, protecting a large base of the labour force from sector-specific shocks and the fluctuations in international market.

By assessing their climate change exposure and taking action to mitigate the impacts, SMEs may predict and adapt to climate change on their businesses. For example, they may relocate away from flood plains and coastal zones, use wind resilient advanced building materials, and develop new products and services to help others adapt to climate change.

All SME owners and managers can address climate change as they do any other business opportunity or challenge -by setting goals, prioritizing, and formulating and implementing a plan to tackle the problem. In this framework, prominent actions include the preparation of a *Business Continuity Planning (BCP)* in the context of Disaster Risk Reduction. The main goal of the plan, which covers the assessment of supplier (upstream) and customer (downstream) losses, is to minimize losses in the event of danger by making an in-depth analysis on the role of a business within a productive chain or sector. Business Continuity Plans can be useful tools, if implemented as a sector or supply chain rather than individually<sup>201</sup>. The companies making a Business Continuity Plan should address four main steps:

- A business impact analysis that determines potential disruptions and subsequent outcomes for business continuity (may also be referred to as risk analysis)
- Adequate recovery strategies and the resources with which to apply them should be determined
- A plan that includes the roles, responsibilities and contact information of company employees, suppliers, and customers should be formulated
- It is necessary to train employees and test, update and improve the plan.

*Making SMEs in Turkey Climate Resilient-* 99.8% of the overall enterprises in the manufacturing industry in Turkey is Small and Medium-sized Enterprises (SMEs). According to the data from 2013, SMEs account for 75.8% of the total employment, 59.2% of the export, and 39.9% of the import in the sector.

In Turkey, SMEs have focused on energy efficiency and greenhouse gas emission reduction in terms of climate change in various strategies and action plans.

The Law No. 6331 on Occupational Safety and Health and the Regulation on Emergency Situations in Workplaces were designed to ensure that employers conduct regular risk and safety assessments against various workplace accidents and common natural disasters and take preventive measures including emergency response plans, first-aid training and emergency drills<sup>202</sup> (TURKONFED, 55)

Large enterprises are better equipped to cope with risks and emergencies than SMEs. There is no reliable data on how many businesses in Turkey have a risk management capacity, insurance coverage, and business continuity plans (BCP). Most Fortune 500 businesses are estimated to have risk management capacities and insurance coverages (mostly due to compliance with global supply chains)

<sup>201</sup> "Small Businesses Impact of Disasters and Building Resilience", UNDP, New York, May 2013

<sup>202</sup> "Resilience in SME's: New Risks, New Priorities Landscape Assessment Report", Turkonfed & UNDP, August 2019



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and various measures in place with regard to business continuity plans. Based on its interviews with Allianz and Anadolu Sigorta insurance companies, it was predicted by TURKONFED that most large enterprises and approximately 20-30% of SMEs had insurance coverage. However, there is no available information on the extent to which such plans include climate change-related risks or cover climate change-related disasters.

For comparison purposes, a recent regional study conducted in Gümüşhane province can be used to emphasize the capacity of SMEs. According to the study, only 15% of SMEs conducted risk assessments on a regular basis, and only 18% had a contingency plan and 20% a bulletin board listing emergency numbers.

When glancing at the institutional strategic plan of KOSGEB, it is seen that no strategy was developed for emergency action plans, other than carrying out credit interest support schemes for SMEs that have suffered damages from natural disasters within the framework of facilitating SME's access to financing (Strategic area 5). The relevant training programmes that are occasionally implemented with AFAD and similar public organizations are not systematic and regular, either. The description of KOSGEB's duties include providing guidance and technical consultancy services to SMEs. In this frame, it could not be determined that any support had been provided in preparing disaster plans or business continuity plans to increase the resilience of SMEs.

Within the scope of "holding meetings and emphasizing the significance of the issue to ensure that private sector organizations enter the disaster management system" pursuant to the "AFAD Strategic Plan for 2019-2023", a "Business Continuity Awareness Raising Training" was formulated and attended by AFAD, KOSGEB personnel as well as various SME managers. However, such trainings failed to become a continuous and recurring programme, as AFAD activity reports indicated that such trainings were given only for a few years.<sup>203</sup>

From a climate change perspective, the actions that can be taken by the public in cooperation with NGOs and other organizations in order to enhance the resilience of SMEs were specified in WRI's<sup>204</sup> report on making small-sized enterprises climate resilient:

- Conducting business-related climate change information and risk analyses
- Technical support and training programmes
- Creating programmes to facilitate climate change adaptation investments
- Providing market and business development opportunities
- Enhancing collaboration and cooperatives
- New financial instruments and accessibility to such instruments

There are various non-governmental organizations representing SMEs (Union of Chambers and Commodity Exchanges of Turkey/TOBB, TURKONFED, Turkish Confederation of Tradesmen and Craftsmen/TESK, Turkish Union of Chambers of Engineers and Architects/TMMOB, United Nations Global Compact Network Turkey, etc.). SMEs can be provided with further awareness, training, and guidance on climate change adaptation through such NGOs, whose efforts occasionally involve the subject of climate change.

In 2013, the "Business Disaster Resiliency Program for Turkey (Robust SMEs, Saglam KOBİ)" project was implemented in cooperation with the UPS Global Foundation, World Economic Forum, American Chamber of Commerce in Turkey, IDEMA and UPS Turkey in order to increase the disaster awareness and enhance the disaster preparedness and resilience of SMEs across Turkey. According to the research under the project, 43% of the SMEs that were affected by disasters had shut down, while 29%

<sup>203</sup> Disaster and Emergency Management Agency (AFAD); Administrative Activity Report 2013, p. 89

<sup>204</sup> "6 Ways to Make Small Businesses More Resilient to Climate Change", WRI, 28.08.2020



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had gone bankrupt within 24 months of the disaster. Although the risks associated with climate change were not considered within the scope of the project, the content of the work was also adaptable to climate change risks.



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### 3.11 Transport sector and climate change adaptation

- Climate vulnerability of transport sector occurs due to mode of transport, transport infrastructure and sectoral regulations.
- Physical risk analyses which will be performed for transport sector should be conducted by taking into consideration the requirements of sub-sectors of transport by road, rail, sea and air.
- Transport sector is directly affected by functioning of several different sectors (such as tourism, energy) by nature and it affects these sectors directly. In this context, it is critical to design climate change adaptation actions which will be developed for transport sector from a multi-sector perspective.
- When the studies which have been conducted in the context of climate change response of transport sector in Turkey are filtered through climate change adaptation, it is understood that road transport is predominantly analysed in parallel with interests of the country. In this context, it is necessary to design climate change adaptation actions which will be designed for transport sector (impact analysis and adaptation) in a manner that will also include other modes of transport on an equal level.
- The transport sector by its nature affects and is affected by the operation of many other sectors (tourism, energy etc.). It is therefore important that climate adaptation actions for the transport sector needs to be designed in a multi-sectoral perspective.
- Reviewing the work in the context of climate action for the transport sector in Turkey reveals that road transport has been primarily analysed in parallel with national interests. It is therefore necessary to design climate adaptation actions (impact analysis and adaptation) for the transport sector with an equal consideration of modes of transport.

The impacts which result from climate change and decrease of access to natural resources day by day make transport sector vulnerable against climate change impacts. New climatic and environmental conditions lead to highly subversive damages to the assets of transport sectors and transport infrastructure. In addition, legal regulations which increase in number day by day so that transport sector is decarbonized especially across EU countries and some developing countries and increasing customer demands for low carbon transport alternatives are unusual impacts on the sector which result from the climate crisis.

In this context, planning activities which will be conducted for the assets and the supply chains whose sphere of influence lies within the boundaries of transport sector should be coordinated by taking into consideration the requirements of new climate regime.

#### 3.11.1 Sectoral impact of climate change

Climate change vulnerability of the assets such as cargo ships, railcars, aircrafts and the structures such as airports and ports occurs due to sea level rises and extreme climate events which are among main climate change impacts. For instance, the increases in the intensity of floods and sea level rises which will be observed due to climate crisis impacts will hamper the activities of ports or airports which have been established on the coast line and in the regions of flood risk in the medium and long term.

It is one of foreseen impact scenarios that activities of such structures which have been designed and commissioned without considering climate crisis impacts will halt in the short and medium term or extreme weather events such as hurricanes and tornados which have increased in frequency will jeopardise both sea and air transportation management. Therefore, it will trigger the financial losses and make ensuring life safety difficult. The impacts of climate change on transport sector have been outlined below by considering the characteristics of transport (GIZ, 2009).



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*Impacts of Climate Change on Road Transport-* Road infrastructure including infrastructure for non-motorised transport (bike lanes and walkways) provides key mobilisation infrastructure which is necessary for public and private sector in developing cities. Road transport is also one of governments' assets with the largest replacement value. In this context, it is critical to provide a climate resilient road infrastructure for any sustainable urban system and the economic welfare of rural systems. Table 25 provides a detailed overview of the climate change impacts on road infrastructure.

Table 25. The impacts of climate change on road transport (GIZ, 2009)

Risk Element of Climate Change	The impacts on Road Transport
Rising temperatures and heat waves which increase in intensity/frequency	Deformation of roads, slowdown or disruption of transport; melting of asphalt / dark surfaces
	Increased asphalt surface ruts due to material restrictions in case of exposure to severe heat
	Severe thermal expansion that is observed on bridge expansion joints and paved surfaces
	Degradation of structural materials of bridges
More frequent droughts (and decreasing soil moisture)	Occurrence of more landslides and subsidence in dry soils as a result of heavier rains
	Degradation of road foundation due to increased variation during wet/dry periods and a decrease in existing moisture
	Safety hazards which will be triggered by less observed road signs as well as less friction in braking which is caused by dust and sand on the roads
Sea level rise and coastal erosion	Flood risk which will be observed in road infrastructure and underground tunnels of coastal cities
	Degradation of road surface and base layers because of salt penetration
More frequent excessive precipitation and floods	Risks are greater in flood plains, low-lying coastal regions and the sites where urban sewers are overloaded or non-existent
	Floods that may occur especially on the roads which pass through the regions where drainage is inadequate and in underground tunnels
	Road damages and reduced structural integrity due to erosion, landslides and increasing levels of soil moisture
	Undermining and washing of bridges because of higher rivers or canals
	Risk of being washed away or rasping which will be observed on the soil roads with limited foundation and with poor or no drainage and on the other roads
	Faster degradation of soil material underneath roads or pavements may lead to its loss of strength and hauling capacity
	Increasing depreciation in infrastructures
More severe and frequent storms	Damage to infrastructure texture, bridges, overpasses, street lighting, signboards and service stations



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	Risk of inundation by the sea during strong winds, especially as a result of high tides and sea level rise
	Blocking roads because of fallen trees, buildings or vehicles due to strong winds
	Disruptions and consequent safety and socio-economic impacts

*The Impacts of Climate Change on Railways-* While the climate change impacts on railway infrastructure are substantially similar to those on road infrastructure, railway requires different approaches in comparison to road networks in the framework of climate change adaptation when a few characteristics of railway infrastructure are taken into consideration. Table 26 provides a detailed overview of the climate change impacts on railway infrastructure.

