



Türkiye Green Growth Analytical
and Advisory Program
Thematic Paper 2

TÜRKIYE ADAPTATION AND RESILIENCE ASSESSMENT

A Whole-of-Economy Approach
to Climate and Disaster Risks



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Abbreviations and acronyms

A&R	adaptation and resilience
AAL	average annual economic loss
AFAD	Disaster and Emergency Management Presidency (Turkish acronym)
AR6	Sixth Assessment Report of the Intergovernmental Panel on Climate Change
ARAS	Disaster Risk Reduction System of Türkiye (Turkish acronym)
ASP	adaptive social protection
BCP	business continuity plan
BIDEP	Regional Climate Change Action Plan (Turkish acronym)
BRSA	Banking Regulation and Supervision Agency
CCACB	Climate Change and Adaptation Coordination Board
CCAP	Climate Change Action Plan
CBRT	Central Bank of the Republic of Türkiye
CCDR	Country Climate and Development Report
ÇEM	General Directorate of Desertification and Erosion Control (Turkish acronym)
COP26	26th Conference of the Parties
CSA	climate-smart agriculture
DASK	Natural Disasters Insurance Institution (Turkish acronym)
DRM	disaster risk management
DSI	State Hydraulic Works (Turkish acronym)
DTM	Digital Terrain Model
EAPI	Energy Architecture Performance Index
EP&R	emergency preparedness and response
EU	European Union
EWS	early warning systems
GDP	gross domestic product
GHG	greenhouse gas emissions
GIS	geographic information system
HCI	Human Capital Index
hydromet	hydrometeorological
ICT	information and communications technology
IHR	International Health Regulations
IPCC	Intergovernmental Panel on Climate Change
IRAP	Provincial Disaster Risk Reduction Plan (Turkish acronym)
ISAS	Integrated Social Assistance System
KAYES	Public Structures Inventory System (Turkish acronym)
KENTGES	Urban Development Strategy (Turkish acronym)
LPI	Logistics Performance Index
LTS	long-term strategy
M&E	monitoring and evaluation
MoAF	Ministry of Agriculture and Forestry
MoEU	Ministry of Environment and Urbanization (now the MoEUCC)
MoEUCC	Ministry of Environment, Urbanization and Climate Change (formerly the MoEU)
MoFSS	Ministry of Family and Social Services
MoH	Ministry of Health
MoIT	Ministry of Industry and Technology
MoLSS	Ministry of Labor and Social Security
MoNE	Ministry of National Education
MoT	Ministry of Trade
MoTF	Ministry of Treasury and Finance
MoTI	Ministry of Transport and Infrastructure
MPAs	marine protected areas
NbS	nature-based solutions

ND-GAIN	Notre Dame Global Adaptation Initiative
NDC	nationally determined contribution
NDP	National Development Plan
NWIS	national water information system
OECD	Organization for Economic Co-operation and Development
OGM	General Directorate of Forestry (Turkish acronym)
OIZ	organized industrial zone
PCC	Presidency of Climate Change
PDTO	Presidency Digital Transformation Office
PM2.5	particulate matter less than 2.5 micrometers in diameter
PPP	public private partnership
R&D	research and development
RCP	representative concentration pathway
SBO	Strategy and Budget Office
SECC	Sustainable Environment and Climate Change
SEEA	System of Environmental Economic Accounting
SER	socioeconomic resilience
SKI	General Directorate of Water and Wastewater Administration (Turkish acronym)
SME	small and medium-sized enterprise
SOE	state-owned enterprise
SP	social protection
SSPs	shared socioeconomic pathways
SYGM	Directorate for Water Management (Turkish acronym)
TABB	Turkish Disaster Information Bank (Turkish acronym)
TARBIL	Agriculture Monitoring and Information System (Turkish acronym)
TARISM	Turkish Agriculture Insurance Pool (Turkish acronym)
TCA	Turkish Court of Accounts
TCIP	Turkish Catastrophic Insurance Pool
TGNA	Turkish Grand National Assembly
TL	Turkish lira
TLS	traffic light system
TSKB	Industrial Development Bank of Türkiye (Turkish acronym)
TSMS	Turkish State Meteorological Service
Turkstat	Turkish Statistics Institute
UHI	urban heat island effect
UNFCCC	United Nations Framework Convention on Climate Change
US\$	United States dollars
WHO	World Health Organization
WRM	Water Resource Management
WSS	water supply and sanitation

Türkiye Adaptation and Resilience Assessment: A Whole-of-Economy Approach to Climate and Disaster Risks

Climate change impacts are widespread and rapidly intensifying across the world.

The frequency of extreme meteorological events leading to disasters is expected to rise globally, increasingly affecting local and national economies and communities through direct loss and damage, and indirectly through changes in food prices and food security water availability and accessibility, health, labor productivity, and other pathways. Direct and indirect climate and disaster impacts disproportionately affect the poor and vulnerable segments of society. In its latest assessment report, the

Intergovernmental Panel on Climate Change established that the planned national mitigation strategies are not enough to limit global warming well below 2°C above pre-industrial levels, and that the magnitude and rate of climate change and associated risks and impacts depend strongly on near-term mitigation and adaptation efforts (IPCC 2022). This calls for urgent action to simultaneously reduce greenhouse gas emissions while creating the necessary conditions for enabling adaptation and building resilience across sectors and levels of government and society, to multiple—and practically unavoidable—impacts.

Strengthening the enabling environment for adaptation and resilience (A&R) can support Türkiye's efforts to resume its development trajectory on a green, resilient, and inclusive pathway in the aftermath of the COVID-19 pandemic and increasing climate change and natural hazard risks. Türkiye is highly vulnerable to the impacts of climate change and other environmental hazards due to its geographic, climatic, and socioeconomic conditions. In recent decades, Türkiye has been affected by earthquakes and increasing hydrometeorological (hydromet) disasters, including coastal and river flooding, heatwaves, droughts, wildfires, and landslides, with losses to lives, livelihoods, ecosystems, and the economy. Compared to other Organization for Economic Co-operation and Development (OECD) countries, Türkiye has high socioeconomic vulnerability and exposure to climate extremes and disasters. In the last decade, it has taken steps to establish and strengthen disaster risk management (DRM) and climate adaptation planning, policy development, and implementation at the national, subnational, and sectoral levels, as outlined in its National Climate Change Action Plan (2011–23), National Climate Change Adaptation Strategy and Action Plan (2011–23), and more recently, its Green Deal Action Plan. At the 26th Conference of the Parties of the United Nations Framework Convention on Climate Change, Türkiye ratified the Paris Agreement, announcing its 2053 net zero emissions target and laying the foundations for its transition toward a green economy.

This report provides an assessment of A&R preparedness in Türkiye and the enabling policy, institutional, and macrofiscal environment. It presents a review of Türkiye's development, DRM, and climate change adaptation-related policies, plans, and programs, and identifies priority areas and interventions for further reducing vulnerability and strengthening national resilience to climate change, natural disasters, and other related external shocks. It aims to inform and support Türkiye's efforts to transition to a green economy and build resilience to climate shocks and disasters, while enabling a rapid, resilient, and inclusive recovery from the COVID-19 pandemic. The assessment builds on the close and long-lasting engagement between the government of Türkiye and the World Bank Group and informs the Country Climate and Development Report.

The assessment offers a whole-of-government perspective on priority areas for adaptation and resilience that can inform ongoing and planned national climate and development policy processes. Over 150 indicators were selected, assessed, and rated as *nascent*, *emerging*, or *established* through a traffic light system (TLS) using the World Bank's Adaptation Principles framework (Hallegatte et al. 2020) to evaluate readiness and identify gaps in capacity and areas for further policy development around six principles and a set of priority actions for effective climate adaptation and resilience in Türkiye:

- 1 Adaptation Principle 1: Lay the foundations through rapid, robust, and inclusive development
- 2 Adaptation Principle 2: Facilitate the adaptation of people and firms
- 3 Adaptation Principle 3: Adapt urban and land use plans and protect critical assets and services
- 4 Adaptation Principle 4: Help firms and people manage residual risks and natural hazards
- 5 Adaptation Principle 5: Manage financial and macrofiscal issues
- 6 Adaptation Principle 6: Prioritization, implementation, and monitoring progress

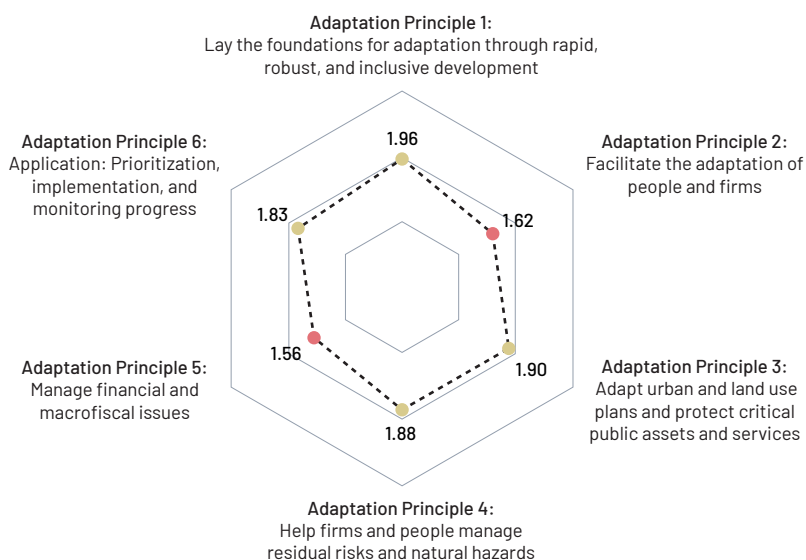
Considering Türkiye's high level of exposure to earthquakes, the assessment was extended to also address seismic and other natural disaster risks.

Although Türkiye has made good progress in several areas to support adaptation and resilience to climate and disaster risks, this assessment finds that its overall enabling environment is still emerging. Based on the 155 indicators used to assess 31 priority actions and six adaptation principles, the results show that, at aggregate level, four principles ranked as *emerging*, two as *nascent*, and none as *established* (figure S.1). The least advanced areas were those linked the conditions required to facilitate the adaptation of people and firms (Adaptation Principle 2) and manage financial and macrofiscal issues (Adaptation Principle 5). Of the 31 priority actions, 20 were ranked as *emerging*, 10 as *nascent*, and only one—related to the key elements of an A&R strategy—was ranked as *established*. A summary of the assessment by adaptation principle is presented here, followed by detailed results for the priority actions. These findings indicate that Türkiye needs to make progress across most priority actions and adaptation principles for effective vulnerability reduction and to build resilience to climate change, natural disasters, and other external shocks.

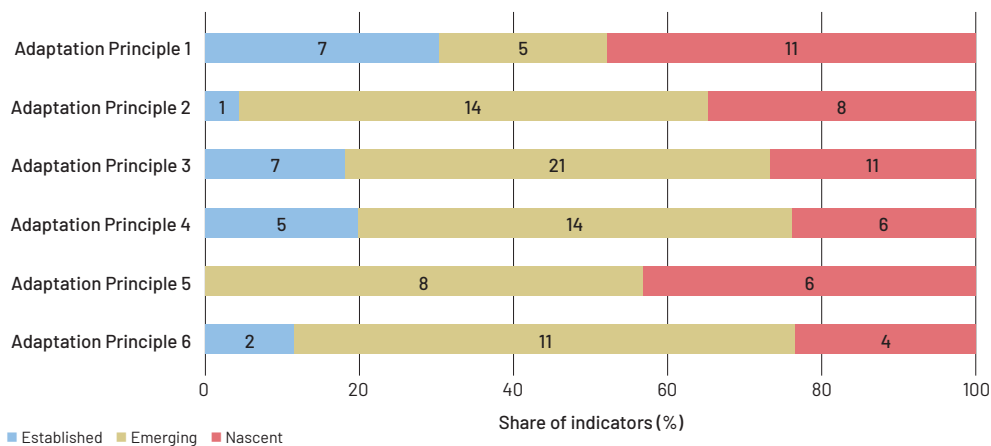
FIGURE S.1 >>

Summary of A&R assessment for Türkiye

a. A&R scores per Adaptation Principle



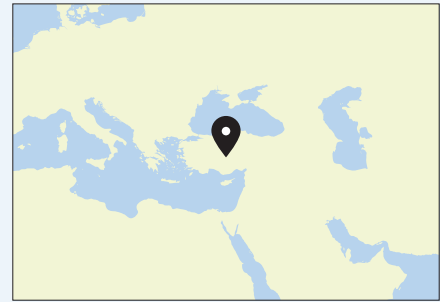
b. A&R scores per indicator used in the assessment



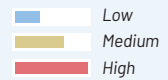
Note: The number in each bar shows the number of indicators per category.