Table 26. The impacts of climate change on railway (GIZ, 2009)

Risk Element of Climate Change	Impacts on Railway
Rising temperatures and heat waves which increase in intensity/frequency	Buckling of rails and slowdown of rail movement or disruption of transport due to thermal expansion
	Rising temperatures in underground networks (and trains)
More frequent droughts (and decreasing soil moisture)	Occurrence of more landslides and subsidence in dry soils as a result of heavier rains
Sea level rise and coastal erosion	Flood risk which will be observed in road infrastructure and underground tunnels of coastal cities
More frequent excessive precipitation and floods	All modes of transport may be affected by flood and risks are greater in flood plains, low-lying coastal regions and the sites where urban sewers are overloaded or non-existent
	Increases in floods which are observed on rail lines and in underground tunnels
	Railbed damages and reduced structural integrity due to erosion, landslides and increasing levels of soil moisture
	Floods which will be observed on the roads which pass through the regions where especially drainage is inadequate and in underground tunnels
	The stability of earthworks are affected by intense precipitation due to the formation of pore water pressures in the soil, especially after periods of hot and dry weather
	Faster degradation of soil material underneath rails may lead to its loss of strength and hauling capacity
	Failure of line circuits with subsequent disruptions due to inability to identify the presence or absence of trains on rails and inability to send relevant signals
	Increased depreciation in infrastructures
	Damage to stations/infrastructure texture, bridges, overpasses, electrified rails with overhead cables, train platforms, street lighting and signboards





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	Risk of inundation by the sea during strong winds, especially as a result of high tides and sea level rise
	Blocking roads or rails because of fallen trees, buildings or vehicles due to strong winds
	Leaf fall is concentrated, which leads to reduced rail security
	Increased lightning strikes to rail signalling or electronic systems
	Lightning strikes which disrupt electronic signalling systems

*The Impacts of Climate Change on Waterways-* Waterways which play an important role in urban transport as well as freight transport generally illustrate climate vulnerability based on water scarcity and flood scenarios. Table 27 provides a detailed overview of climate change impacts on waterway infrastructures (GIZ, 2009).

Table 27. The impacts of climate change on waterway

Risk Element of Climate Change	Impacts on Waterway
Rising temperatures and heat waves which increase in intensity/frequency	Clogging of waterways due to increased aquatic vegetation
More frequent droughts (and decreasing soil moisture)	Reduced water availability in waterways which leads to restriction of their use and obligation to further use road networks
Sea level rise and coastal erosion	Destruction of port enterprises, facilities and coastal waterways
More frequent excessive precipitation and floods	Reduced clearance under waterway bridges
	Reduced navigability of rivers and canals
	Increase in silt beds
More severe and frequent storms	Damage to waterways
	Clogging of rivers and canals due to floating debris

*The Impacts of Climate Change on Airways-* A detailed overview of climate change impacts of climate vulnerability on airway infrastructure which generally occurs as a result of extreme weather events has been provided in Table 28 (Eurocontrol, 2020).

Table 28. The impacts of climate change on airway (GIZ, 2009)

Risk Element of Climate Change	Impacts on Airway
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Rising temperatures and heat waves which increase in intensity/frequency	Changes in aircraft performance
	Changes in noise impact due to changes in aircraft performance
	Heat damage to airport surface (runway, taxiway)
	Increased heating and cooling requirements
	Increased pressure on local services, e.g. water and power (for cooling)
Sea level rise and coastal erosion	Loss of airport capacity
	Decrease which will be observed in runway capacities due to lack of ground capacity
	Loss of airport infrastructure
	Loss of road transport access
More frequent excessive precipitation and floods	Disruptions to operations (e.g. flooding of airport, ground subsidence)
	Reduction in airport efficiency
	Inadequate drainage system capacity
	Inundation of underground infrastructure (for example, electrical infrastructure)
	Inundation of road transport access (passenger and personnel)
	Loss of supply of local public services (for example, electricity)
Change in the characteristics of wind	Convective weather: Disruption to operations
	Convective weather: Route extensions
	Jet stream: potential increase in the intensity and number of en-route turbulence
	Local wind patterns: Potential disruption to operations and changes in distribution of noise impact
More severe and frequent storms	Disruption to operations, route extensions
	Disruption to road transport access
	Disruption to supply of public services

#### 3.11.2 Transport sector's adaptation to climate change

Resilience of transport sector should be addressed in line with characteristics and special requirements of transport service. In this context, the adaptation practices which are implemented for transport by road, rail, water and air have been outlined below.



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Climate Resilience of Road Transport (GIZ, z) - When the impacts of climate crisis on road transport such as restriction of usage of road, slowdown of mobilisation and occurrence of accidents are taken into consideration, the adaptation measures which will be developed for the sub-sector of road transport generally contribute to design and planning actions which are listed below:

- Operating more resilient design standards for infrastructure construction and using the materials
- Using enhanced drainage systems
- Conducting regular maintenance of the whole infrastructure
- Operating urban planning which avoids high risk areas
- Minimizing the need for road infrastructure through compact urban planning

In the light of the measures above, the adaptation practices which have been developed for the sub-sector of road transport in line with key risk elements of climate crisis have been compiled in Table 29.

Table 29. Adaptation of road transport to climate change (GIZ, 2009)

Risk Element of Climate Change	Adaptation Practice
Rising temperatures and heat waves which increase in intensity/frequency	Planting roadside vegetation to reduce the exposure of roads to heat
	Improving infrastructure designs by using rut-resistant asphalt and concrete
	Increasing maintenance activities
	Improving design standards to withstand higher temperatures
More frequent droughts (and decreasing soil moisture)	Conducting road risk mapping
	Removing high risk areas from sectoral development plans
	Monitoring soil condition of existing roads which are used
	Further cleaning and maintenance of roads
Sea level rise and coastal erosion	Creating vulnerability mapping
	Restricting sectoral growth activities in high risk areas
	Protecting sea walls and coastal wetlands
	Improving drainage capacity, designing underpasses by considering pumping and elevating road technologies
More frequent excessive precipitation and floods	Creating flood maps
	Improving flood plain and coastal management
	Using early warning systems



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	Protecting green areas
	Increasing the frequency of hydrological monitoring activities
More severe and frequent storms	Revising design standards in line with new storm regimes
	Incorporating weather forecast reports into designs
	Creating disaster risk maps

Climate Resilience of Railway Transport (GIZ, 2009) - In the light of the impacts of climate change on railways, the adaptation practices which have been developed for the sub-sector of railway transport in line with key risk elements of climate crisis have been compiled in Table 30.

Table 30. The adaptation of climate change to railway transport

Risk Element of Climate Change	Adaptation Practice
Rising temperatures and heat waves which increase in intensity/frequency	More frequent rail maintenance activities
	Implementing new design standards so that rails withstand higher temperatures
	Revising management procedures to impose differentiated speed limits
	Using warning systems where transfer centres, teams and stations are included in target audience
	Incorporating meteorological models into sector development plans
	Improving cooling systems of underground networks (e.g. subway, tunnel)
More frequent droughts (and decreasing soil moisture)	Conducting sectoral risk mapping
	Regularly monitoring and maintenance of infra- and super-structures under high risk
	Avoiding rail lines in high risk areas
Sea level rise and coastal erosion	Creating vulnerability maps
	Protecting sea walls and coastal wetlands
	Using strengthened pumping systems
More frequent excessive precipitation and floods	Improving and increasing the capacity of drainage infrastructure
	Conducting flood risk assessment



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	Using enhanced pumping systems
More severe and frequent storms	Conducting the resilience analyses of existing infra- and super-structures
	Using meteorological modelling as a restoration and design parameter
	Using wind fences for open railway lines
	Using circuit breaker protection for overhead lines
	Improving signalling equipment
	Conducting contingency planning

Climate Resilience of Waterway Transport (GIZ, 2009) - In the light of the impacts of climate change on waterways, the adaptation practices which have been developed for the sub-sector of waterway transport in line with key risk elements of climate crisis have been compiled in Table 31.

Table 31. The adaptation of waterway transport to climate change

Risk Element of Climate Change	Adaptation Practice
Rising temperatures and heat waves which increase in intensity/frequency	More frequent maintenance activities
More frequent droughts (and decreasing soil moisture)	Assessing the restrictions which will be conducted for the use of urban waterways in transport sector and using the assessment results as an input for planning
Sea level rise and coastal erosion	Creating vulnerability maps
	Protecting sea walls and coastal wetlands
	Using strengthened pumping systems
More frequent excessive precipitation and floods	Planning for use of alternative transport modes
	Planning super-structures such as bridge and overpass in a manner that will be built at higher levels
	More frequent dredging of silt
More severe and frequent storms	Increasing monitoring and maintenance activities
	Conducting contingency planning



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Climate Resilience of airway transport (Eurocontrol, 2018)- In the light of the impacts of climate change on railways, the adaptation practices which have been developed for the sub-sector of railway transport in line with key risk elements of climate crisis have been compiled in Table 32.

Table 32. The adaptation of climate change to airway transport

Risk Element of Climate Change	Impacts on Airways
Rising temperatures and heat waves which increase in intensity/frequency	Increasing the frequency of maintenance of aircrafts
	Improving cooling technologies of airport
Sea level rise and coastal erosion	Establishing new airports at higher levels
	Revising runway planning with technological renewals (pumping technologies)
Change in the characteristics of wind	Integrating meteorological planning into activity and planning reports
	Increasing resilience of aircrafts for new turbulence regimes

When the impacts of climate change on transport sector are analysed in a mesh and behavioural manner, contemporary adaptation practices are necessary to be coordinated in line with “Value Protection” and “Value Creation”.

Adaptation practices which will be implemented for the protection of sectoral values are critical for protecting physical presence of companies and having the skill to maintain workflows that companies implement in the reference scenario. These practices are generally observed in the triangle of climate risk assessment and management, product design and insurance parameters.

For example, the companies called Cobham and National Express Group which are located in the United Kingdom have implemented special climate programmes for identifying climate change impacts and integrated the result of these programmes into medium and long-term growth plans of the companies. As an example for other adaptation measures, the ultrasound technology that has been developed by a Brazilian company called America Latina Logistica to detect cracks and fractures on the roads and R & D studies that have been implemented by Rolls Royce from the USA in order to use new fuel alternatives and fuel cells in its vehicles have been recorded as climate change adaptation practices which have been conducted through product design in transport sector. In addition to that, a Spanish company called Cintra which is one of the biggest companies in the highway construction sector and the company called Electrocomponents whose headquarters is located in the United Kingdom have restructured their insurance policies which they have implemented for supply chains and operations by considering the impacts of climate crisis.

The adaptation practices which will be implemented to establish new value resources in the sector is critical for discovering new revenue stream alternatives while companies, suppliers, stakeholders and customers adapt to climate change. These practices are generally observed in the triangle of institutional climate strategies, new technologies and productivity.

Auckland International Airport and Boeing are noteworthy companies on the subject of climate change adaptation in transport sector in this context. For example, Auckland International Airport has prepared a comprehensive report on the impacts of climate crisis on value chains and in accordance





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with this report, it has established a budget for climate action in order to design climate change adaptation of the airport in a sustainable manner. In addition to R & D studies which have been conducted for the use of biofuel, Boeing conduct periodic sectoral impact analysis.

The practice of a company called Deutsche Post DHL which provide postal services with its headquarters in Germany stands out in the context of fostering and increasing climate adaptation practices with new technologies. Deutsche Post DHL has taken action to minimize carbon emissions of the service which is provided by the supplier with the help of carbon scenarios that Deutsche Post DHL has presented to its suppliers. With the help of the programme called GoGreen, the company has improved its environmental prestige across Germany and described how this practice has increased its power of competition in transport sector through the activity report which it published in 2009.

Considering it in an **institutional** aspect, relevant government stakeholders and public-private stakeholders have central roles and responsibilities in terms of making transport sector resilient against climate change impacts. Planning climate change adaptation strategies of transport sector in Turkey in a rationalist and holistic manner depends on the identification of roles of other stakeholders, mainly public administration regarding the sector and conducting a proper gap analysis for the stages which stakeholders are currently involved in. The institutions which have the most important responsibility in terms of adapting industries/economic sectors in Turkey to climate change are as follows:

- Strategy and Budget Office of the Presidency
- Ministry of Transport and Infrastructure; General Directorate of Civil Aviation (DCGA), General Directorate of Highways (KGM), General Directorate of Turkish Maritime Enterprises, TCDD Enterprise General Directorate and affiliates of the Ministry.
- Ministry of Environment and Urbanisation.

Strategy and Budget Office of the Presidency is an institution that implements the studies with its mission to accelerate economic and social development of Turkey and make development balanced and sustainable and ensures the coordination of developing sectoral and thematic policies and strategies, preparing and implementing central government budget and implementing plan, programme, allocation of assets, budget, policies and strategies, mainly preparation of key policy documents. Including Eleven Development Plan which has been prepared under the guidance of Strategy and Budget Office of the Presidency and Ministry of Development of current period, retrospective development plans (9<sup>th</sup> and 10<sup>th</sup> Development Plans) have been analysed by using the place of industries in development plans and climate change adaptation filter. At the end of the analyses which were conducted, it has been understood that development plans are for sector-specific demand and for economic growth projections and there is no inclusion on climate change adaptation.

The last five years' "Activity Reports, Transporting and Accessing Turkey reports<sup>205</sup>, Sector Reports, Performance Reports and Strategic Plans" which were published by Ministry of Transport and Infrastructure and affiliated organizations were analysed in the scope of climate crisis response. In addition, the objectives and existing project outputs of Green Airport Project which is implemented by General Directorate of Civil Aviation were also examined from the perspective of climate crisis response and it has been understood that this project included the practices for greenhouse gas mitigation policies of climate crisis response and it did not include any practices, objectives or plans on climate change adaptation of aerospace sector in Turkey.

<sup>205</sup> Transporting and Accessing Turkey reports are publications that are prepared periodically for the sub-sectors of Air, Road, Rail and Sea Transport Enterprises by the Ministry of Transport and Infrastructure.



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In addition to this study, there are not any objectives for climate change adaptation in the project of DCGA which is implemented in consortium of MEU, General Directorate of Environmental Management, GIZ Turkey and Life Energy for including Turkish aerospace industry in existing MRV chart. On the other side, according to an analysis regarding climate change adaptation which was conducted for 2017-2021 Strategic Plan of Ministry of Transport and Infrastructure in 2019 by Talu and Kocaman, it is foreseen that Climate Change Adaptation Project will be conducted in transport sector; an increase in the number of road vehicles which will lead to increase in greenhouse gas emissions is shown as a risk in spite of investments which are conducted in the field of transportation and contribute to greenhouse gas emission mitigation (high-speed trains, subway, development of railway infrastructures, etc.). In this analysis, it has been identified that light rails, smart transport systems and any types of investment and project which contribute to the development of public transport will ensure the mitigation in sectoral emissions because they will guide existing road-intense transport system to more ecological modes; it has been stated that it is needed to calculate the contribution of investment activities/projects to national emission mitigation efforts and it has been stated that the strategies are integrating climate change adaptation into relevant policy, programme and activities and identifying policies that increase energy efficiency in the sector.

Ministry of Environment and Urbanisation (MEU) leads national level coordination efforts for decision making and regulations related to climate change. In the strategy documents which were prepared for climate change response led by MEU (IDES, CCAP, National Climate Change Adaptation Strategy and Action Plan, National Communications), the climate change impacts which are observed in transport sector and climate change adaptation measures have been filtered in detail and it has been pinpointed that planning transport sector under the title of climate crisis response is substantially aimed for establishing inventory of greenhouse gas and identifying decarbonisation practices at the end of these analyses. In addition, the inclusions which have been identified for climate change adaptation may be enumerated as follows:

- Making urban transport resilient against financial impacts of climate crisis by establishing mitigation and adaptation synergy
- Preparing the impact analyses for existing transport infrastructures (for example, port enterprises, road transports, railways)
- Strengthening existing transport infrastructures in line with the results of impact analyses
- Implementing technological integration studies in the sections (for example, railway Scada systems) which are seemed necessary in transport networks (for example, improving existing signalling network and technology)
- Establishing smart transport networks.

#### 3.11.3 Work by stakeholders

When the studies which were prepared for climate crisis response of transport sector under the coordination of **the Presidency of the Republic** are examined, it may be stated that some projects and activities for encouraging the use of bicycles which have been implemented in recent years have contributed to mitigation and adaptation synergy of transport sector in Turkey: One of them is the project “Encouraging a Culture of Healthy Life” of the Presidency of the Republic and in the Project, it is emphasized that construction of bike lanes have been approved to encourage physical activity and improve environmental factors and the use of bicycle is one of the most effective tools in increasing physical activity. Other projects are “Presidential Cycling Tour of Turkey” and “2020 UCI Mountain Bike Marathon World Championship” of the Presidency of the Republic.



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When the studies of academic institutions in Turkey are examined under the scope of climate change response filter of the sector, some studies stand out in the scope of climate change adaptation. One of them is the study “**Transformation of Transport Policies/Planning for Greenhouse Gas Mitigation**” which was prepared by Nişantaşı University. This study has concentrated on the transport policies in Turkey and the distribution of modes and has essentially mentioned climate change and greenhouse gas emissions from the perspective of sustainability. In this study which was prepared on decarbonisation of the transport sector in Turkey, the inclusions on the subject of establishing a strong mitigation and adaptation synergy in the transport sector by proposed sustainable transport alternatives have been identified.

The article “**Urban Climate Change Governance**” which was published is a baseline analysis of sustainability of urban transport networks. In the context of climate crisis response, this study which focuses on the analysis of mitigation policies on a large scale includes some analyses on climate change adaptation parameters which should be considered in designing new transport modes.

In the study “**Econometric Analysis of Climate Change and Transportation Sector Relation**” which was prepared in the consortium of Abant İzzet Baysal University, Çanakkale Onsekiz Mart University and Ardahan University, the economic impacts of climate crisis on transport sector were analysed.



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### 3.12 Tourism sector and climate change adaptation

- As one of the sectors which are dependent on meteorological conditions and water, tourism sector is one of the most important sectors which require climate change adaptation policies, considering its strong economic impact.
- Climate change will have serious impacts on summer and winter tourism in Turkey. Long term strategy plans are necessary to adapt to these impacts and reduce the financial loss of the sector.

Since the second half of 20<sup>th</sup> century, tourism has become one of the most rapidly developing sectors of the world economy (Bilgiçli and Altınayak, 2012). Tourism has been mostly used as a tool for national or regional development like many other industries. Tourism sector has become a substantial factor which widely plays a role in establishing income, business and tax revenues, mitigating problems of balance of payments, contributing to regional and national economic developments. As one of essential leading sectors of Turkish economy, tourism is a subject that governments dwell on as a remedy against especially foreign trade deficit, inflation and unemployment (Çımat and Bahar, 2003). When statistics were examined, it was identified that approximately 52 million tourists visited Turkey in 2019 and the total tourism revenue was 34.5 billion USD (TURKSTAT, 2019).

Climate is one of critical factors which shape tourism industry. Tourism is a sector which is dependent on climate elements such as temperature, precipitation, wind, moisture and their changes. Also, climate, coasts, oceans, mountains, forests, wildlife and related ecosystems provide an important touristic attraction at many destinations (Holden, 2018). In this context, climate has a determinant feature during the selection stage because it mainly depends on weather and climatic conditions in the touristic area for tourists to have a holiday or conduct their touristic events efficiently. Increase in storm, tornado and extreme weather events leads to damage to tourism activities across the areas which are affected by these events. Likewise, drought, epidemics and heat waves which result from global warming affect tourism (Acar, 2020).

In addition to that tourism sector is affected by results of climate change, it leads to an increase in global temperature as a result of greenhouse gas emissions which are caused by tourism sector. According to the result of a study which has been conducted in Australia, it has been identified that tourism sector was responsible for the 8 percent of global greenhouse gas emissions. In this study, it has been identified that the carbon multiplier of tourism sector is higher than those of global manufacturing and construction sectors (Lenzen et al., 2018). In this context, tourism sector appears as a sector which both is affected by climate change and leads to climate change.