DRIVERS OF CLIMATE AND DISASTER RISK

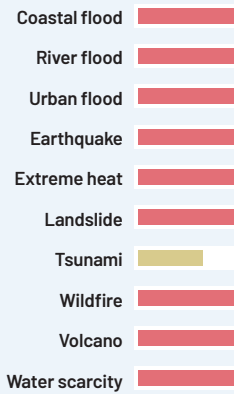
- Surface area (sq. km): **769,630**
- 💰 GDP per capita (2020): **US\$ 8,536.4**
- 👤 Total population (2019): **83,430,000**



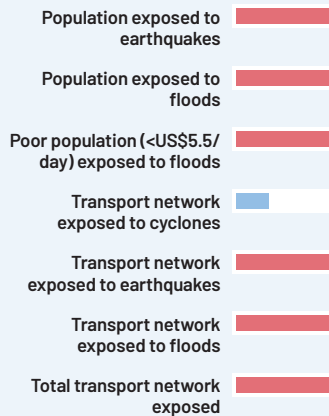
Summary of selected climate and disaster physical risk drivers for Türkiye. The ratings (*high, medium, and low*) are all relative to other OECD countries, except for the probability of natural shocks, which is from Thinkhazard.org. See [Appendix C](#) for more details on data sources and methods applied for each indicator.



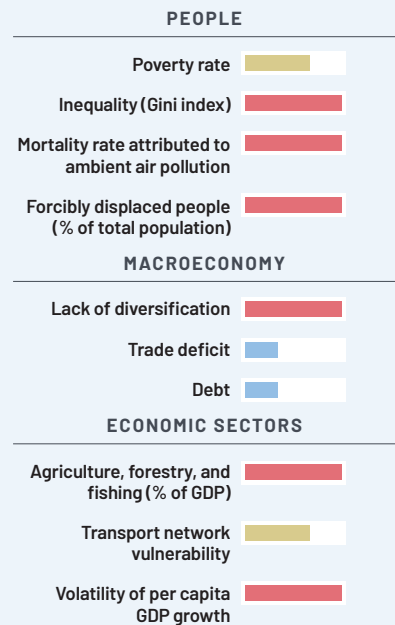
PROBABILITY OF NATURAL SHOCKS



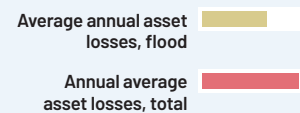
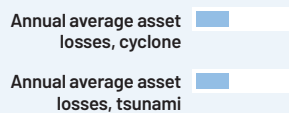
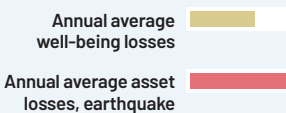
EXPOSURE



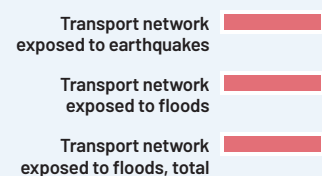
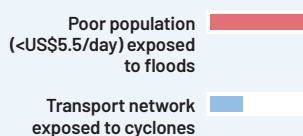
VULNERABILITY



RISK



FUTURE CLIMATE CHANGE IMPACTS (2050, RCP 4.5)



ADAPTATION AND RESILIENCE ASSESSMENT

●●● Nascent
●●● Emerging
●●● Established

Summary of selected A&R indicators for Türkiye. The indicators presented in the TLS below form a non-exhaustive list to assess progress towards adaptation and resilience under a whole-of-economy approach in Türkiye. The assessment follows the framework of *The Adaptation Principles* (Hallegatte et al. 2020) adapted to the Türkiye context. Using the TLS, indicators were rated as *nascent*, *emerging*, or *established*, either compared with other OECD countries based on global datasets or based on available information against established criteria. Detailed descriptions of the indicators, sources, and rating criteria are provided in [Appendix C](#). The TLS is intended to serve as guidance for strengthening A&R-related policies, strategies, and investments in Türkiye, and is not meant to provide an absolute assessment of A&R preparedness.

ADAPTATION PRINCIPLE 1

●●● Lay the foundations for adaptation through rapid, robust, and inclusive development

●●● 1.1. Increase economic productivity and growth, while keeping buffers for shocks

●●● Economic growth	●●● Macroeconomic stability	●●● Economic productivity
●●● Adjusted net savings	●●● Investment	

●●● 1.2. Ensure that economic growth is inclusive

●●● Poverty rate	●●● Access to basic water	●●● Access to financial services
●●● Poverty headcount change	●●● Access to safe sanitation	●●● Access to public services for refugees
●●● Shared prosperity	●●● Access to electricity	●●● Social protection coverage
●●● Unemployment rate	●●● Access to universal health coverage	●●● Social spending
●●● Overall governance	●●● Access to information and communications technology (ICT)	●●● Socioeconomic resilience
●●● Human Capital Index	●●● Access to primary and secondary education	
●●● Women's empowerment		

ADAPTATION PRINCIPLE 2

●●● Facilitate the adaptation of people and firms

●●● 2.1. Assess climate and disaster risks, and make this information available

●●● Hydromet data availability and completeness	●●● Local-scale hazard maps availability and completeness	●●● Community awareness of hazard and vulnerability levels
●●● High-resolution Digital Terrain Model (DTM) data coverage and availability	●●● Local-scale climate change scenarios	●●● Climate and disaster risk assessment for main economic sectors
●●● National-scale hazard map availability and completeness	●●● Data platform providing easy access to climate and disaster information	

●●● 2.2. Clarify responsibilities and align incentives with A&R objectives

●●● Institutional responsibilities for disaster and climate risk management
●●● Residual risk target level
●●● Private sector climate change action plans
●●● Companies integrate A&R in sustainability risk reporting

●●● 2.3. Facilitate access to technical solutions for resilience through R&D and trade policies

●●● Public R&D spending
●●● Private sector R&D spending
●●● Innovativeness of the private sector
●●● Resilience tariff

●●● 2.4. Ensure financing is available to all; provide support to poorest and most vulnerable people

●●● Most vulnerable populations and communities identified
●●● Access to financial services for the bottom 40%
●●● Social protection coverage for the poorest quintile
●●● Job opportunities for refugees

●●● 2.5. Facilitate structural change in the economic system

●●● Diversification of the economy	●●● Strategy to manage the decline of sunset sectors	●●● Strategy to support the development of sunrise sectors
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ADAPTATION PRINCIPLE 3

●●● Adapt urban and land use plans and protect critical public assets and services

●●● 3.1. Identify critical public assets and services

●●● Critical assets and infrastructure identified	●●● Vulnerability of critical assets and infrastructure assessed	●●● Logistics Performance Index
		●●● Energy Architecture Performance Index

●●● 3.2. Design and implement a government-wide strategy to increase the resilience of infrastructure systems and public assets

●●● Resilient infrastructure investment needs	●●● Infrastructure maintenance budget	●●● Construction standards and codes for buildings
●●● Long-term resilient infrastructure plan	●●● Asset management system	
●●● Resilient infrastructure agency	●●● Construction standards for infrastructure	

●●● 3.3. Revise urban and land use plans to make them risk-informed

●●● Institutional and regulatory framework for urban and land use planning	●●● Number of qualified planners per capita	●●● Financing for implementation of urban plans
●●● Identifying areas that are at risk	●●● Quality of urban plans	

●●● 3.4. Increase resilience of the agriculture sector and ensure food security

●●● Food vulnerability	●●● Agricultural insurance	●●● Agricultural land irrigated
●●● Climate-smart agriculture strategy	●●● Ex-post assessment of drought impacts	
●●● Agriculture early warning system (EWS)	●●● Public agricultural research expenditure	

●●● 3.5. Increase the resilience of water infrastructure and water resource management (WRM)

●●● WRM strategy incorporating climate change considerations
●●● Dedicated WRM agencies
●●● National water information system
●●● Water productivity
●●● Untreated water discharge

●●● 3.6. Increase the resilience of the health system

●●● International Health Regulations score
●●● Health expenditure (% of GDP)
●●● Health sector emergency response plan
●●● Health risk communication
●●● Surge demand health capacity
●●● Medical countermeasures stockpiles

●●● 3.7. Increase the resilience of the education system

●●● Disaster-proof schools
●●● Operational standards for use of schools as shelters
●●● Safe and continued learning environment
●●● Resources to enable remote learning
●●● A&R included in education curriculum

●●● 3.8. Increase the resilience of forests and other natural ecosystems

●●● Use of nature-based solutions (NbS) for A&R	●●● Blue economy strategy	●●● Biodiversity Habitat index
●●● Forests and climate change strategy	●●● Natural capital accounting	●●● Ecosystem services index
	●●● Land degradation	

ADAPTATION PRINCIPLE 4

●●● Help firms and people manage residual risks and natural disasters

●●● 4.1. Save lives (and money) with hydromet, early warning and emergency management systems

●●● Daily weather forecasts	●●● Early warnings communication and dissemination	●●● Emergency service and shelter capacity
●●● Impact based forecasting (IBF)	●●● Emergency preparedness and response (EP&R) management system	●●● Effective crisis response coordination mechanism
●●● Early warning systems (EWS) for natural hazards	●●● EP&R training	●●● Community emergency response plans

●●● 4.2. Provide all firms and households with risk management instruments

●●● National strategy for managing residual climate and disaster risks	●●● Financial instruments uptake to cope with shocks
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●●● 4.3. Develop the insurance sector, building on public-private partnerships

●●● Non-life insurance penetration	●●● Private sector disaster risk insurance	●●● Building stock insurance
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<ul style="list-style-type: none"> ●●● 4.4. Build a social protection system and make it responsive to shocks ●● Social registry coverage and targeting ●●● Interoperable social protection and DRM information systems ●●● Multiple social protection delivery mechanisms ●● Adaptive social protection 	<ul style="list-style-type: none"> ●●● 4.5. Help firms develop business continuity plans (BCPs) and financial preparedness ●● Firms with BCPs ●●● Access to finance for firms ●●● Generator ownership ●●● Revenue lost due to outages 	<ul style="list-style-type: none"> ●●● 4.6. Be prepared to build back better after disasters, with contingency plans and financing ●● Resilient recovery and reconstruction principles and guidelines ●● Emergency procurement planning and procedures ●● Reconstruction time
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ADAPTATION PRINCIPLE 5

●●● Manage financial and macrofiscal issues

<ul style="list-style-type: none"> ●●● 5.1. Include contingent liabilities from natural disasters and environmental shocks in the planning and budgeting process 		
<ul style="list-style-type: none"> ●●● Climate and disaster risks are assessed and considered in fiscal policies 	<ul style="list-style-type: none"> ●● Contingent liabilities are quantified and included in budget documents 	<ul style="list-style-type: none"> ●● Institutional arrangements for public financial management during emergencies
<ul style="list-style-type: none"> ●●● 5.2. Develop a financial strategy to manage contingent liabilities, combining multiple instruments 		
<ul style="list-style-type: none"> ●● National climate and disaster risk financing strategy 	<ul style="list-style-type: none"> ●● Use of climate and disaster risk financial instruments ●● Emergency budget allocation 	<ul style="list-style-type: none"> ●● Process to manage ex-post financial assistance inflow
<ul style="list-style-type: none"> ●●● 5.3. Anticipate and plan for long-term macroeconomic impacts 		
<ul style="list-style-type: none"> ●●● Proportion of tax revenues from high-vulnerability sectors 	<ul style="list-style-type: none"> ●● Long-term plan to diversify tax revenues 	<ul style="list-style-type: none"> ●●● Debt sustainability or financial sector assessment program considers climate and disaster impacts
<ul style="list-style-type: none"> ●●● 5.4. Communicate and mitigate the disaster and climate risk exposure of the financial sector 		
<ul style="list-style-type: none"> ●● Integration of climate and disaster risks into business processes by banks, insurers, and large investors 	<ul style="list-style-type: none"> ●●● Specific disaster and climate risk requirements in bank, insurer, and large investor regulations 	<ul style="list-style-type: none"> ●●● Quantified estimates of exposure to natural hazards required for banks, insurers, and large investors ●●● Climate and disaster risk stress tests for banks, insurers, and large investors

ADAPTATION PRINCIPLE 6

●●● Application: Prioritization, implementation, and monitoring progress

<ul style="list-style-type: none"> ●●● 6.1. Create a strong institutional and legal framework, with appropriate stakeholder involvement 		
<ul style="list-style-type: none"> ●● Climate change law ●● A&R governance framework 	<ul style="list-style-type: none"> ●● Government coordination mechanism for A&R policies and actions 	<ul style="list-style-type: none"> ●● Effective stakeholder involvement
<ul style="list-style-type: none"> ●●● 6.2. Design an A&R strategy with prioritized actions 		
<ul style="list-style-type: none"> ●●● National Climate Change Adaptation Strategy 	<ul style="list-style-type: none"> ●●● National communications and biennial reports 	<ul style="list-style-type: none"> ●● Long-term strategy ●● Nationally determined contribution
<ul style="list-style-type: none"> ●●● 6.3. Set concrete sector-level targets to guide implementation by line ministries and local governments 		
<ul style="list-style-type: none"> ●● National development plan incorporates A&R targets ●●● Tasking central ministries to tackle climate change issues 	<ul style="list-style-type: none"> ●● Sectoral priority setting and implementation ●● Sectoral A&R priority setting and implementation 	<ul style="list-style-type: none"> ●● Clear A&R functions assigned between national and local authorities ●● Regional priority setting, implementation ●● Local climate change action
<ul style="list-style-type: none"> ●●● 6.4. Screen all public policies and expenditures for climate and disaster risks and align them with adaptation targets 		
<ul style="list-style-type: none"> ●●● Disaster and climate-informed public investment management ●●● Green taxonomy considering A&R ●●● State-owned enterprises (SOEs) identify and consider climate- and disaster-related risks 	<ul style="list-style-type: none"> ●●● 6.5. Allocate appropriate funding to the adaptation strategy ●●● National budget allocates funding for A&R actions ●●● Subnational governments budget for A&R actions ●●● Environmental protection spending ●● Private sector financing for A&R 	
<ul style="list-style-type: none"> ●●● 6.6. Track progress over time, and review and revise the strategy 		
<ul style="list-style-type: none"> ●●● Monitoring and evaluation of A&R ●●● Independent monitoring of A&R progress ●● Disaster-related expenditure tracking and review 		

Policy recommendations for strengthening adaptation and resilience

The assessment identified a series of policy recommendations that the government of Türkiye can undertake to bridge gaps, build capacity, and create the necessary conditions to facilitate adaptation and resilience in the country. While the list of recommendations is not exhaustive, it provides a basis for prioritizing efforts and investments in the short, medium, and long term that can inform ongoing national strategic processes on climate change and development in the aftermath of the COVID-19 pandemic.