#### 3.12.1 Sectoral impact of climate change

In line with studies which have been conducted, it has been identified that 2 degrees of warming which will occur due to climate change will affect tourism in Central and Northern Europe positively, but Southern European countries will be negatively affected by this situation in the summer months. Therefore, the necessity of developing adaptation policies for tourism sector has been highlighted based on temperature rise projections which will occur between the years 2031-2060 (Grillakis et al., 2016).

In the case of Turkey, while efforts are made to diversify tourism and spread it over 12 months of the year, the tourism type that attracts tourists the most is still summer tourism (Sevim and Ünlüönen, 2010). Another leading tourism type is winter tourism in Turkey. Winter tourism is included in alternative tourism types which are qualified as a priority in the context of Tourism Strategy of Turkey - 2023 (Soyak, 2013).



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It is observed that tourism economy of Turkey has been exposed to multiple stresses such as sea level rise, water scarcity, drought, extreme weather events and disasters due to climate change. While the critical and strong economic impact of drought in Turkey is observed in agriculture and its sub-sectors which are most dependent on water resources, other sectors are also negatively affected. One of them is tourism sector that is one of the sectors which are dependent on meteorological conditions and water. An increase in water demands of hotels, swimming pools etc. during drought periods is one of critical issues.

The effects of climate change such as decreasing availability of water resources and an increase in temperatures started leading to spatial (From South to North) and seasonal (from summer months to spring months, from winter months to spring months) shifts in tourism sector in the medium and long term (they have already started occurring). It is inevitable that winter tourism will be affected. It has been described in Figure 32 how Mediterranean Basin which Turkey is also inside will be affected by climate change. It is observed that the impacts which are mentioned on the map will be predominantly felt especially in the Mediterranean and East-Southeast Regions and Eastern Black Sea Region.

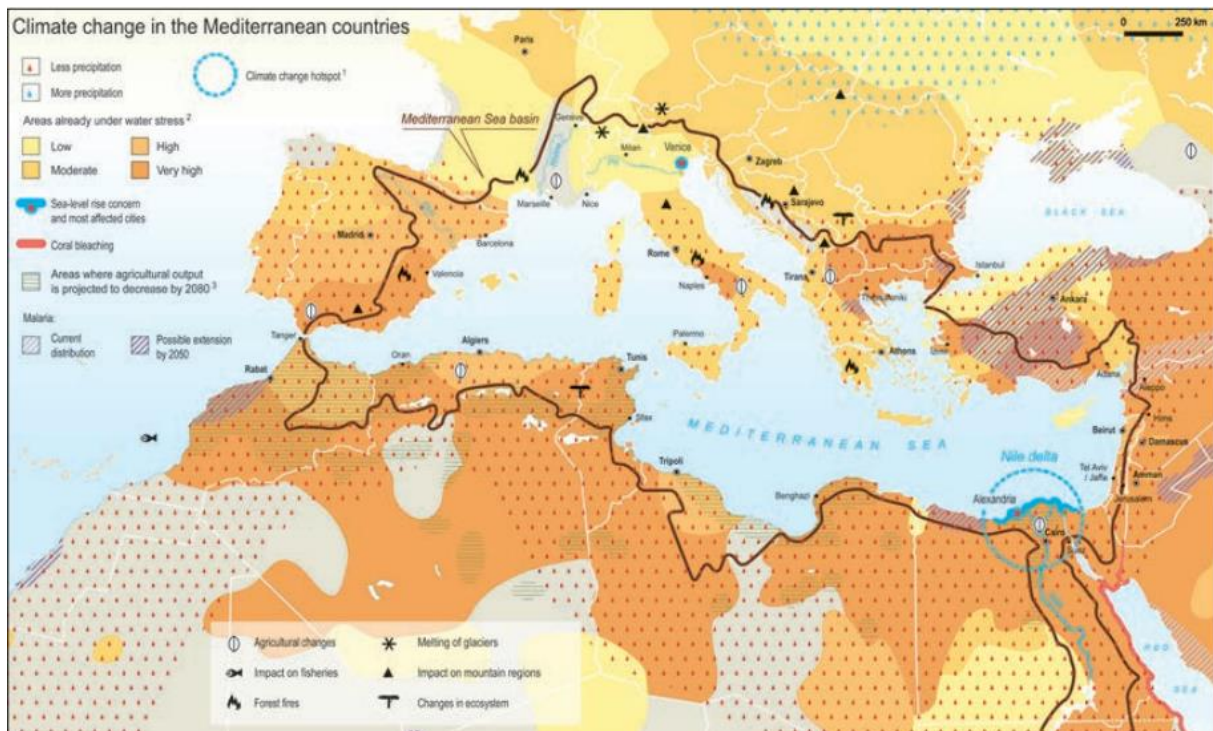


Figure 32. The Impacts of Climate Change on Mediterranean Basin (Planbleu Notes, 2020)

In this context, the impacts of climate change on summer and winter tourism have been described in detail below.

- The biggest impacts of climate change on summer tourism are tourist facilities and beaches at risk of inundation as a result of sea level rises which will occur and beaches at risk of disappearing due to coastal erosion. Especially climate change-induced sea level rise and changes in wave regimes are among the biggest factors of coastal erosion (Toimil et al., 2017). This situation leads to shoreline change and making beaches disappear. When examined specific to Turkey, coastal erosion is observed in the Black Sea Region, on Konyaaltı Beach of Antalya and in Karasu region of Sakarya. Changes which are observed on the shoreline as a result of coastal erosion which has occurred in Karasu region and on Konyaaltı beach are shown in Figures 33 and 34.





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Figure 33. Coastal Erosion which is observed on Karasu (On the left) and Konyaalti (On the right) Beaches (Kutoğlu et al., 2011)

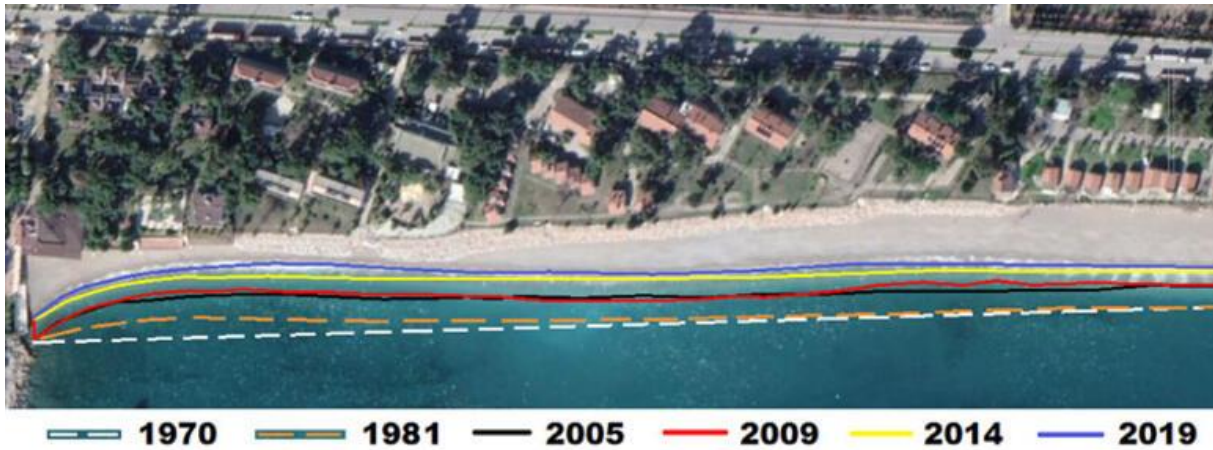


Figure 34. Change of Konyaalti Beach as a result of Coastal Erosion (Kocababa S., 2017)

- Since the beginning of 20<sup>th</sup> century, a rise in average global sea level has been observed. While a sea level rise of 16–21 cm between the years 1900-2016 has been observed, it is foreseen that this rise will continue accelerating in line with the results which have been achieved through satellite images (Cazenave, 2018). The thermal expansion of sea water often results from human-made global warming which leads to melting of ice sheets on land and glaciers. According to IPCC evaluations in 2007, a high end estimate of 60 cm through 2099 was foreseen, but this estimate was raised to 90 cm in 2014 and as a result of current studies, it was found that global sea level rise of 200-270 cm in the 21<sup>st</sup> century was “physically reasonable” (Bamper et al., 2019). This situation will lead to shoreline change and accordingly inundation of beaches. As seen in Figure 35, as a result of a sea level rise of 2,7 meters which will be observed by 2100, the beaches and enterprises which constitute a great majority of tourism revenues of Turkey and are located on the Aegean-Mediterranean shoreline will be submerged (Somuncu, 2018).





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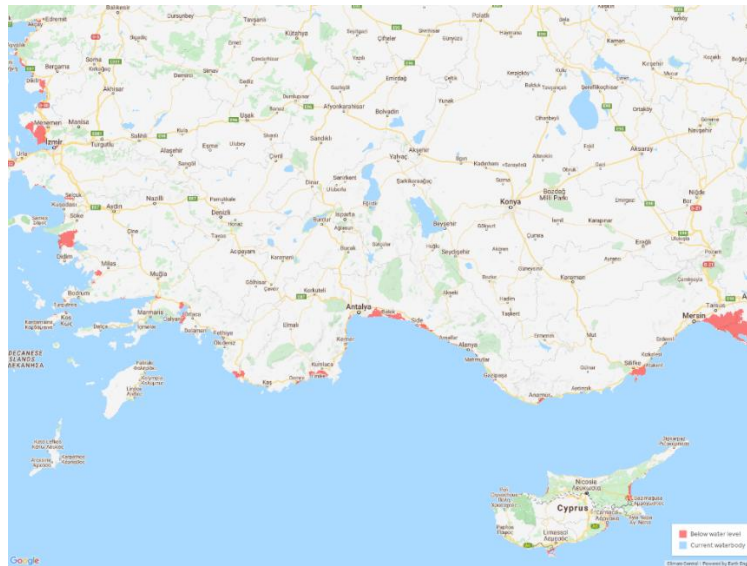


Figure 35. Change of the Aegean-Mediterranean Shoreline as a result of Sea Level Rises (Climatecentral, 2019)

- Flows in tourism sector proceed through certain assumptions. For example, assumptions that a hot and dry summer season will occur in the Mediterranean, there will be regular snowfalls at ski centres during the winter months are determinant elements for tourism and tourists' selection of destination, but an increase in frequency of floods, inundations and storms depending on extreme weather events which occur due to climate change, drought, desertification and accordingly decreasing access to clear water resources, health conditions which emerge due to extremely high temperature lead to uncertainty in tourism sector which proceeds through certain assumptions (Somuncu, 2018). In the report "Climate Change and Tourism Policy in OECD Countries" which was published in 2008 by World Tourism Organisation and United Nations Environment Programme (UNEP), warmer summers, water stress, loss of biodiversity in terrestrial and aquatic ecosystems and epidemics are among the events that may be observed due to the impacts of climate change in the Mediterranean Basin which also includes Turkey (UN/WTO and UNEP, 2008). Also, it is stated that a temperature rise of between 0,3°C and 0,7°C will occur every ten years, temperature-relative humidity index will increase and the number of days on which temperature is above 40°C will increase on the Mediterranean Basin. It is foreseen that this situation will be a determinant factor for tourists' selection of destination.
- It has been identified that high-pressure zones in the tropics will shift to the north depending on climate change. It is foreseen that this change will affect mass tourism movements in the countries which are located on the Mediterranean basin that also includes Turkey. Because global temperature rise will occur and precipitation will start late, tourism season may take longer. This situation which can be of benefit in the short term will lead to an increase in greenhouse gas emissions which result from tourism sector as a result of increasing tourism demand in the long term and will lead to the occurrence of more environmental issues. In addition, as a result of that Aegean and Mediterranean regions lose their attractions for mass tourism due to an increase in summer temperatures which will occur, negative outcomes such as reduced tourism movements and even termination of these movements especially on the Mediterranean coasts in summer season may be attested in near future (Somuncu, 2018).
- Ski seasons become shorter due to increases in temperatures and deficient snowfall because of climate change. While artificial snow is produced via snowmaking machines in the regions where snowfall is inadequate, it will not be possible to produce artificial snow especially in low-lying areas and on



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courses on south-facing slopes if an increase in temperature continues. Warming will reduce the number of facilities which are especially located at lower altitude and “*rely on snow*” and it will also make ski season shorter (Somuncu, 2018). The impacts of this situation are also currently observed in Turkey. While total area of 13 mountain glaciers of Turkey was measured to be 25 km<sup>2</sup> in 1970, this value decreased to 11 km<sup>2</sup> nowadays. As a result of modelling studies, it is foreseen that winter tourism facilities will be negatively affected by decrease in snowfall and temperatures increases which will be observed by 2050 (Demiroğlu, 2016).

The impacts of climate change on tourism sector have been outlined in Table 33:

Table 33. The Impacts of Climate Change on Tourism Sector (Somuncu,2018).

The Impacts of Climate Change	Potential Impacts on Tourism Sector
Increase in temperatures	Change in seasonality, changes in heat stress for tourists, cooling costs, plant-wildlife-insect populations and their distribution, spread of communicable diseases
Decreasing snow cover and shrinking glaciers	Inadequacy of snow in winter sports destinations, increase in snowmaking costs, shorter winter sports season, decrease in landscape aesthetics
Increase in intensity and frequency of extreme storms	Risk for tourism facilities, increase in insurance costs/loss of insurability, business interruption costs
Increase in evaporation in some regions and decrease in precipitation	Competition on water between water scarcity, tourism and other sectors, desertification, increase in fires which affect demand and threaten infrastructure
Increase in frequency of heavy precipitation	Flood damage to historical architectural and cultural assets, damage to tourism infrastructure, changing seasonality
Sea level rise	Coastal erosion, loss of beach areas, high costs to protect and maintain port districts
Increase in sea surface temperatures	Increase in coral bleaching, degradation of snorkel and diving destinations, water resources and aesthetics
Changes in terrestrial and marine biodiversity	Loss of species in destinations and natural attractions, higher risk of disease in tropical-subtropical countries
More frequent and bigger forest fires	Loss of natural attractions, increase in flood risk, damage to tourism infrastructure
Changes in soil (For example, moisture levels, erosion and acidity)	Impacts on destination attractions and loss of archaeological assets and other natural resources

#### 3.12.2 Sectoral adaptation to climate change

The developments on the adaptation of tourism sector to climate change in terms of legislation, institutional structure and policies in Turkey have been assessed below.

Law No. 2634 of 12.03.1982 on Tourism Incentives regulates tourism sector and investments and incentives on tourism sector. The provision of Law on Tourism Incentives that is directly related to climate change adaptation is Article 8 which regulates the allocation of forests to tourism investments. The decision no. 2007/55 of the Constitutional Court stated that the allocation of forests to tourism investments depended on conditions of inevitability and necessity and annulled the regulation on forests due to incompatibility with Article 169 of the Constitution on protecting forests. It can be discussed to what extent re-legislation with Law No. 5761 of 07/05/2008 which was conducted in the article responded to the decision of annulment. The article makes allocation of forests which are included in immovable properties in culture and tourism conservation and development areas and tourism centres to investments for tourism activities possible. Through Supplementary Article 4, it is



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foreseen that land allocation for tourism investment in areas which are considered state-owned forest, national parks and special environment protection areas will be conducted with affirmative opinion of relevant ministry. In addition, it is stated that the aim of allocation of meadows, summer quarters and winter quarters which are located in culture and tourism conservation and development areas will be amended in line with the provisions of Meadows Law.<sup>206</sup>

The regulations which were issued in the context of Law on Tourism Incentives include the Regulation For Public Immovables Allocation For Tourism Investments (2006), Regulation on Preparation and Approval of Land Development Plans in Culture and Tourism Conservation and Development Areas and Tourism Centres (2003) and Regulation on Designation and Declaration of Culture and Tourism Conservation and Development Areas and Tourism Centres (2004).

In the context of Law on Tourism Incentives, the duties and powers which are allocated to the Ministry of Culture and Tourism on the identification, announcement and plans of tourism regions, areas and centres are implemented by General Directorate of Investments and Establishments which is the main service unit of the ministry.

In the 11th Development Plan (2019-2023), the issue of climate change was addressed in the part of policies and measures of tourism sector. Accordingly, the statement “The studies on identification of the impacts of climate change on tourism sector will be conducted (paragraph 426.6)” has been included in the plan.

In order to achieve the objectives of the 11th Development Plan, in the 2019 Presidential Annual Programme which was published in Official Gazette of 27.10.2018, the followings are stated in the section related to “Tourism” sector;

- Coastal areas where tourism activities are concentrated are under pressure due to negative conditions which result from human-made uses and global climate change,
- It is required to establish a new integrated coastal areas management model,
- It is aimed to conduct a sustainable growth, considering protection-use balance with natural and cultural values in sector.

In 2020 Presidential Annual Programme, it was emphasized that coastal areas where tourism activities are concentrated were under pressure due to adverse conditions that result from human-made uses and global climate change.

In “Climate Change Strategy of Turkey” (NCCS) which covers the years 2010-2023, tourism sector has been included in the section titled The Adaptation of Strategy to Climate Change with the following statements: “The impacts of climate change on hydrological energy production capacity, tourism, health, food safety, water demand and forests of our country will be evaluated”.

In Climate Change Action Plan (CCAP) which covers the years 2011-2023, the subject of how tourism sector will be affected by climate change and a direct statement which is specific to relevant sector are not included. However, CCAP has identified as an objective that the organizations which are involved in water management will include sectoral impacts of climate change in their strategy plans and

<sup>206</sup> “Turkey’s Climate Change Policy, Legal and Institutional Framework”, Dr. Nuran Talu, Habip Kocaman, Ministry of Environment and Urbanisation, Enhancing Required Joint Efforts on Climate Action Project in Turkey/İklimİN, Climate Change Training Module Series 4, Ankara, 2019 ([http://www.iklimin.org/wp-content/uploads/egitimiler/seri\\_04.pdf](http://www.iklimin.org/wp-content/uploads/egitimiler/seri_04.pdf)).



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tourism has also been stated to be in sectors. As another objective which is included in CCAP, it is aimed to cooperate with national and international organizations which work on tourism (CCAP, 2011).

In Climate Change Adaptation Strategy and Action Plan of Turkey which covers the years 2011-2023, it has been stated that temperature increases, sea level rise and extreme weather events will affect tourism sector and the risk of coastal erosion will increase. In addition, it has been emphasized that flood risk which will rise depending on climate change will increase communicable diseases and human mobilities especially like tourism will facilitate the entry of communicable and/or new pathogen microorganisms or vectors into environment and finding new habitats. The strategy has described how tourism sector will be affected by climate change and stated that it is necessary to prepare strategy plans so that the sector adapts to climate change.

Any objectives related to the impact of climate change on tourism sector and the adaptation of the sector have not been included in policy documents “Tourism Strategy of Turkey - 2023” and “Tourism Strategy of Turkey- 2023 Action Plan 2007-2013”.

#### 3.12.3 Work by stakeholders

No work by stakeholders has been found which addresses climate vulnerability and adaptation options by directly targeting tourism sector.

Works related to tourism sector are presented as a by-product of works whose focal point is generally different. For instance, the aim of “The Impact of Climate Change on Snowmelts and Streamflows Project” which is implemented by Ministry of Agriculture and Forestry General Directorate of Water Management has been set to evaluate the impacts of climate change on snow masses and their melting on Upper Euphrates Basin during 2020-2100 period and accordingly the changes in stream flow. In order to establish the estimates of the impact of climate change on the area, temperature and precipitation data which are foreseen from “The Impacts of Climate Change on Water Resources Project” of the Ministry which has been conducted to identify changes in climate scenarios and water budget have been used in the project. In the context of the project:

- Snowfall observation data has been collected,
- Daily river flow rate has been estimated,
- Snow cover characterization has been identified,
- Snow depletion curves have been established by using satellite images,
- MPI-ESM-MR general air circulation model outputs for the purposes of RCP4.5 and RCP8.5 scenarios for the years 2020-2100 have been used to estimate the followings:
  - Snow-covered areas,
  - Snow-water equivalent,
  - Runoff that results from snowmelt,
  - Snowmelt-induced peak discharge timing and projections of shifts,
  - The amount of flow during the period of low flow and its temporal projections.

The sectoral impacts of outputs which were achieved in the project were also examined. In this context, tourism sector was addressed in the area where winter tourism was concentrated, and it was examined how it would be affected by the changes which were projected. Because of shifts towards higher altitude at snow line as a result of the changes which will occur, it has been estimated that both snow-covered area and water volume will decrease. It has been emphasized that these changes will cause harm to winter tourism sector the most.