ADAPTATION PRINCIPLE 1: Lay the foundations for adaptation through rapid, robust, and inclusive development	Priority
✔ Maintain a stable macroeconomic pathway to preserve the resilience achieved so far and keep buffers for external shocks	Medium to long-term
✔ Foster economic productivity through fiscal and policy adjustments and incentives, including through skills-building programs and investments involving the private sector	Short to medium-term
✔ Consider the use of additional measures of growth in national accounting that incorporate aspects of resilience, such as the United Nations System of Environmental Economic Accounting (UN-SEEA)	Medium to long-term
✔ Continue efforts to reduce poverty and unemployment to improve well-being and socioeconomic resilience	Short to medium-term
✔ Establish a plan to improve overall governance and monitor performance in each of the governance dimensions	Short to medium-term
✔ Increase the level and efficiency of public spending in human capital and create incentives for the private sector to build skills and employ women, youth, and vulnerable populations	Short to medium-term
✔ Accelerate efforts to empower women, including by removing structural barriers that prevent them from participating in the labor force	Short to medium-term
✔ Improve access to services—including universal health coverage, primary and secondary education, ICT, and financial services—to increase resilience	Short to medium-term
✔ Continue ensuring that social protection programs reach the most vulnerable, and create a consolidated, universal social security system incorporating social assistance, cash benefits, and unemployment mechanisms	Medium to long-term
ADAPTATION PRINCIPLE 2: Facilitate the adaptation of people and firms	Priority
✔ Strengthen the generation and access to climate risk and socioeconomic information for people and firms to use in adaptation planning	Short to medium-term
✔ Establish residual risk targets and promote the elaboration of climate change action plans for private actors to assess and adopt additional risk management strategies	Medium-term
✔ Expand the availability of A&R solutions through increased public and private investment in R&D for their development and by assessing opportunities for the reduction of tariff and non-tariff barriers for resilience-related technologies	Short to medium-term
✔ Strengthen the resilience of vulnerable populations by facilitating their access to social protection systems and financial services	Short to medium-term
✔ Build a climate-resilient economy by supporting diversification, identifying promising sunrise sectors, and creating a strategy to address the socioeconomic impacts of climate change on sunset sectors	Short to medium-term

ADAPTATION PRINCIPLE 3: Adapt urban and land use plans and protect critical public assets and services	Priority
✓ Map all public assets and identify critical infrastructure to enable strategic risk reduction investments	Medium-term
✓ Design, fund, and implement a masterplan to progressively increase resilient infrastructure stock	Medium to long-term
✓ Identify high-risk areas for multiple hazards to support urban, land use, emergency, and other planning processes	Short-term
✓ Design and implement a comprehensive adaptation strategy for the agriculture sector to improve food security under climate change	Short to medium-term
✓ Design, fund, and implement an overarching water resource management strategy to ensure water availability and quality under climate change	Short to medium-term
✓ Strengthen the health care system and workforce to enhance surge capacity to cope with higher demands due to climate change and during emergencies	Medium to long-term
✓ Make education infrastructure climate and disaster proof and create the enabling conditions for vulnerable populations to access online quality education in the aftermath of disasters	Medium to long-term
✓ Recognize the value of terrestrial, coastal, and marine ecosystems and apply nature-based solutions for adaptation and economic growth	Medium to long-term

ADAPTATION PRINCIPLE 4: Help firms and people manage residual risks and natural disasters	Priority
✓ Develop IBF systems to strengthen the quality and effectiveness of existing climate services	Medium-term
✓ Strengthen emergency response staff capacity to improve the effectiveness of interventions under increasingly complex emergency situations	Short-term
✓ Formulate a national strategy for managing residual risks once residual risk targets have been established	Short to medium-term
✓ Promote a greater insurance coverage and diversify available risk financing instruments against climate-related risks for households and firms and further promote private capital mobilization through risk transfer	Medium to long-term
✓ Advance the establishment of adaptive social protection systems by expanding beneficiary identification and enrolment in the Integrated Social Assistance System, ensuring its interoperability with DRM systems and setting up a contingency plan to scale up social assistance during emergencies	Medium to long-term
✓ Create incentives for firms to elaborate and implement business continuity plans to reduce and avoid losses during disruptions caused by hazardous events	Medium-term
✓ Prepare procedures for building back better after disasters to reduce future vulnerability and speed up recovery time	Medium to long-term

ADAPTATION PRINCIPLE 5: Manage financial and macrofiscal issues	Priority
✓ Assess the macroeconomic impacts of disasters by comprehensively assessing disaster risks, understanding how disasters translate into contingent liabilities and therefore fiscal risks, and using these data to inform government budget planning, such as the Medium-Term Development Strategy	Short-term
✓ Based on the understanding of disaster risk, design a cost-effective national disaster risk finance strategy adopting a risk layering approach to meeting post-disaster costs	Medium-term
✓ Diversify the tax base away from climate-exposed sectors and assess potential climate change and disaster implications on debt levels to reduce macrofinancial risks	Medium to long-term
✓ Incentivize and regulate climate risk assessment, management, and disclosure of private financial institutions to reduce macroeconomic risks	Medium-term

ADAPTATION PRINCIPLE 6: Application: Prioritization, implementation, and monitoring progress	Priority
✓ Strengthen the legal framework for A&R implementation and governance with clear roles and responsibilities for central and line ministries and across different actors through a framework climate change law	Short-term
✓ Update the National Climate Change Strategy and the National Adaptation Strategy and Action Plan to include short, medium, and long-term A&R actions and targets linked to the NDP and sectoral strategic plans	Short-term
✓ Promote the development, funding, and implementation of comprehensive sectoral A&R strategies and plans led by sectoral line ministries in close collaboration with local governments	Short to medium-term
✓ Incorporate systematic climate and disaster risk screening in public investment management and private investment through a green taxonomy	Short to medium-term
✓ Secure appropriate public and private funding for national, subnational, and sectoral A&R actions, and increase environmental spending to foster resilience	Medium to long-term
✓ Design and implement an overall monitoring and evaluation plan for the updated A&R strategy and conduct regular and independent progress reviews	Medium-term

Adaptation and resilience to climate and disaster risks: a global imperative

Climate change impacts are widespread and rapidly intensifying across the world.

Global surface temperature has increased more rapidly since 1970 than in any other 50 year-period in the last 2,000 years, and the past four decades have each been warmer than the one before (IPCC 2021). Indeed, 2020 and 2021 represent the second and sixth hottest years on record globally (NOAA 2022). Global mean sea level rise has been faster since 1900 than any century in the past 3,000 years (IPCC 2021). Since the 1950s, most land regions have experienced more frequent, more intense hot extremes (including heatwaves) and heavy precipitation events, and less frequent and milder

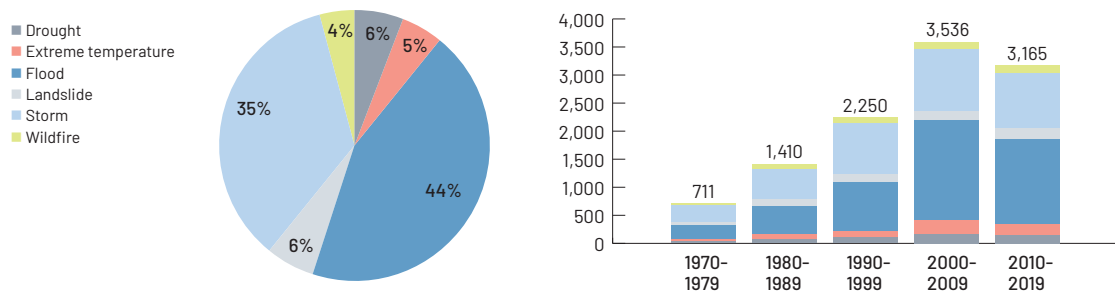
cold extremes (IPCC 2021). Human-induced changes in the global climate system affect every inhabited region in the world today and will continue to do so into the future. The latest Intergovernmental Panel on Climate Change (IPCC) report by Working Group II on Impacts, Adaptation and Vulnerability confirms that climate change and extremes are already causing widespread and compound adverse impacts on human health, livelihoods, food security, ecosystems, the built environment, and the economy. Some systems already face or are fast approaching “hard” limits to adaptation—that is, some climate impacts are already too severe to adapt to (IPCC 2022).

Natural disaster risks increase with climate change. Along with temperature rise, the number of weather, climate, and water-related disasters has also increased globally by a factor of five in the past 50 years. Between 1979 and 2019, these hazards accounted for more than 11,000 disasters—about 50 percent of all disasters—as well as 45 percent of all reported deaths, and 74 percent of all economic losses reported worldwide, causing on average US\$202 million in losses daily (WMO 2021; *figure 1.1*). Damage from extreme weather events caused US\$280 billion in 2021 alone (Sims and Hübner 2022). With increasing temperatures and through changes in the global hydrological cycle, climate change is expected to drive more frequent and more extreme weather events, further increasing the risk of disaster in the future. It is also projected to impact natural and socioeconomic systems through other, more subtle yet major effects, such as altering crop growing seasons, biodiversity and ecosystem services, streamflows, quantity and quality of water resources, and sea level rise (IPCC 2022).

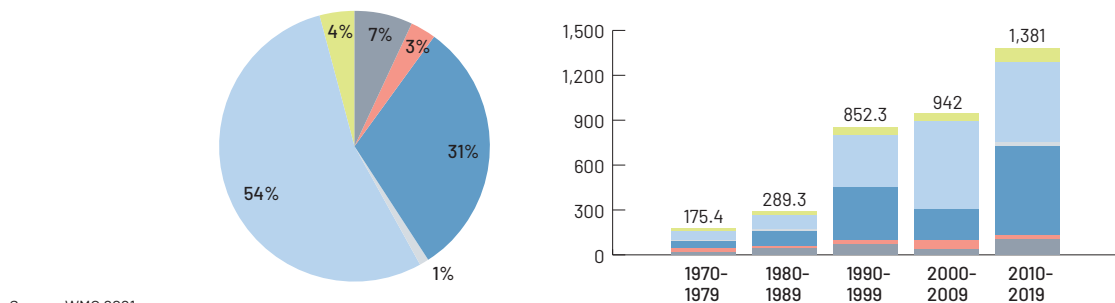
FIGURE 1.1 >>

Number of disasters and economic losses globally, by hazard type (1970–2019)

a. Reported disasters (total = 11,072)



b. Reported economic losses (US\$, billions) (total = US\$3.6 trillion)



Source: WMO 2021

Climate change and disaster impacts are unequally distributed. Short- and longer-term climate and disaster impacts interact with existing social vulnerabilities and affect countries and populations unequally. The poor disproportionately bear the greatest burden of climate change and disaster events, as they often live in high-risk areas, depend on hazard-exposed resources, have fewer means to reduce risks, and lack the capacity to relocate, rebuild or recuperate their assets and livelihoods after hazard impacts. They also receive less support than non-poor people from financial instruments and incur well-being losses that go well beyond traditional economic estimates of asset and production losses (Hallegatte et al. 2017). The many impacts of climate change may push up to 132 million people into poverty by 2030 (World Bank 2020a).

While countries are increasing their pledges and efforts to mitigate climate change as climate and disaster risks intensify, some impacts are already irreversible. Global surface temperature will continue to increase in the next few decades, even with significant reduction of greenhouse

gas (GHG) emissions today (IPCC 2021). In its Sixth Assessment Report (AR6), the IPCC established that the planned mitigation and adaptation strategies submitted by the Parties to the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) in their nationally determined contributions (NDCs) are insufficient to limit global warming well below 2°C above pre-industrial levels required to reduce the risks and impacts of climate change (IPCC 2021; UNFCCC 2021a). Even under the most optimistic mitigation scenario, where net zero emissions are reached by around 2050, global warming is expected to continue in the short to medium term and potentially stabilize at 1.5°C above pre-industrial levels (IPCC 2021). This will cause unavoidable increases in multiple climate hazards and present compound risks to people and ecosystems (IPCC 2022). The expected impacts of accelerating climate change call for urgent action.

Strengthening adaptation and resilience to climate change and natural hazards is a global imperative. The findings of the IPCC AR6 indicate that the magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, with profound implications for development policies. The report stresses the need for increased mitigation ambition to reduce GHG emissions and stabilize global surface temperatures, and the urgency for national efforts to accelerate adaptation and build resilience in all systems and at all levels to multiple, practically inevitable impacts. This involves efforts to accelerate the planning, funding and implementation of resilience measures and adaptation interventions to keep pace with escalating impacts arising from the *physical risks* of climate change ([box 1.1](#)).

Global finance for adaptation is not enough to reduce growing risks. A recent estimate set public and private climate finance flows in and between countries in 2019–20 at US\$632 billion a year (about 0.7 percent of global gross domestic product or GDP), with private financing accounting for 49 percent of the flows. Of this, US\$571 billion were allocated to mitigation, and only US\$46 billion to adaptation investments—almost exclusively from public sources—with the remaining invested in projects with both mitigation and adaptation benefits (Buchner et al. 2021). By the 26th Conference of the Parties (COP26) to the UNFCCC in 2021, the climate finance goal agreed in the Paris Agreement of reaching US\$100 billion a year by 2020, with half of this committed for adaptation, had not been met (UNFCCC 2021b). This is cause of concern, as recent estimates indicate that developing countries' adaptation costs and needs are far greater than previously estimated, and five to ten times larger than current international finance support for adaptation (UNEP 2021).

At COP26, countries agreed to increase their climate ambition. In response to the findings of the IPCC AR6 and lagging climate finance, the Glasgow Climate Pact commits countries to revisit and strengthen their 2030 national climate targets by the end 2022 in an effort to limit global temperature increase to 1.5°C. Developed countries also committed to double adaptation finance by 2025, raising their pledges to support developing countries in their growing adaptation needs.

Recovery from the COVID-19 pandemic opens up opportunities for adaptation and resilience. COVID-19 has caused major loss of life, loss of development gains, forced hundreds of millions of people into extreme poverty (World Bank 2020a) and led governments and businesses to draw on reserves and issue new debt to deal with the economic downturn. This has increased structural vulnerabilities and weakened people's and nations' capacities to address the compound risks of climate change, pandemics, and other hazards, and to recover from future external shocks (UNEP 2021). But the COVID-19 recovery process also offers a unique opportunity for countries to apply the lessons learned from managing the pandemic and use recovery funding and policies as vehicles for accelerating climate action and risk reduction, narrowing the adaptation gap, and transitioning to greener, more resilient, and more inclusive development (World Bank 2021b).

BOX 1.1 >>

Key definitions used in this report

- » **Hazard** is the potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.
- » **Risk** is the potential for adverse consequences for human or ecological systems, recognizing the diversity of values and objectives associated with such systems.
- » **Physical risks** refer to the direct effects of a changing climate, and include slow-onset hazards, such as increased temperature and changes in rainfall, and more sudden hazards, such as those caused by extreme weather events.
- » **Transition risks** are primarily driven by the global transition to a low-carbon future, such as shifts in technology, fuel availability, and changes in trade dynamics—for example, due to consumer preferences or tariffs on emissions-intensive goods.
- » **Residual risk** is the disaster risk that remains in unmanaged form, even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained.
- » **Vulnerability** is the propensity or predisposition to be adversely affected, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.
- » **Adaptation** is the process of adjusting to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.
- » **Resilience** is the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.
- » **Socioeconomic resilience (SER)** is the capacity to mitigate the impact of disaster-related asset well-being losses, including people's ability to maintain consumption for the duration of recovery, their ability to save or borrow to rebuild their asset stock, and decreasing returns in consumption (a US\$1 reduction in consumption affects poorer people more than richer ones).

Sources: Financial Stability Board 2016; Feyen et al. 2020; Hallegatte et al. 2017; IPCC 2014; IPCC 2022; UNDRR, n.d.

As part of its new Climate Change Action Plan (CCAP) 2021–25, the World Bank Group is prioritizing adaptation and resilience on several fronts. Highlighting the centrality of adaptation in supporting countries to meet their development needs while mitigating the impacts of climate change (World Bank Group 2021a), the new plan is in line with the strategic directions set in the World Bank Group Action Plan on Climate Change Adaptation and Resilience (World Bank 2019d). At strategic level, this entails working with client countries to support climate and development diagnostics, planning, and policies to align their financial flows with the Paris Agreement's low-carbon and climate-resilient goals. Key sectoral priorities include resilient infrastructure, climate-smart agriculture (CSA) and food security, nature-based solutions (NbS) and the blue economy¹, resilient cities, supporting country governments to increase the resilience of key

¹ The blue economy is the sustainable use of marine resources for economic growth, improved livelihoods, and jobs while preserving the health of marine ecosystems (World Bank and United Nations Department of Economic and Social Affairs 2017).

industries through business continuity planning, and reducing shocks and protecting livelihoods through hydrometeorological (hydromet) services and early warning systems (EWS).

The Country Climate and Development Report (CCDR) is a new World Bank Group core diagnostic tool aimed at integrating climate and development. Firmly anchored in a country's development goals, CCDRs take a multisector, whole-of-government approach to help countries accelerate the transition to a low-carbon economy while adapting and building resilience to climate change. CCDRs explore synergies and trade-offs between climate objectives and macroeconomic policies and investments, and identify opportunities, reforms, and policy instruments to leverage public and private sector resources to address the physical and transition risks of climate change (World Bank Group 2021b).

As part of the Türkiye CCDR (World Bank Group 2022) this report provides an assessment of adaptation and resilience (A&R) preparedness and the country's enabling policy, institutional, and macrofiscal environment. It provides a review of Türkiye's development, disaster risk management (DRM) and climate change adaptation-related policies, plans, and programs, and identifies priority areas and interventions for further reducing vulnerability and strengthening national resilience to the physical risks of climate change, natural hazards, and other related external shocks, with a special emphasis on the five key areas addressed in the National Climate Change Adaptation Strategy and Action Plan (2011–23). It aims to inform and support Türkiye's efforts to transition to a green economy and build resilience to climate shocks and disasters, while enabling a rapid, resilient, and inclusive recovery from the COVID-19 pandemic. The assessment was elaborated in the context of close and long-lasting engagement between the government of Türkiye and the World Bank Group.

The assessment offers a whole-of-government perspective on priority areas for adaptation and resilience that can inform ongoing and planned national climate and development policy processes. These include, among others, implementing the New Economy Program (2021–23) and its Green Deal Action Plan, developing its 12th National Development Plan (NDP), 2023–30 CCAP, 2050 Climate Change Strategy, updating its NDC under the UNFCCC, and the next cycle of its National Climate Change Adaptation Strategy and Action Plan, due to be updated soon. The indicator framework developed for the assessment could also serve as a tool for monitoring national progress on A&R-building in the mid to long term.

The report is structured in 10 chapters as follows:

- » *Chapter 1* offers a global perspective on the imperative of climate and disaster adaptation and resilience.
- » *Chapter 2* provides a summary of selected climate change and disaster physical risk drivers for Türkiye.
- » *Chapter 3* describes the methodological approach of the assessment.
- » *Chapters 4–9* present the key results of the assessment and policy recommendations for the main priority actions under each adaptation principle.
- » *Chapter 10* provides an overview of the results and overall conclusions.
- » *Appendixes A–C* provide a heatmap of the drivers of climate and disaster risk in Türkiye compared to other OECD countries, the A&R country scorecard for each priority action, and definitions of the indicators included in the TLS used for the assessment.

The report also includes six deep dives on key aspects of adaptation and resilience in Türkiye, as identified in its National Climate Change Adaptation Strategy and Action Plan.

Localized impacts: physical risks and vulnerability to climate and natural hazards in Türkiye

Türkiye has made remarkable development progress in the past two decades and has built a resilient economy; but it remains vulnerable to shocks.²

Since the early 2000s, strong economic growth, supported by structural reforms and economic programs targeting vulnerable groups and marginalized regions, more than halved the incidence of poverty and extreme poverty in the country. At the same time, employment, income per capita, access to public services, school enrollment, and life

expectancy increased, as the national economy transitioned to upper middle-income status.³ Throughout 2021, the Turkish economy achieved a remarkable performance, with 11 percent growth in GDP. But despite the strength and resilience of its economy, the country's economic growth and development gains remain vulnerable to shocks, as shown by the recent period of macrofinancial volatility and to some extent the COVID-19 pandemic. As such, they might be exposed, in the short and long term, to the impacts of climate change and natural hazards.

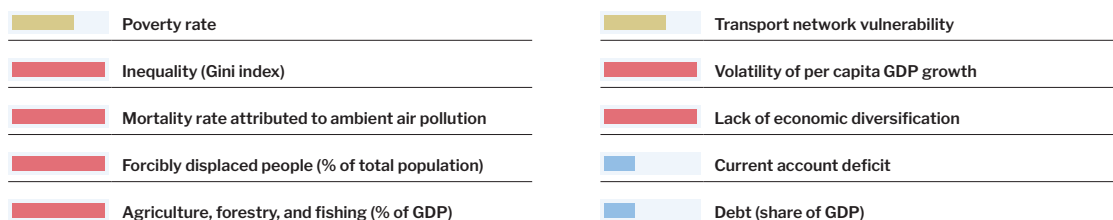
² The ratings in this chapter (high, medium, and low) are all relative to OECD countries, except for the probability of natural shocks, which is from Thinkazard! (<https://www.thinkazard.org>). See Appendix C for more details on data sources and methods applied for each indicator.

³ World Bank Türkiye Overview. <https://www.worldbank.org/en/country/turkey/overview>.

Macroeconomic volatility and a significant share of the population with low adaptive and coping capacity are underlying factors of socioeconomic vulnerability. In recent decades, Türkiye has achieved rapid economic growth and robust public service provision at levels similar to other Organization for Economic Co-operation and Development (OECD) countries. Although its economic growth is among OECD's highest, and its GDP per capita reached US\$8,536 in 2020, there is significant scope to improve income inequality (Gini index of 41.9 in 2019), and poverty rates have recently increased, reaching 15 percent of the population in 2019.^{4,5} About 80 percent of Türkiye's extreme poor live in rural areas (World Bank Group 2016). The country also hosts one of the world's largest refugee populations, having offered temporary protection to approximately 3.6 million Syrians who have been integrated into cities, towns and villages and make up about 4 percent of the population (UNHCR 2018, n.d.). With a growing population, emissions of fine particulate matter (PM2.5) have been increasing, with associated health risks. Levels of air pollution result in 47 deaths per 100,000 population each year, which puts Türkiye in the highest tercile of OECD countries (Sachs et al. 2021). While Türkiye ranks better than most of its peers within the OECD in terms of trade deficit and gross debt-to-GDP ratio, its volatility of per-capita GDP growth and lack of economic diversification places it within the highest tercile of OECD countries (The Growth Lab 2021).⁶ The contribution of agriculture, forestry, and fishing to GDP—all sectors that are highly exposed to climate variability and climate change—is relatively high (6.7 percent) compared to the OECD. A detailed assessment of Türkiye's transport system, conducted through simulation modeling and analysis of multi-hazard risks to Türkiye's road and railway infrastructure including a criticality analysis of the national transport network, concluded that it has higher-than-average vulnerability (expressed as average consumer losses from single link disruptions); and that increasing its resilience will be expensive (World Bank Group 2022). These factors contribute to the vulnerability of Türkiye's socioeconomic systems to the impacts of natural hazards compared to other OECD countries (*table 2.1*).

TABLE 2.1 >>

Drivers of socioeconomic vulnerability in Türkiye



Sources: UNHCR 2018; The Growth Lab 2021; IMF World Economic Outlook (WEO) Databases; World Development Indicators; UN Open Data Hub: SDG 3.9.1; Koks et al. forthcoming

Poor households in Türkiye are structurally more exposed to weather shocks and less equipped to bear the direct and indirect effects of—bounce back from—natural disasters. For example, data from the 2019 Survey on Income and Living Conditions (TurkStat 2019) show that households below the international poverty line of US\$5.5 a day (2011 purchasing power parity) are more dependent on agriculture for their livelihoods.⁷ On average, close to 10 percent of their income is from agriculture, almost three times more than the middle class. These households also have a

4 World Development Indicators. <https://databank.worldbank.org/source/world-development-indicators>. Calculations are based on the national poverty line; when measured against the international poverty line of reference for upper-middle-income countries (US\$5.50 per person per day), Türkiye's poverty rate in 2019 was 10.2%.