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The Impact of Climate Change on Snowmelt and Streamflows Project was included in EU Climate ADAPT Platform as one of best practice projects.<sup>207</sup> The area which is covered by the project has been provided in Figure 36.

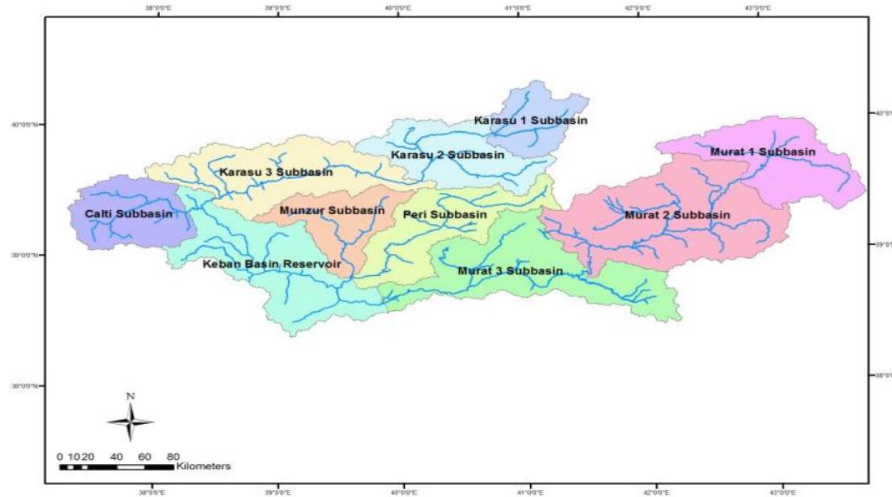


Figure 36. Upper Euphrates Basin

1st International Winter Tourism Congress was conducted between 19-21 December 2019 by Atatürk University Faculty of Tourism. It was stated that the aim of the congress was to address different aspects of winter tourism and share knowledge and experiences by bringing researchers who work in different fields at national and international level, public bodies and sector representatives together. Thus, it was aimed to strengthen winter tourism which has an important role in regional economy. In the congress, The impacts of climate change on winter tourism and current state were discussed. In addition, a panel called “Climate Change and Winter Tourism” was held in the context of the congress.

When the papers submitted in the congress are examined, the paper “Understanding the Current State of Winter Tourism in Erzurum and Evaluation of its Future in the Context of Climate Change” seeks to address current state of winter tourism that stands out as a sector which has a high socio-economic importance in Erzurum and evaluate winter tourism from the perspective of climate change which is one of the biggest factors that the sector will encounter. While addressing current statistics for current state, regional data, meteorological observations and region-specific works in the statement, the database of Copernicus Climate Change Services (C3S) European Tourism was used for the identification of future snow reliability and results were obtained by using different emission scenarios specific to the 21<sup>st</sup> century. According to the results, the winter tourism potential of Erzurum was identified and strategies for the vulnerability of tourism in the area against climate change were developed (Uzunboy et al., 2019)

In the statement “The Effect of Erzurum City Heat Island on Palandöken Ski Facilities” which was submitted to the congress, the effect of urban heat island on ski facilities was examined. In the study, LANDSAT satellite images were used for the identification of temperature and the temperature map of the area was prepared. In addition, urbanization in the area, land use, surface distribution of temperature and urban heat island density values were examined. As a result of the study which was

<sup>207</sup><https://climate-adapt.eea.europa.eu/news-archive/assessment-of-climate-change-impacts-on-snowmelt-and-streamflows-of-mountain-region-in-eastern-turkey>



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conducted, it was identified that the areas with high albedo value increased as a result of an increase in settlements in the area. It was stated that urbanization that especially expanded towards Palandöken ski facilities increased urban heat island effect in the area and it included problems for facilities (Günek, 2019).





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### 3.13 Communications sector and climate change adaptation

- Communications sector has the potential to mitigate greenhouse gas and contribute to adaptation efforts at the same time.
- Extreme weather events increase the risk of interruption in supply of electricity which telecommunications is based on.
- Communications companies should work for the purpose of creating a new value related to the climate change adaptation of their customers, suppliers and stakeholders.
- The view of communications sector on climate change in Turkey is aimed at mitigating greenhouse gas emissions and no studies on climate change adaptation have been found/exist.

While the products and services which ensure the mitigation of emission of Information and Communication Technologies sector that also includes communications sector constantly remain on the agenda, its potential to ensure community's preparation for climate change impacts and responding to it is less discussed. An important an easier way of reducing energy use (accordingly reducing emission) and dealing with increased energy costs and interruptions is to deploy information technologies. Sector has the potential to mitigate greenhouse gas and contribute to adaptation efforts at the same time.

As climate change leads to higher temperatures, increased water scarcity and more frequent and extreme weather events, the risks for communications facilities and infrastructure and the need for communications sector solutions increase in this sense. It is necessary that enterprises, governments, communities and consumers manage better globally, they believe in the continuity of communication and they become aware of potential interruptions in order to ensure business continuity and sustainable growth.

Communications sector plays an important role in environmental protection, waste management and environment-friendly supply chain management. Practices in this field were addressed in the context of 3<sup>rd</sup> Programme of International Telecommunication Union Doha Action Plan (International Telecommunication Union/ITU-D) which was adopted in World Telecommunication Development Conference that was conducted in 2006. It is stated in the plan that the sector can play a further role in combatting climate change by performing more than compensating its own impact. According to that, identifying the problem and measuring its impact, developing effective response strategies, implementing energy saving and improved resource management technologies and processes in all sectors can ensure that they cope better with disasters and other climate change outcomes (BSR, 2011).

In the ITU Plenipotentiary Conference which was held in Antalya in 2006, the member states made decisions on "Telecommunication/Information use for early warning, prevention, mitigation and monitoring and management for help in emergency and disaster situations. ITU has been operating on standardisation of studies in this field for many years (ITU, 2008).

#### 3.13.1 Sectoral impact of climate change

It can be stated that the risks related to climate change which communications sector may be exposed to are substantially physical risks. These risks have been outlined below.

*Temperature rises and an increase in duration and intensity of heat waves* can establish an additional burden to cool the equipment in power plants and base stations and may lead to an increase in breakdown rates. Increase in operating temperature of the equipment and exceeding of its design limits may lead to breakdown or early termination of its lifetime. Energy demand which increases during heat waves may lead to power outages and accordingly similar interruptions in telecommunication services. Such interruptions may increase the cost of energy supply. Increases in



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temperatures may lead to an increase in temperature-related health and safety risks of employees. Temperatures which increase in winter may reduce heating cost in facilities and bring cost savings.

Increased precipitation (rain or snow) may cause harm to underground infrastructure and facilities and erosion and flood may lead to damage to transport infrastructures and cables may come out. Icing during rain may affect telecommunication lines and infrastructure. Decrease of precipitation may lead to subsidence and swelling of the soil in a manner that will be able to reduce the telecommunication stability both above ground and underground. Increased precipitation and moisture may affect radio spectrum which wireless communication is based on. Rain and snow absorb signals in some frequencies and consequently intense precipitation may lead to failure of receiving some transmitted signals. Reduced precipitation may reduce the amount of water which is required for cooling by increasing seasonal water scarcity.

Reduced precipitation with increased temperatures may increase the frequency of fires. This situation poses a risk for infrastructure especially in rural or remote areas. Reduced snowfall may reduce the impact on transmission infrastructure such as pillars and antennas and it may require less measure and maintenance.

Increases in the frequency or intensity of storms, wind and extreme weather events increase the risk of damage to overhead transmission infrastructure. Pillars, antennas, switch boxes and cables are generally terminal access connections that connect to houses and workplaces, which may affect the communication service delivery negatively. An increase in storm frequency may lead to more lightning strike, which leads to power outages by damaging to transmitters and overhead cables. Increase in frequency and intensity of world-wide extreme weather events increase the risk of interruption of production operations. Thailand floods which occurred in 2011 have illustrated how regional level climate change impacts may affect global supply.

Increased frequency and intensity of extreme weather events increase the risk of interruption in power supply which telecommunication is based on. Extreme weather events may make going to work difficult for employees or make accessing to infrastructure especially in remote transmission networks difficult for maintenance staff.

Changes in moisture level increase the risk of corrosion of equipment. Higher moisture levels may lead to the requirement of adjusting the moisture of indoor environments at tolerance intervals and excessive condensation may lead to short circuiting or water intrusion into equipment.

Sea level rise and accordingly increases in storm surges, increase the risk of saltwater corrosion on the coasts. The erosion or inundation of coast and underground infrastructure is another risk. Sea level rise may also lead to changes in reference data for some telecommunication transfer calculations. Sea level rises will affect the functioning of data centres and service centres which telecommunication is based on.

#### 3.13.2 Sectoral adaptation to climate change

Most adaptation actions that are practised or recommended in the communications sector are technical adjustments or regulations. These options generally cover engineering, built environment, and technological solutions. Prominent adaptation measures also include the improvement of existing practices and the development of new ones as well as advanced planning, maintenance and design. Such actions are related to the activities categorized by Business for Social Responsibility (BSR) as “value protection” strategies. For further information, see the “Climate Risks Study for Telecommunications and Data Services” report published by Riverside Technology and specified in the References section of the report. The actions that can be taken by the sector with regard to climate change adaptation are summarized below.



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- Field and asset risk assessments and business continuity planning
- Enhancing the resilience of assets and processes
- Enhancing resource efficiency and protection in production sites and processes
- Supply chain risk assessment and management
- Protecting employees from climate change-induced disasters.

Communication enterprises also engage in activities designed to create new value regarding the climate change adaptation of their customers, suppliers and stakeholders.

- Infrastructure design for resilience: Enterprises have been developing new infrastructure and web designs with easy system installation and integration. Some examples include mobile and portable transmitters sent to disaster areas.
- Formulating solutions to cope with energy and water shortage: Technological solutions improve the capability for remotely monitoring water and energy use and increasing productivity.
- Business continuity and flexibility practices: Enterprises have been developing products and services that allow for defining and addressing the security gaps in their own operations, systems and processes. Cloud solutions are important products that have recently become commonly used.
- Disaster preparation and response solutions: Communication enterprises have been developing early warning and disaster response systems. Leading examples for such efforts include real-time monitoring of disasters through sensors and establishing forecasting systems.

#### 3.13.3 Work by stakeholders

When institutions and publications related to communications sector are examined, it is observed that the greenhouse gas emissions mitigation dimension of climate change has been further studied and measures have been taken in this direction and the studies related to climate change adaptation have remained in the background.