5 The MoFSS estimates that cash transfers, unemployment insurance and other social assistance programs prevented poverty rates from rising much higher during the COVID-19 pandemic.

6 IMF WEO Databases. www.imf.org.

7 Note that in 2021, the highest increase in mean annual income (29.2%) was observed in the agriculture sector (TurkStat 2022).

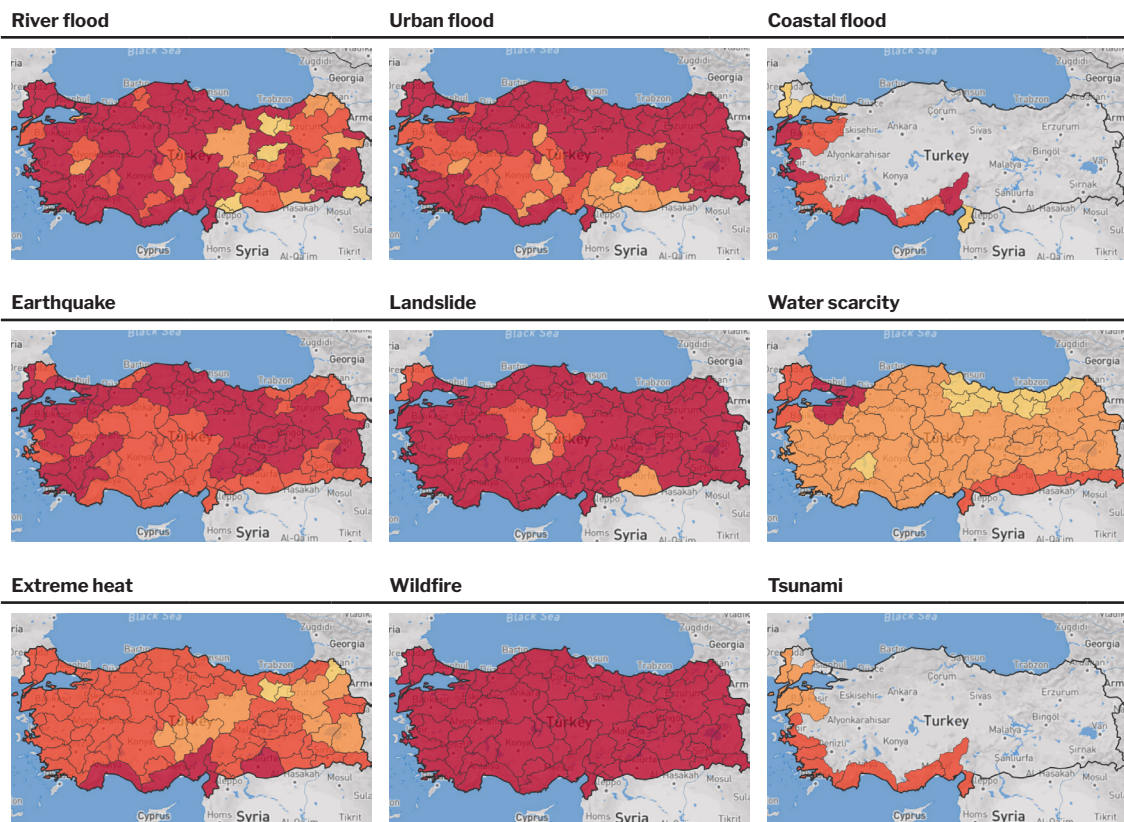
lower stock of human capital, reducing their capacity to diversify income and transition to sectors that are less affected by major shocks. Their jobs are less stable, they are more likely to engage in seasonal and casual employment, work in informal activities, and endure longer unemployment spells. Food and non-alcoholic beverages account for 41 percent of total expenditure in the poorest households, three times more than in the richest households (Baez et al. 2021). Their asset holdings are more limited and less resilient to natural hazards, as they are built in marginal and hazardous areas, with little consideration of seismic and other natural hazards and risks, and not complying with building codes. Over half of poor households (55.3 percent) live in dwellings with a leaking roof, damp walls, floors or foundations, or rotting window frames or floor—twice as many as middle-class households (27.5 percent) (TurkStat 2019).

Due to its geological, topographic, climatic, and socioeconomic characteristics, Türkiye is highly exposed to the impacts of natural hazards and prone to disasters. The high probability of earthquakes, floods, landslides, extreme heat, water scarcity, wildfires, and other natural hazards threatens lives, livelihoods, natural resources, and the economy across the national territory (*figure 2.1*).

FIGURE 2.1 >>

Probability of natural shocks in Türkiye

■ High ■ Medium ■ Low ■ Very low



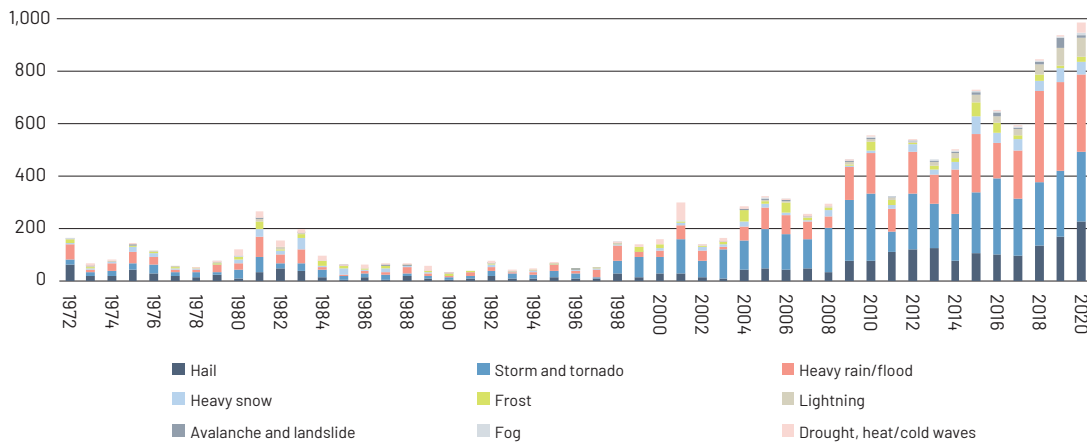
Source: ThinkHazard!

In the past two decades, the frequency of extreme climate events has increased and new natural hazards have emerged. The first cyclone in Türkiye’s modern history was recorded in 2018 and 2020 saw a historical record of 984 extreme events (MoAF TSMS 2021), exceeding the previous year’s record of 935 events. Although not all recorded climate events resulted in disasters, and no studies are yet available to attribute them to climate change, there is a clear trend of rising hazardous events (*figure 2.2*).

Earthquakes are Türkiye’s most frequent and devastating disaster events. Their frequency exceeded all other disaster events recorded between 1985 and 2020 (figures 2.3 and 2.4). During this period, Türkiye was affected by 42 earthquake disasters, with on average one 5–6 magnitude earthquake disaster per year (World Bank Group 2016; EM-DAT⁸). About 95 percent of the territory and 70 percent of the population are proximal to an active fault line, with 21.2 million people (27.1 percent of the 2015 population) exposed to 1-in-250-year earthquake (GFDRR 2016), and 42 percent of the transport network exposed to seismic risks (World Bank 2019c). Türkiye’s population and economic center, Istanbul, is located near the North Anatolian Fault and at high seismic risk; in 1999, a 7.6 earthquake near Istanbul caused over 18,000 deaths, affected more than 1.3 million people, and left an excess of US\$28 billion in damages (World Bank 2021c). On average, each year earthquakes take 1,000 lives, affect 1 million people, and represent a risk to assets equal to 0.09 percent of GDP and to well-being up to 0.21 percent of GDP (GFDRR 2016; World Bank 2021c).

FIGURE 2.2 >>

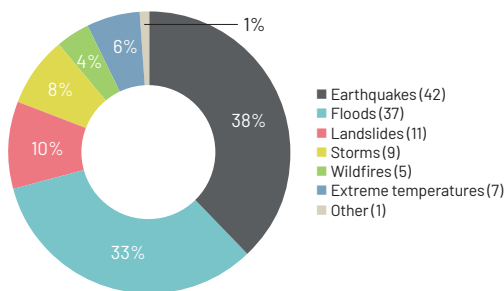
Annual number of extreme meteorological events in Türkiye (1972–2020)



Sources: OECD 2019b; MoAF TSMS 2021

FIGURE 2.3 >>

Natural disasters, excluding drought, reported in Türkiye (1985–2020)

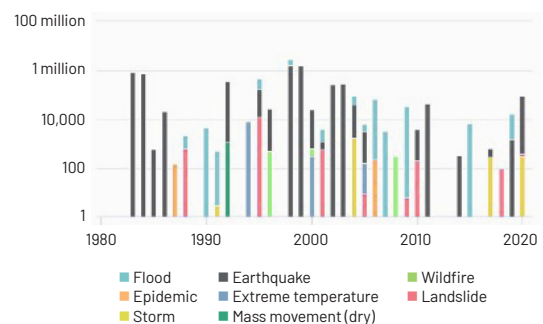


Source: EM-DAT

Note: The total number of recorded events is in parentheses.

FIGURE 2.4 >>

Number of people affected by natural disasters in Türkiye (1985–2020)



Source: CCKP

Floods, including flash floods, are the country’s second most frequent cause of disaster. Between 1985 and 2020, it recorded 37 flood events, primarily affecting the coastal plains.⁸ In Türkiye, 14.2 percent of the population—including 13.7 percent of the poor—and 6.4 percent of the transport network are exposed to flooding (Hallegatte et al. 2019; Rentschler and Salhab 2020), affecting

⁸ www.emdat.be.

600,000 people a year on average (GFDRR 2016) and posing an annual risk to assets and well-being equivalent to 0.1 and 0.3 percent of GDP, respectively. In 2021, floods in the Kastamonu, Sinop, and Bartın provinces caused several deaths, multiple injuries, and significant damage to critical infrastructure, leaving 300 villages without electricity (BBC News 2021).

Storms, landslides, drought, and wildfires are also frequent causes of disaster in Türkiye. After earthquakes, landslides are the most destructive hazard, triggered by floods and storms (MoEUCC 2020). Drought events have led to agricultural losses, freshwater shortages, and drying and shrinking of lakes (such as Lake Tuz) and wetlands. Türkiye experienced severe droughts in 2007–08 and 2013–14 (Kumaz 2014), with the earlier drought affecting more than 435,000 farmers and resulting in losses of US\$1.4–2.2 billion (Bagherzadeh and Shigemitsu 2021). With 2020 the driest of the past five years, at the beginning of 2021, some regions still faced severe drought, and numerous reservoirs around Istanbul reached their lowest water storage levels in 15 years, presenting a risk to the city’s water supply (Patel 2021). Although direct drought-related losses may be lower than earthquake losses, the indirect effects of drought can be catastrophic, particularly for vulnerable communities. Wildfires are another growing threat in the wildland-urban interface, particularly in the Mediterranean and Aegean regions. In 2021 alone, wildfires burned in 139,500 hectares of forest across 54 provinces (OGM 2021), representing the largest recorded area burned in a single fire season (*box 2.1*). *Table 2.2* summarizes selected indicators

BOX 2.1 >>
Wildfires in Türkiye

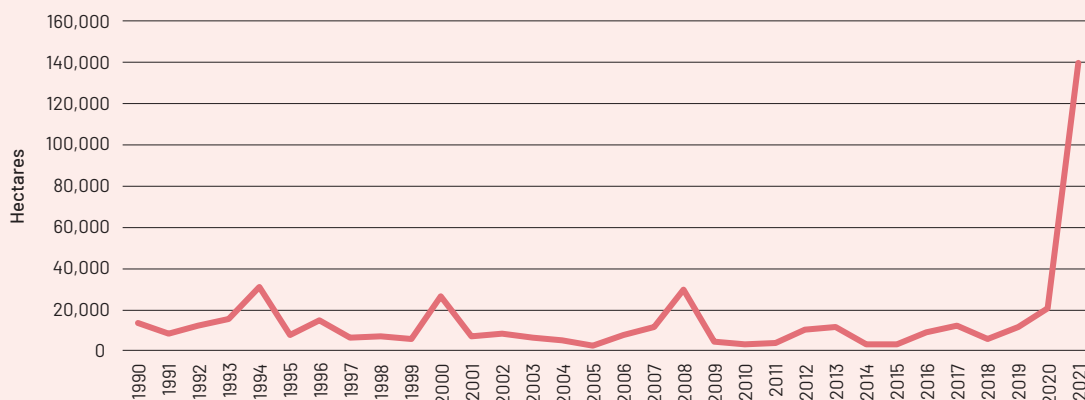
The summer of 2021 was one of the worst wildfire seasons in Türkiye’s history. Between July 28 and August 12, 357 forest fires burned across multiple areas, devastating 139,500 hectares. (*figure 2.5*). The fires led to the evacuation of multiple villages and resulted in the death of 11 firefighters and the hospitalization of many people.

While only 10 percent of all fires in Türkiye are natural, the higher temperatures and drier conditions caused by climate change are expected to increase the duration of fire weather conditions, increasing wildfire risks.

Preventing and abating wildfires will become increasingly important, particularly in areas adjacent to populated centers. This involves interventions to strengthen wildfire management, including policies and incentives to promote fire-smart landscape approaches, invest in fire prevention and suppression, implement good fire management practices, collect wildfire data, and analyze, review, and strengthen stakeholder preparedness, coordination and participation in wildfire prevention and management.

FIGURE 2.5 >>







Area burned by wildfires in Türkiye (1990–2021)



Sources: OGM (1990–2021 data)

TABLE 2.2 >>







Exposure to natural hazards in Türkiye

	Population exposed to floods
	Population exposed to earthquakes
	Poor population (<US\$5.5/day) exposed to floods
	Transport network exposed to cyclones
	Transport network exposed to floods
	Transport network exposed to earthquakes

Sources: GFDRR 2016; Hallegatte et al. 2019; Rentschler and Salhab 2020

TABLE 2.3 >>

Risk to assets and well-being in Türkiye

	Annual average well-being losses
	Annual average asset losses, earthquake
	Annual average asset losses, cyclone
	Annual average asset losses, tsunami
	Annual average asset losses, floods
	Annual average asset losses, total

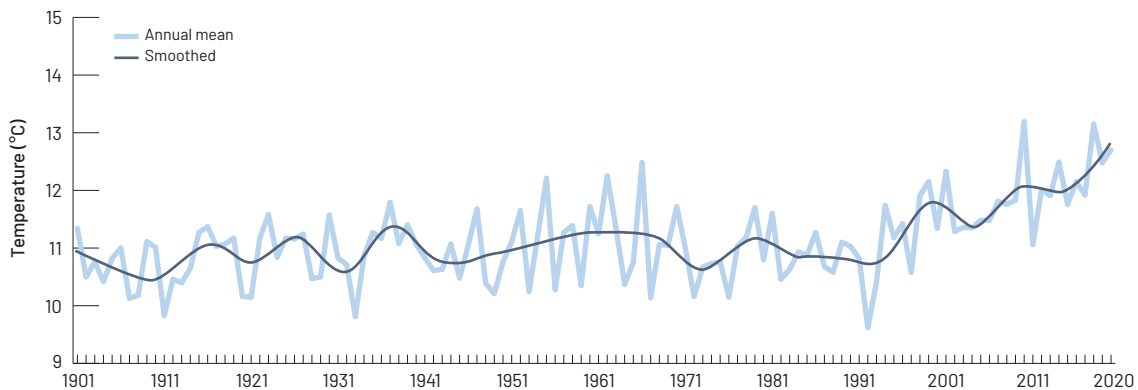
Sources: Hallegatte et al. 2017; UNISDR 2015a

related to people’s and assets’ level of exposure to natural hazards and [table 2.3](#) presents respective risks to assets and well-being, compared to OECD countries.

Observed changes in temperature in Türkiye are consistent with rising global temperature trends. The observed average annual mean temperature in Türkiye increased by more than 2°C during the last century, from 10.9°C in 1901 to 12.9°C in 2020 ([figure 2.6](#)). Seasonal and daily maximum and minimum temperatures have also increased significantly over the last 50 years ([figures 2.7](#) and [2.8](#)). There has been a significant decrease in the number of frost and snowy days since the 1990s, while the number of warm days and nights, and lowest night and the highest daytime air temperatures have all increased (MoEUCC 2019b). The changes in extreme temperatures vary spatially and have repercussions on the frequency, duration and magnitude of heatwaves and other extremes such as drought and wildfire, with significant impacts on health, labor productivity, ecosystems, agriculture, and other economic activities.

FIGURE 2.6 >>

Observed average annual mean temperature in Türkiye (1901–2020)

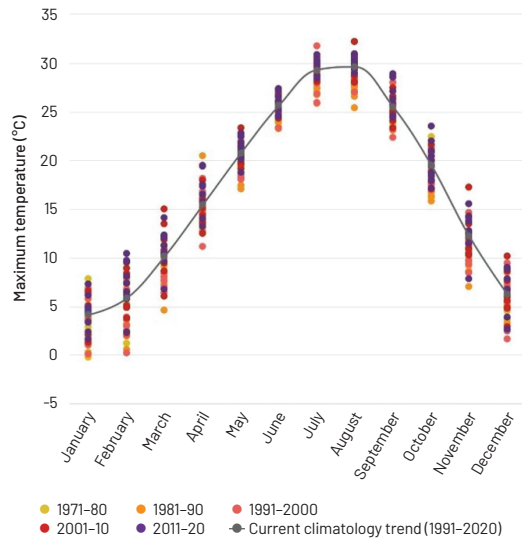


Source: CCKP

There have been subnational changes in precipitation, although natural variability makes it difficult to establish a significant pattern of change at the national level. More seasonal variability in precipitation has been observed in the past 50 years, with rainfall decreasing in the summer months ([figure 2.9](#)) and irregular precipitation being experienced ([figure 2.10](#)). Regional observed changes include a trend of increasing total annual precipitation in the northern and eastern areas of the Black Sea region, the Central and Eastern Anatolia regions, and the Tekirdağ and Istanbul areas of Thrace; a declining trend in total annual precipitation in the western and southern regions; and decreasing winter and spring precipitation in the Marmara, Aegean, Mediterranean, and Central, Eastern, and Southeast Anatolia regions (MoEUCC 2019b).

FIGURE 2.7 >>

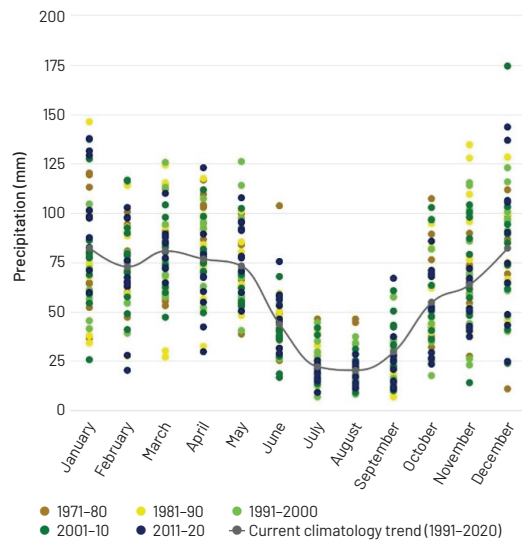
Variability and trends in maximum temperature in Türkiye, across seasonal cycle (1971–2020)



Source: CCKP

FIGURE 2.9 >>

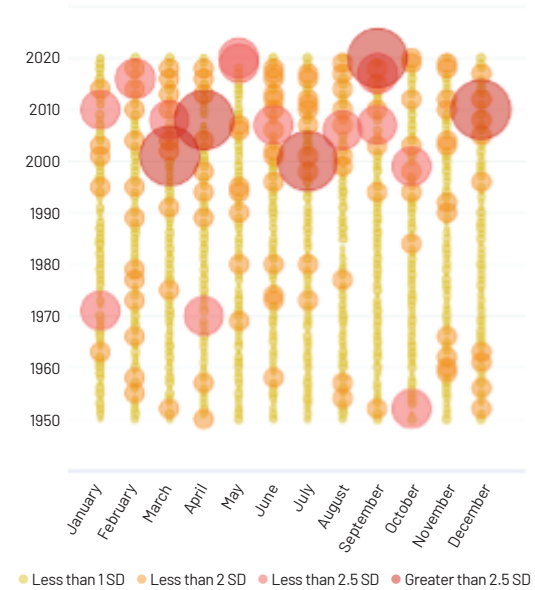
Variability and trends in precipitation in Türkiye, across seasonal cycle (1971–2020)



Source: CCKP

FIGURE 2.8 >>

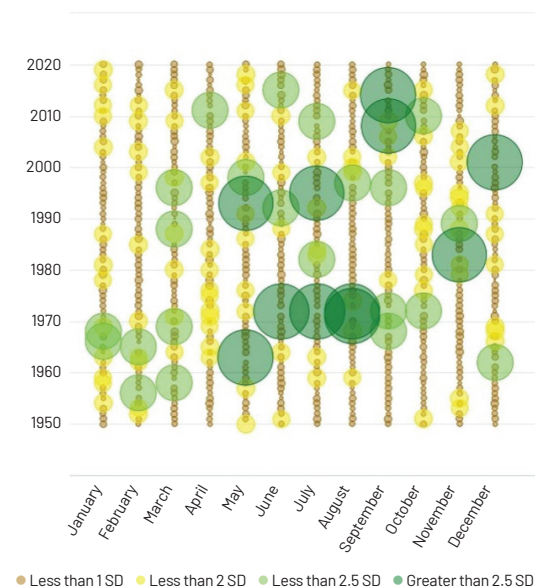
Changes in maximum daily temperature in Türkiye (1950–2020)



Source: CCKP

FIGURE 2.10 >>

Changes in precipitation event intensity in Türkiye (1950–2020)



Source: CCKP

Beyond temperature records, Türkiye is already experiencing some changes consistent with the expected effects of climate change in the natural environment. Time series of satellite data show that Türkiye’s glaciers are shrinking and that more than half of the country’s ice cover has disappeared since 1970; this has been attributed to an increase in summer minimum temperatures (Yavaşlı et al. 2015). Other observed changes related to higher temperatures include reduced permanent snow cover and melting permafrost in periglacial areas in mountains (MoEUCC 2018b). The arrival of a large number of alien species in the Mediterranean Sea through the Suez Canal has been associated with higher sea temperatures (MoEUCC 2018b).

In the summer of 2021, a major marine mucilage outbreak affected the Sea of Marmara, which several experts linked with climate change ([box 2.2](#)).

BOX 2.2 >>

Marine mucilage outbreaks: an emerging threat

Marine mucilage has affected Türkiye's waters since 2007. A mixture of microorganisms—including phytoplankton and their excretions—mucilage proliferates in marine areas that are rich in phosphorus (aggravated by pollution from land sources), during periods of relatively low wind conditions and typically after drought. Mucilage blooms are becoming a major environmental threat in Türkiye. In 2021, a 30-meter-thick bloom in the Sea of Marmara disrupted fishing and tourism and suffocated marine life.

Mucilage blooms could worsen with climate change and warmer

sea waters, which promote proliferation. While mechanical extraction can control it in the short term, sustained pollution control measures are needed for effective remediation. These include improved wastewater treatment and solid waste management in urban centers, the treatment of pollution from industrial sources, and NbS such as wetland conservation. Several of these measures, along with designating the Sea of Marmara a protected area, are part of an action plan announced by the Turkish authorities in 2021 in response to the mucilage crisis.

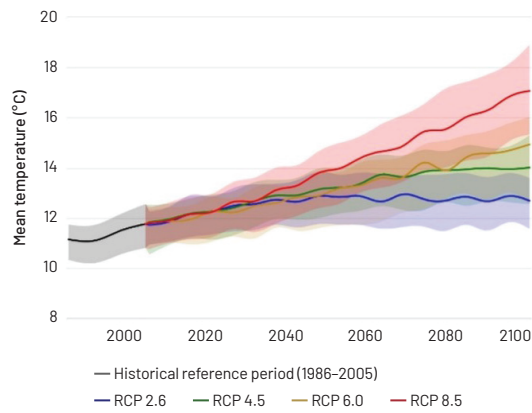
Climate change projections indicate overall warmer conditions and changes in seasonal and subnational precipitation patterns in Türkiye. Recent projections developed using the IPCC scenarios of possible future climate conditions—expressed as Representative Concentration Pathways (RCPs)—coincide with those presented by the Turkish State Meteorological Service (TSMS) in the country's seventh national communication to the UNFCCC (MoEUCC 2018b), with mean temperatures projected to continue rising in the coming decades and temperature increases in the second half of the century varying widely depending on the emissions pathway in each scenario. Under the most optimistic climate scenario (RCP2.6), the mean annual temperature is expected to increase in a relatively stable manner, from 12.3°C in 1986–2005 to 12.7°C (11.6–13.4°C) in 2100. Under the most pessimistic scenario (RCP8.5), the mean annual temperature could climb to 13.9°C (12.5–14.8°C) in 2050 and 17.1°C (15.3–18.9°C) by 2100, and the mean summer temperature (July and August) could increase by more than 4°C in the 2040s, 6°C in the 2080s, and 7°C in the 2090s ([figures 2.11](#) and [2.12](#)). Although mean annual precipitation projections do not show a clear pattern of change at national level, Türkiye's seventh national communication and simulations using regional climate model (RegCM4.3.4) suggest general decreases in precipitation in the future except in the winter season and more irregular and variable precipitation regimes across the country up to 2099 (Demircan et al. 2017; MoEUCC 2018b).