Considering in terms of **public** administration, the ministry which is responsible for communications sector is Ministry of Transport and Infrastructure. While the subject of sustainable growth has been mentioned in the strategic plans of the ministry, the linkage of the subject with climate change seem incomplete. It is generally emphasized on protection of environment and sustainable use of resources. One of other strategic goals of Ministry of Transport and Infrastructure is to issue effective regulations, practices and audits to attain sustainable, straight-through transport and communications systems which oversee environment and by which the safety of life and property is provided at the highest level. Given that planned changes on climate change adaptation are aimed at making physical infrastructure more resilient, this goal overlaps with climate change adaptation actions. However, no studies on the risks that climate change can establish in the sector have been found.

The subject of climate change has been mentioned twice in the strategic plan of ICTA. The first one is the approach that the European Union can address the issues which occur due to development in information and communication technologies, climate change and aging of community. The other one is related to that the products and services of M2M and IoT have a series of implementation areas such as increasing productivity in production, facilitating transport, monitoring and protecting public health, reducing energy need and responding to climate change.



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The **private sector** has continued its work on mitigating greenhouse gas emissions for many years. Business in Turkey has published its strategies, greenhouse gas emissions, absolute mitigation objectives in both sustainability reports and CDP reports.

Turkcell disclosed that it would provide all of its electricity consumption from renewable energy resources by 2030 and it would be carbon neutral in 2050. Vodafone made a commitment on providing 100 percent of electricity consumption from renewable energy and reducing carbon footprint at the rate of 50 percent by 2025. Türk Telekom has not set any objectives yet, but when the sustainability reports of three companies are examined, it is observed that subjects related to environment and sustainability focus on the mitigation of greenhouse gas emissions and waste management.

Companies seem to have focused on the needs of their customers who operate in some fields on the climate change adaptation of communications sector. For example, Vodafone Digital Agriculture Solution has developed a system that offers “the best timing” suggestions for agricultural operations by analysing the obtained data which are specific to the field where it is established from air and soil through sensors and modules inside it and that will enable to avoid product casualty and equipment damage by providing early warnings. This is a support and decision system which enables to reduce production costs such as electricity, drug and fertilizer amount, while it maximises the efficiency that is obtained from the field on which it is worked.

Considering **non-governmental** work, Mobile Telecommunication Operators Association (m-TOD) which was established to maximise technological development and public interest in cooperation of Turkcell, Türk Telekom and Vodafone started its activities in 2017. The only activity of the association which can be associated with climate change is that it has prepared a public message called “Disaster Communication Guidelines” in cooperation with AFAD and BDK. The relevant public message describes things to do so that communication is not cut off during a disaster, mainly an earthquake.

The members of the Free Telecommunication Operators Association (TELKODER) are composed of firms which have obtained the authorisation of *Business Management of Telecommunications* from ICTA or have planned to obtain it. In this context, representatives of Telecommunication Operator firms which have been established according to Turkish laws and which are resident in Turkey, with domestic and foreign capital can become a member of TELKODER (TELKODER, 2020). No studies on climate change in the association are conducted.



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### 3.14 Education sector and climate change adaptation

- Education sector has a strong connection in relationships between climate change and socio-economic parameters.
- Across the countries where the impacts of climate change are further observed, the direct negative impacts on “Quality Education” and “Gender Equality” which are included in SDGs have been observed.
- Destruction of educational structures as a result of extreme weather events hampers education.
- In order to mitigate the risks which the impacts of climate change on education will create, works in Turkey are necessary to do planning, allocate adequate resource and develop an adaptation strategy.

#### 3.14.1 Sectoral impact of climate change

The living standards of households which are exposed to climate change impact; mainly income, food safety, health and education are negatively affected. Although climate change is a threat on a global scale, it is foreseen that its impacts will be felt in an unequal manner across the world. In this context, it has been stated that climate change impacts will be further observed especially in poor areas and developing countries and it is necessary to take precautions under the Fifth Assessment Report (IPCC/AR5) of Intergovernmental Panel on Climate Change.

In addition to that climate change impacts are more intensely experienced by poor and vulnerable areas, it can be stated that inequality of opportunity and deficiencies of access in education in these areas even under normal conditions is an indicator that the sustainability of education sector will be further interrupted. According to this vulnerability, several scientific studies on the impact of climate change on education have been conducted in different geographies with high vulnerability, therefore in different climatic conditions. The studies which are conducted especially in the tropics which are close to the Equator and in the developing areas where vulnerable population is concentrated present the importance of the situations and scenarios where the climate change impacts coincide with poverty.

Except for the mentioned geographical areas, the studies which are conducted across the continent of USA also indicates that economic support and policies are very important in terms of that they enable education not to be interrupted due to climate change impacts (Sheffield, 2017). Across the countries with high social and economic vulnerability, it has been revealed with the studies that the negative impacts of climate change on education is far higher. By taking some lessons from the studies which are conducted in different geographies and considering conditions and climate change scenarios also in Turkey and examining the relationship between education and climate change, it is obvious that detailed studies are needed in this field.

It is known that the pandemic which was declared by the World Health Organization (WHO) due to **COVID-19** (coronavirus) in 2020 has affected many areas across the world and led to changes and these effects continue. The pandemic process has led to important changes in **education**, as well and affected the current system and brought new systems up for discussion. In this process, inequality of opportunity which is experienced by students with disabilities, *children with special needs (affected by autism or other)*, *refugee children etc.* has further emerged and *the disadvantaged group* have been deprived of *their rights to education*. Another inequality occurs between students who attend private and public schools due to educational conditions which are provided (access to digital education, adequacy of lessons etc.). The pandemic has recalled the communicable diseases phenomenon which is one of indirect impacts of climate change on human health in a manner that will create a global crisis. Today, the connections between climate change and the role between areal spread and intensity of the pandemic have started to be widely discussed in the context of both socio-economy and natural



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sciences. In this case, as applicable to all the sectors, the existence of a strong connection in relationships between climate change and socio-economic parameters also in education sector can be mentioned.

#### 3.14.2 Sectoral adaptation to climate change

While the relationship between climate change and education sector should be assessed with the negative impacts of climate change on education on the one hand, it should be assessed with the need that education is an integral component of climate change adaptation on the other hand. In order to minimise the climate change impacts and ensure the resilience, it is necessary to develop interventions and implement immediate actions (United Nations, 2015).

It is possible to assess the adaptation to the impacts of climate change on education from several different points. Because of the destruction of educational structures or habitats which have been destroyed as a result of extreme weather events, using training units as temporary housing areas can make **physical units** of education unusable. In this case, it is important that physical structures which are designated for education of children are resilient against climate change.

According to the argument that the studies which are implemented across African countries, food security losses which occur due to heat waves or drought affect the income of households who conduct agricultural production and lead to their inability to afford their education fees. Households especially in poor areas may have to engage in additional work to increase their income and they may have to include their children in these working conditions, as well. In addition, households who have lost the productivity in their agricultural soils which have been affected by climate change and have been exposed to drought may have to **migrate** with their children to seek for a job and water and may lead to the removal of children from education life (Randell, 2019).

In climate change response and as a solution to increased vulnerabilities of vulnerable communities, the benefits that education can provide for children and especially **girls** are ever more needed. According to the research by UNICEF, it is emphasized that training of girls benefits all the families and communities. As the pressure of climate change increases, the rates of children's participation in education life will get worse. The more a woman obtains education, the higher the possibility of her children's benefiting from education is. While this situation has been highlighted with the studies which have been conducted across the mentioned countries and it has been observed that the rates of girls' participation in education in Turkey were not at the intended level in the previous years at all, NGO supports and effective public policies have substantially increased the enrolment rate of girls in recent years.

In addition to these issues, it is observed that changing climate conditions may create additional challenges in maintaining healthy educational setting where millions of children spend almost one third of their daytimes. According to a study which has been conducted in the USA, poor funding and resources which are allocated to support environmental health at schools and low prioritization of environmental health at schools in comparison to other sectors lead to outbreak of risks that result from climate change (Sheffield, 2017). Based on these examples which are mentioned in different geographies, it is critical to reveal the disruptions in education which climate risk will create and develop adaptation strategies with the help of the studies which will be conducted in Turkey.

Livelihoods and potential impacts on economy and social norms may lead to the withdrawal of children from school by their parents in some areas. In many cultures, this behaviour means primarily the removal of girls from school. Across the countries such as Bangladesh and South Africa, children who are removed from school due to economic reasons are required to help their mothers collect firewood and water. As a result of reduction of water and other natural resources due to climate change impacts,





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it is assessed that this pressure on children will increase and children will be further away from education and school life. However, even if children attend school, they may have to keep working.

Considering from another perspective, climate change will also have adverse impacts on **children's health** and nutrition. This situation will reduce children's comprehension capacities even if they attend school and it will also affect their educational attainment.

In current and future environment of increased diseases and vulnerability, it is a critical topic that governments, humanitarian organizations and wider organizations which undertake international social activities support necessary measures to help children and communities prepare for climate change impacts and help them mitigate climate change impacts. Such measures should be included in all the national and international planning steps from rural to urban scale.

Because children constitute approximately 50 percent of the ones who are affected by disasters, Disaster Risk Reduction (DRR) strategies should oversee the needs of children and violations of right and children should be also included in practices and designs as a part of solution. This situation not only will contribute to the reduction of certain risks that children will face but also will increase their solution partnerships, their capacities to cope with disaster and their confidence.

Education has an impact which raises awareness and teaches the ways of being resource-efficient (energy, water etc.) on all levels of society. Also, formal and adult education is a requirement to train citizens of all ages. Training activities of individuals in early periods of their lives will help them have necessary knowledge and skills to combat the reasons and impact of climate change.