Continued warming is likely to drive more extreme temperatures, longer heatwaves, drought, water stress, sea level rise, and floods, posing major and compound risks to the Turkish economy and population, particularly in urban areas. Under a moderate climate change scenario (RCP 4.5), extreme daily temperatures (above 35°C) across Türkiye are expected to reach 24.9 days per year between 2040 and 2059 (CCKP 2022). The regions projected to experience extreme heat include the Mediterranean coast and southeastern Anatolia. Under a 2°C global warming scenario, the IPCC projects that the area around Izmir could experience more than 16 days with temperatures above 40°C each year, while Gaziantep would experience 31 days.⁹ Heat extremes experienced in

9 IPCC. Interactive Atlas. <https://interactive-atlas.ipcc.ch>.

FIGURE 2.11 >>

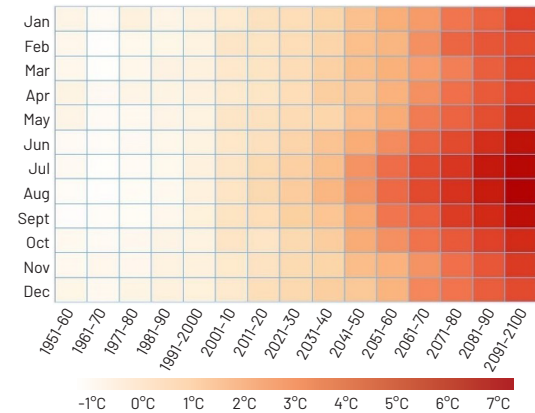
Projected annual mean temperature in Türkiye, under different scenarios



Source: CCKP

FIGURE 2.12 >>

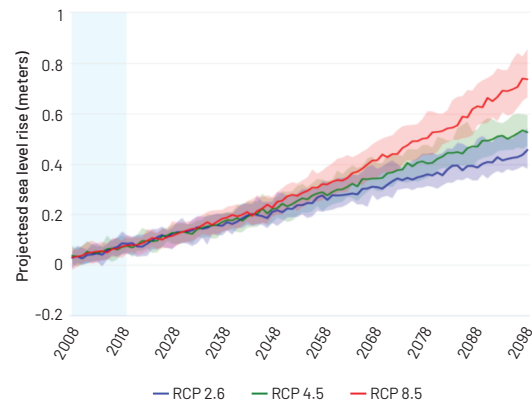
Projected intra-annual mean temperature anomalies in Türkiye, under RCP 8.5



Source: CCKP

FIGURE 2.13 >>

Projected sea level rise in coastal Türkiye



Source: CCKP

TABLE 2.4 >>

Selected future climate change impacts in Türkiye by 2050 (RCP 4.5 scenario)

	Future population exposed to sea level rise and frequent coastal floods
	Additional population exposed to frequent coastal floods (RCP 8.5 scenario)
	Extreme heat days (>35°C)
	Soil moisture change
	Wheat yield change

Sources: Kulp and Strauss 2019; CCKP; Climate Analytics, Climate Impact Explorer

Türkiye’s cities may be even greater than predicted by global climate models, most of which do not consider the urban heat island (UHI) effect, which can magnify the warming caused by GHG emissions by up to a factor of two (Huang et al. 2019).¹⁰ Data for 2003–18 already show a summer daytime UHI effect of over 3°C in Istanbul, and close to 2°C in Bursa.¹¹ Heatwaves are associated with a range of health conditions, increased mortality, lower productivity in outdoor and indoor work, poorer educational outcomes, and increased crime, domestic violence, and even suicide rates. Low-income neighborhoods tend to get hotter than wealthy ones, because they usually have less vegetation. Projected sea level rise poses risks such as inundation, storm surge, and flooding to Türkiye’s coastal areas (*figure 2.13*). Studies show that under a moderate climate scenario (RCP 4.5), 0.67 percent of the population would be exposed to sea level rise and frequent coastal flooding in Türkiye by 2050 (up from 0.59 percent today), placing it in the middle tercile of OECD countries (Kulp and Strauss 2019). With climate change and higher temperatures, it is projected that soil moisture and wheat yields could drop by 4.7 and 8.4 percent, respectively, by 2050 (Climate Analytics 2022), affecting agricultural productivity and the land’s ability of absorb carbon (Green et al. 2019). *Table 2.4* summarizes selected impacts of climate change that are expected to act as major drivers of climate and disaster risk in Türkiye by 2050.

10 The UHI effect is caused by artificial materials absorbing heat, a lack of vegetation, buildings trapping heat and blocking breezes, cars, factories, and air conditioning releasing heat, and other factors.
 11 Global UHI Surface Explorer. <https://yceo.yale.edu/research/global-surface-uhi-explorer>.

Climate change is expected to exacerbate risks across all sectors of the Turkish economy. As temperatures rise in the coming decades, more impacts will become apparent and interact—whether individually or together—with underlying risk factors such as environmental degradation to magnify risks on people, livelihoods and assets, economic sectors, and the environment. A summary of the drivers of climate and disaster risk described in this chapter for Türkiye is presented in [Appendix A](#).

Strengthening A&R preparedness can lower impacts and economic costs and reduce risks from current and future climate change and disasters for Türkiye. The cost of delaying action may be too heavy to bear as climate change progresses, hazards intensify and change, and the population and assets exposed to impacts increase. For example, the cost of delaying coastal protection from sea level rise could be significant in terms of coastal erosion, saltwater intrusion into groundwater resources and subsidence, and greater than the investment needs to build resilience. Without adaptation, the costs of coastal flooding alone could reach 0.24–0.54 percent of Istanbul’s and Izmir’s GDP by 2050 (Hallegatte et al. 2013). Planning for adaptation and investing in resilience-building is cost-effective and saves lives and suffering while preventing asset and well-being losses. Every dollar invested in resilient infrastructure creates jobs, saves lives, and reduces disaster response and recovery costs. Resilient infrastructure investments can also promote innovation and generate social, environmental, and economic benefits that materialize even in the absence of disasters (Hallegatte et al. 2019; UN 2019; World Bank Group 2021c).

Although Türkiye has not had access to the Green Climate Fund, it has benefited from considerable climate-related development finance from bilateral and multilateral donors outside the financial mechanisms of the UNFCCC. Most has been for mitigation-related issues, with support for adaptation largely delivered through grants and representing only a small fraction of Türkiye’s climate finance budget (OECD 2019b). The prospect of higher international contributions for adaptation in Türkiye has improved since it ratified the Paris Agreement. However, beyond climate finance, accelerating and ensuring the sustainability of adaptation and resilience depends on their integration into development policies, plans, and actions.

Türkiye has started to lay a solid foundation for building resilience to climate change through adaptation and risk reduction planning at various levels of government and in various sectors. This is the result of the development of robust climate change and DRM policies, strategies, and plans that guide its mitigation and adaptation actions ([box 2.3](#)).

Türkiye has made progress in mainstreaming climate change adaptation and DRM into its national development processes. Its 11th NDP (2019–23) addresses adaptation directly and indirectly, includes actions for building national adaptation capacities, and mandates the identification of urban and regional climate change challenges and adaptation needs, and the elaboration of CCAPs for Türkiye’s seven regions. The plan includes multiple resilience measures, including adaptation measures for reducing vulnerability to potential climate change impacts at sectoral level—for example, in agriculture—and mitigation measures with adaptation co-benefits, most of which are focused on energy efficiency. The plan also emphasizes disaster preparedness for reducing the impacts of earthquakes and extreme weather events ([table 2.5](#)).

Subnational and sectoral adaptation and risk reduction planning is also advancing. [Table 2.6](#) summarizes the potential impacts of climate change on the national sectors prioritized for adaptation in the National Climate Change Adaptation Strategy and Plan (2011–23). Progress includes developing Türkiye’s first Provincial Disaster Risk Reduction Plan (IRAP, in Turkish acronym) in 2021, which addresses earthquake and climate change-related risks in the Kahramanmaraş Province (Bagherzadeh and Shigemitsu 2021) and the completion of CCAPs

BOX 2.3 >>

Key national strategic documents guiding climate action in Türkiye

The **Climate Change Strategy (2010–23)** serves as a basis for the National CCAP (2011–23), establishes a national vision to combat climate change, and calls for mitigation and energy efficiency in five key sectors and the development of policies on climate change adaptation.

The **National CCAP (2011–23)** introduces a roadmap for addressing climate change, establishes measurable targets for lowering GHG emissions and a set of adaptation objectives in five key sectors—water resource management (WRM), agriculture and food security, ecosystem services, biodiversity and forestry, natural DRM, and public health—and has objectives for integrating adaptation in a set of crosscutting issues as its sixth area of focus.

Türkiye’s **National Climate Change Adaptation Strategy and Action Plan (2011–23)** sets framework goals and sectoral targets for adaptation, focusing on the same sectors and objectives as the CCAP and elaborating a series of measurable and timebound actions for each sector, including assigning responsibilities to lead agencies.

The **National Energy Efficiency Action Plan (2027–23)** presents 55 actions to promote energy efficiency in buildings and services, energy, transport, industry and technology, agriculture, and crosscutting areas. Its targets aim to reduce Türkiye’s primary energy consumption by 23.9 million tons of oil equivalent and emissions by 66.6 million tons of carbon dioxide equivalent by 2023.

for Türkiye’s seven regions, as mandated in the 11th NDP. IRAPs are now under preparation for all provinces. One of the objectives of the Ministry of Environment, Urbanization and Climate Change’s (MoEUCC) Strategic Plan (2018–22) is to issue local climate action plan regulations. Once these are in place, it is expected that 30 metropolitan municipalities covering approximately 83 percent of the population will start to prepare their local plans, followed by 51 provincial plans (MoEUCC 2018b). Sectoral CCAPs are also foreseen, with their elaboration included in the government’s Final Declaration on Combating Climate Change, announced in February 2021.

TABLE 2.5 >>

Key adaptation measures in Türkiye’s 11th NDP (2019–23)

NDP area	Policies and measures that directly address climate change and disaster risk
Agriculture	<ul style="list-style-type: none"> » Expanding the agricultural area with modern irrigation systems to ensure efficient water use » Scaling up water pollution prevention measures » Studies to establish underground water basins and dams to prevent water loss due to evaporation considering the effects of climate change » Action plans for invasive species and agricultural pathogens that may affect the sector under climate change » Developing production change scenarios under climate change for various products » Resilient infrastructure supported (e.g., animal shelters and greenhouse production) » Reclaiming and managing pasture » Expanding products and hazards covered under the agricultural insurance scheme, with sustained efforts to introduce revenue protection insurance
Urban areas	<ul style="list-style-type: none"> » Urban planning based on spatial plans that integrate climate change, disaster risk, geographical characteristics, and historical values » Expanding green spaces in urban areas, including establishing national gardens to attenuate higher temperatures under climate change
Environmental protection	<ul style="list-style-type: none"> » Capacity building to increase adaptation and undertake GHG mitigation in key emitting sectors: buildings, energy, industry, transport, waste, agriculture, land use and forestry » Planning, developing, and implementing national and regional adaptation strategies and action plans, including preparing CCAPs for seven regions

Disaster risk management	<ul style="list-style-type: none"> » Preparing Türkiye's national and provincial DRM plans » Preparing and implementing local DRM projects » Scaling up natural disaster insurance to cover all hazards, at household and sovereign levels » Elaborating hazard and risk maps under various climate change scenarios » Continuing earthquake retrofitting works, including for critical infrastructure, and increasing emergency shelter capacity in Istanbul » Continuing the inventory of public assets » Identifying a critical infrastructure prioritization method » Defining procedures and principles for the Post-Disaster Recovery Plan and preparing local recovery plans » Completing an uninterrupted and secure communication infrastructure for more effective disaster response » Developing a geographic information system (GIS)-based decision support mechanism for effective disaster management » Strengthening local disaster management units' technical and administrative capacity » Raising awareness of disasters and emergencies across the country » Providing required shelter materials
Energy efficiency	<ul style="list-style-type: none"> » Establishing a subsidy mechanism for replacing inefficient electric motors used in industrial processes » Increasing forest assets and energy efficiency gains to reduce carbon emissions » Supporting green port applications to increase energy efficiency in port operations, minimize environmental impacts, and ensure sustainability

TABLE 2.6 >>

Key climate change impacts in Türkiye's climate priority sectors change adaptation