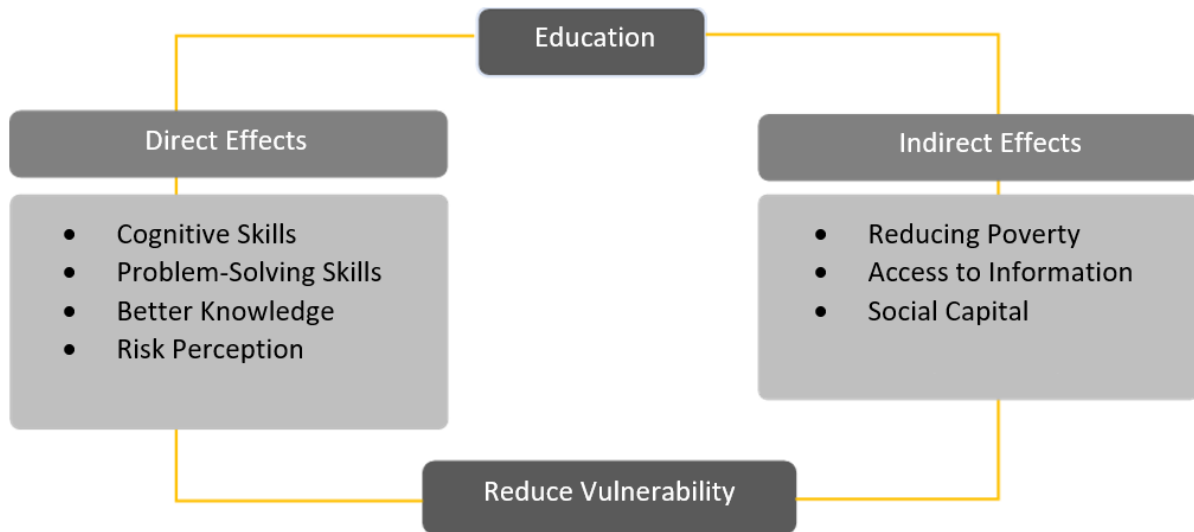


Figure 37. The flow diagram which indicates the impact of education on mitigating vulnerability (Source: UNICEF, 2015)

The concrete steps to take in order to mitigate climate change vulnerability of education were outlined in the report titled “Education and Resilience” of UNICEF with nine steps<sup>208</sup>. The report was prepared by considering not only climate change but also the areas where the possibility of conflict exists.

<sup>208</sup> “Education and Resilience: 9 priority paths for making schools safer and societies more cohesive”, 2015



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With the participation of all the stakeholders, the identification of climate change-related risks and vulnerabilities at national, regional and local level and determination of impacts of these risks should be the first step. It is critical to identify the vulnerability of physical structures and infrastructures and launch the work in order to eliminate the deficiencies in the framework of a specific plan. To this end, the support of professional associations in the field of engineering and NGOs can be taken.

Also, mechanisms should be established by using different tools in order to identify and support vulnerable groups at local level (in Turkey, EBA support points<sup>209</sup> which are established for children who have to have education at home and face with impossibilities during COVID-19 in the framework of EBA practices (Milli Eğitim Bakanlığı, 2020) can be considered as a useful example).

- Planning to reduce the risks and allocating adequate budget are subjects that should be included in all the planning and budget processes.
- The development of current climate change curriculum in a manner that will also cover adaptation is critical for raising children with this awareness. Various cooperation related to training of teachers, changing book contents can be developed.
- Provision of safe education opportunities for all children
- It is necessary to establish flexible systems for the education of vulnerable group not to be interrupted and increase online infrastructure and opportunities.

If resources are effectively used, it will be possible to increase education capacity and accordingly reach a climate change resilient and coherent profile in **Turkey**. With data-based studies on the development of educational policies, an effective monitoring-evaluation system can be established. As a requirement for adapting to climate change, increasing the quality of education can be achieved by addressing policies in a multipronged manner and with the help of multi-stakeholder cooperation which public sector, NGOs, private sector and academia are included in together.

#### 3.14.3 Work by stakeholders

On the subject of raising the awareness of the public in the framework of **public** administration, while the importance of education is generally emphasized in relevant strategy and policy plans, a separate heading related to the subject in Turkey's Seventh National Communication has been opened (as required by the format of National Communications) and information on the curriculum related to the subject at every education level - by starting at **pre-school** has been provided. In this sense, for example, "Water Ambassadors" is a project in which different government institutions cooperate with each other. In 2017, "Technical Assistance for Water Ambassadors Education and Awareness Raising Project" became operational in 2017 in order to raise the awareness of the public for the purpose of raising awareness in the management of water resources and raise *young generation water ambassadors*. The project was co-financed by the European Union and Turkey and it was implemented in West Mediterranean Basin, Konya Closed Basin, Eastern Black Sea Basin and Ankara with the cooperation of MoNE, DSI and General Directorate of Turkish Radio and Television Corporation (TRT).<sup>210</sup>

Turkey's current education **strategies** and **policies** are formulated in line with the Strategic Plans of Ministry of National Education (MoNE), Development Plans, Economy Programmes and the Recommendations of the Council of National Education. When the studies and progress reports which are directly related to education sector are pursued, it is observed that the subjects of climate change in the sector have not been adequately addressed and it is necessary to develop immediate policies

<sup>209</sup> <https://www.meb.gov.tr/eba-destek-noktaları-uzaktan-egitime-erisimin-onundeki-engelleri-kaldiriyor/haber/21553/tr>

<sup>210</sup> Turkey's Seventh National Communication "Education, Training and Raising the Awareness of the Public", September 2019



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especially on the adaptation to impacts. In the Private Specialization Commission Report on Improving Quality in Education System of Eleventh Development Plan (2019-2020), there are not any objectives directly related to climate change and adaptation. However, the Plan includes the objectives on supporting renewable energy investments in the sector to reduce school costs. At the intersection of energy and education policies, firstly, it was determined to open 10 “Natural Resources and Renewable Energy High Schools” in 9 provinces to close the qualified personnel gap in energy sector by Ministry of Energy and Natural Resources.

The need for implementing more effective policies which builds capacity in education services of public sector continues in both the improvement of economic and social welfare of the country and its resilience against climate risks and the adaptation to impacts. In addition to that, it will be an important step to identify risky physical assets against climate change-related disasters and extreme weather events, allocate the resource to take necessary measures and do the planning. It is critical that different institutions support the MoNE on this subject and implement a coordinated work. The MoNE should cooperate with different government institutions (Ministry of Family, Labour and Social Services, Ministry of Environment and Urbanisation, Ministry of Energy and Natural Resources, Ministry of Transport and Infrastructure and Ministry of Agriculture and Forestry etc.) and non-state institutions (NGOs, private sector, private schools etc.) in identifying the groups who are more vulnerable to climate change, identifying the risks of physical superstructures and infrastructures, taking necessary measures, allocating the resource to make investments (human force, financing etc.), producing solutions so that the education of disadvantaged group who live in the countryside is not interrupted.

Turkey’s education system is developed with both public sector and **private sector** investments. However, it is realized that climate change strategies and accordingly climate change adaptation strategies have not been adequately included in this development relationship yet. According to 2017-2018 period, 6% of the total number of elementary schools and 11% of the total number of middle schools in Turkey have the private school status. In addition to this, the student population who have education at private schools also have been on the constant rise in recent years. According to the data of the same period, the number of students at private schools has increased to 5% at elementary schools, 15% at middle school and 4% at vocational and technical secondary education<sup>211</sup>. This situation indicates that it is necessary to examine the relationship of private schools with climate change adaptation in education policies and identify common education policies for the objective to create a more resilient community.

As a good and reproducible example, it is possible to indicate Private Renewable Energy High Schools and Private Anatolian Technical High Schools which have been opened in the relationship between energy policies and climate crisis. An Organized Industrial Zone (OIZ) and a private college (Smart College) have cooperated in Turkey for the first time and helped these high schools with the capacity of 7200 students open. While such constructive steps are practices which can be an example for policies which mitigate climate risks, they can also serve as a model for other stakeholder sectors.

**Non-governmental organizations** in Turkey have been actively working in almost every dimension of climate change response (including adaptation to impacts) in recent years about raising awareness and providing solutions for policies. In this context, it is critical that NGOs expand the cooperation on the climate change adaptation and subjects related to education with other stakeholders, mainly public sector and become active stakeholders in the preparation of learning curriculum and various training programmes (like lifelong learning) for all the students and adults by starting from preschool education.

<sup>211</sup> “Sectoral Outlook: Education”, Industrial Development Bank of Turkey (TSKB), 2018.



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The **academia** plays a critical role in analysing the relationship between climate change adaptation and education and in ensuring that modules related to climate change adaptation are added to education system in the long term. Training programmes on climate change which are occasionally organized with different motivations through *continuing education centres* at universities are included. Bosphorus University, Centre for Climate Change and Policy Studies, İstanbul Technical University, the Continuous Education Centre, Middle East Technical University, Continuing Education Centre and Sabancı University, İstanbul Policy Centre are the leading centres which operate on this subject.

Currently, there are departments which can be directly or indirectly related to climate action and accordingly the subjects of climate change adaptation at undergraduate and postgraduate departments of universities at higher education level. The number of departments in these fields have been increased and efforts have been made to diversify them especially in recent years.

“Associate Degree Programme in Emergency and Disaster Management” is maintained in order to be able to deal with emergency and disasters effectively and help students obtain necessary knowledge and competence in this field. Individuals who have education in this field can meet the demand for qualified human force in public sector, local governments, NGOs and private sector.

“Master’s Degree Programme in Climate Change” has been planned to meet the need for qualified personnel which have increased in recent years by implementing multi-dimensional education and training programmes in social, economic and cultural aspects with key concepts on climate change and adaptation.

“Master’s Degree Programme in Climate Change, Energy and Health” includes the design of solutions for reducing the climate change impacts and ensuring the climate change adaptation by establishing their connection with the energy. With the help of engineering designs which are addressed in an innovative and different manners, it is aimed to eliminate or minimise the conditions which cause harm to human health and environment.

It is very important that higher education programmes which can be directly related to climate change adaptation are reproduced like foreign examples and various supports are provided in this field. Considering the sophistication of climate change adaptation, it is critical to connect climate change adaptation with the subjects with socio-economic content at both undergraduate and postgraduate programmes of universities. However, it is important to produce training programmes where the subjects of disaster risk management and climate change can also be connected and develop the existing ones so that resilient communities and resilient provinces can be created. For example, there is a postgraduate programme titled “Disaster Risk Management and Climate Change Adaptation” at Lund University in Sweden. Analysing this and similar good examples well and programming them in Turkey’s conditions and at universities of Turkey should be one of the priorities of academia.



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[%C4%B0klim-De%C4%9Fi%C5%9Fikli%C4%9Fi-ve-Afetlerin-Sigortac%C4%B1l%C4%B1k-Sekt%C3%B6r%C3%BCne-Etkileri-%C3%87al%C4%B1%C5%9Ftay%C4%B1.aspx](#) .

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This project is co-funded by  
the European Union and the Republic of Turkey.

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*This publication has been produced with the assistance of the European Union and the Republic of Turkey. The contents of this publication are the sole responsibility of UNDP Turkey and can in no way be taken to reflect the views of the European Union and the Republic of Turkey.*