Sector	Key climate change impacts
Water resource management	» Through changes in temperature and precipitation patterns, and the shift from snow to rain in the highlands, climate change could substantially alter streamflows in the country's river basins, cause the loss of surface waters, reduce the quantity and quality of available freshwater, and compromise the water resources needed for drinking, domestic and industrial consumption, hydropower, and agriculture. By 2030, the Gediz and Büyük Mederes River Basins could lose 50% of their surface waters, creating extreme water scarcity for the sectors and people who depend on them. With a rapidly growing population, water scarcity and climate change impacts on water resources, 30–45% of Türkiye's population could experience water stress by 2100. More intense rainfall events could also aggravate soil degradation processes, with direct implications on the quality of water resources.
Agriculture and food security	» Increased evapotranspiration, extreme weather events, changes in agroecological zones and growing periods due to changing climate conditions, and increased pest and disease incidence may lead to large crop production losses. Wheat, barley, corn, cotton, and sunflower yields could see a significant decline across the country by 2050. Livestock production could be affected by changes in the availability, quantity and quality of feed and water, physiological stress, epidemics, and an increase in input prices. Overall, climate change impacts on agriculture could have serious consequences on the sector's contribution to GDP, employment in agriculture and related value chains, and food security, as food price rise and volatility increases.
Ecosystem services, biodiversity, and forestry	» All terrestrial ecosystems are expected to be affected by climate change. Species will migrate to new habitats in search of suitable climate conditions, biodiversity patterns will change, and species will be lost. Mountain species are disproportionately sensitive to a changing climate. It has been predicted that a 3.6°C rise in global temperature could lead to a loss of over 50 percent of plant species in the Mediterranean mountainous region shared by Türkiye. Shallow lakes and wetlands may be affected by eutrophication and salinization. Seawater warming is expected to lead to changes in marine ecosystems and their biological composition, including the appearance of invasive species and the disappearance of temperature-sensitive species, with consequences for fisheries and aquaculture-based activities.
Natural hazards and DRM	» A surge in the number, intensity and duration of climate extremes will require commensurate risk management measures—including infrastructural interventions—to reduce the risk and improve disaster response and better manage floods, droughts, and forest fires. The latter could change in duration and become year-round threats.
Public health	» Higher summer temperatures and the expected 24.9 extreme heat days per year by 2050 could increase the incidence of heat stroke and heart-related mortality. Climate change could increase the incidence of waterborne and tick-borne infectious diseases, malaria, Crimean Congo Hemorrhagic Fever, and other diseases. More prolonged and intense heatwaves are expected to impact labor productivity and GDP, with GDP losses projected to steadily increase over the next 40 years in Europe, particularly southern Europe, including Türkiye.

As Türkiye emerges from the COVID-19 pandemic crisis and prepares for a green transition, new opportunities emerge for continuing to strengthen A&R policies and actions. Opportunities for mainstreaming adaptation and resilience in climate and development processes include the following:

- » Preparing the 12th NDP.
- » Executing the Medium-Term Program (2022–24), which seeks to set up a growth model that creates quality jobs and reduces inflation and current account deficit.
- » Implementing the Green Deal Action Plan (2021), which provides a strategy for achieving a green transformation in all economic sectors to support Türkiye’s alignment with the European Green Deal. Although many of the actions in this plan are geared toward accelerating decarbonization and attracting green investments to strengthen Türkiye’s integration to global supply chains, it also includes actions to support informed decision making on adaptation, such as: including the Land Degradation Neutrality approach in national investment programs; elaborating the Climate Change Combat Report (in 2021), the 2023–30 CCAP (in 2022), the 2050 Climate Change Strategy (in 2022), the Water Reuse National Master Plan (by 2023), and studies on climate change effects on biodiversity and ecosystems and interactions with land degradation and desertification; estimating potential water losses due to climate change; and identifying NbS for coasts, lakes and/or wetlands, and NbS studies for land applications.
- » Developing an updated NDC and long-term strategy (LTS) after ratifying the Paris Agreement.

The Adaptation Principles framework

This report provides a whole-of-economy assessment of Türkiye’s A&R preparedness and identifies priority areas for action.

The assessment follows the approach developed in the World Bank Adaptation Principles (Hallegatte et al. 2020), which provides a flexible framework for designing effective national climate and disaster A&R policies and strategies. It aims to help central ministries that oversee the wider economic system—

for example, ministries of finance or economy—address A&R challenges. The approach is not meant to provide detailed sectoral assessments or roadmaps; rather, it focuses on concrete macroeconomic-level actions that reflect universal principles for effective climate change adaptation. If prioritized according to a country’s objectives, needs and risks, such actions can help reduce and manage climate and disaster risks, and accelerate development and poverty reduction.

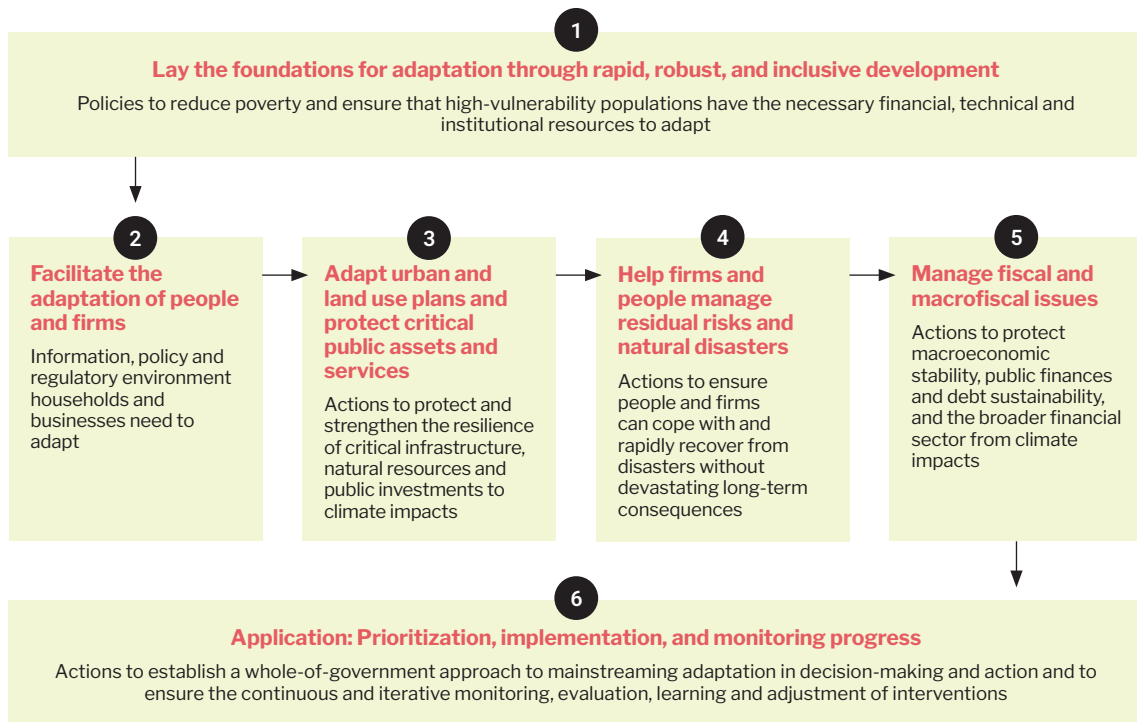
The assessment reviews Türkiye’s performance against a series of priority actions organized around six adaptation principles (*figure 3.1*). The priority actions correspond to common policy domains and cover key aspects of the enabling environment required for effective adaptation, including:

- 1 Adaptation Principle 1: Lay the foundations through rapid, robust, and inclusive development
- 2 Adaptation Principle 2: Facilitate the adaptation of people and firms
- 3 Adaptation Principle 3: Adapt urban and land use plans and protect critical assets and services
- 4 Adaptation Principle 4: Help firms and people manage residual risks and natural hazards
- 5 Adaptation Principle 5: Manage financial and macrofiscal issues
- 6 Adaptation Principle 6: Application: Prioritization, implementation, and monitoring progress

Considering Türkiye’s high level of exposure to earthquakes, the assessment also addresses seismic and other natural disaster risks.

FIGURE 3.1 >>

The Adaptation Principles framework



Source: Adapted from Hallegatte et al. 2020

In total, 155 indicators and 31 priority actions were selected to assess Türkiye’s A&R preparedness. To ensure a balanced evaluation, about five to seven indicators capture key aspects of A&R attributes for each priority action. The indicator selection builds from the list of suggested indicators in *The Adaptation Principles* (Hallegatte et al. 2020) and recent resilience assessments carried out in other countries using the same approach (Rozenberg et al. 2021).

The framework was further adapted to include priority actions for the five areas identified in Türkiye’s National Climate Change Adaptation Strategy and Action Plan (2011–23)—WRM, agriculture and food security, ecosystems, biodiversity and forestry, DRM, and public health—with sectoral deep dives providing more targeted assessments and recommendations. The distribution of indicators across the adaptation principles is presented in *table 3.1*.

TABLE 3.1 >>




Number of A&R preparedness indicators included in the assessment

Adaptation principle	Number of indicators
1. Lay the foundations for adaptation through rapid, robust, and inclusive development	23
2. Facilitate the adaptation of people and firms	23
3. Adapt urban and land use plans and protect critical public assets and services	46
4. Help firms and people manage residual risks and natural disasters	25
5. Manage financial and macrofiscal issues	14
6. Application: prioritization, implementation, and monitoring progress	24
Total number of indicators:	155

The traffic light system (TLS) used in this report assesses and rates Türkiye’s progress in each A&R preparedness indicator. The rating system is based on three categories defined in the TLS: *nascent*, *emerging*, and *established* (*figure 3.2*). The TLS rates progress against each indicator based on available data and information, and is then aggregated to provide a scorecard with a rating for each priority action and adaptation principle (*Appendix B*). Specifically, scores of 1, 2, or 3 are assigned to each category, with average ratings of 1–1.67 for *nascent* (red), 1.67–2.33 for *emerging* (yellow), and 2.33–3 for *established* (blue). Using an equal weight for each indicator, the rating scores are aggregated for each underlying indicator to provide an average score for each priority action. Using an equal weight for each priority action, these are then aggregated to provide an aggregate score for each adaptation principle. This system offers a simple way to identify gaps and areas for improvement, prioritize actions, facilitate target setting, and monitor progress across key aspects of adaptation and resilience. See *Appendix C* for detailed descriptions of the indicators, sources, and rating criteria.

FIGURE 3.2 >>

Traffic light system used in the assessment, defined for each indicator

	<p>Nascent (red): The country does not meet the standard or includes areas that are at an early stage of development, or ranks in the bottom tercile of a benchmark group</p>
	<p>Emerging (yellow): The country partly meets the standard, has progressed beyond the early stage, or is ranked in the middle tercile of a benchmark group</p>
	<p>Established (blue): The country meets the standard, or is ranked in the top tercile of a benchmark group</p>

The assessment uses a wide range of information sources and methods, including benchmarking with peer countries. Where possible, Türkiye’s performance is compared against OECD countries, in line with the CCDR benchmarking approach. As such, the assessment uses several globally available quantitative public data sources—such as the World Bank’s World Development Indicators¹² and OECD Data¹³—for approximately one-third of the indicators, which may

12 <https://databank.worldbank.org/source/world-development-indicators>.

13 <http://data.oecd.org>.

differ from national statistics. The assessment also uses Türkiye’s national statistics and data, qualitative evaluation of policy documents and reports published by the government of Türkiye, a literature review of a wide range of scientific information and technical reports, and expert judgment when other data were not available. Due to the use of global databases to allow for benchmarking, differences may exist between the data provided in the report and national statistics. *Table 3.2* provides a summary of the types of methods and sources of information used in the assessment, which are also marked for each indicator throughout the report.

TABLE 3.2 >>

Methods and data sources used in this assessment

Data category	Methods and data sources	Number of indicators
I	Quantitative benchmarking assessment supported by global data or statistics (e.g. World Development Indicators, OECD Data, etc.)	48
II	Qualitative assessment based on national statistics, review of policy documents and reports, websites, literature from different sources including government, World Bank and OECD analytics, among others	80
III	Qualitative assessment based on technical/country expert judgement	27
Total number of indicators:		155

Based on the results obtained in each priority action, a series of recommendations are developed for each adaptation principle, aimed at informing policy, strategy, and investment-related decision making for strengthening adaptation and resilience within short (2022–30), medium (20–2040) and long-term (2040–50) time horizons, aligned with NDC and LTS milestones and reporting processes (UNFCCC 2019; Falduto and Rocha 2020). Given potential relationships and dependencies between priority actions within the adaptation principles—for example, where one action is the basis of or reinforces another action—each recommendation is linked to the main priority action it supports, while also highlighting links with other priority actions that may lead to synergistic impacts on adaptation and resilience. Although not all priority actions are expected to have direct fiscal implications—through studies, assessments, inventories, EWS, and so on—recommendations with clear fiscal implications are indicated, but a detailed assessment of budgetary needs was outside the scope of this report. Cost-benefit analysis, complemented by distributional effects analysis, would further contribute to the prioritization of adaptation actions and plans with positive externalities, improve equity in the distribution of benefits, and strengthen the efficiency of public investment for adaptation along different time horizons (Bellon and Massetti 2022; Aligishiev et al. 2022).

A number of caveats and limitations should be considered when interpreting the results of the assessment. First, although the assessment intends to capture important elements of adaptation and resilience from a whole-of-economy perspective based on the Adaptation Principles framework as adapted for Türkiye, it does not provide an exhaustive list of actions that a country may consider or undertake. Detailed sectoral assessments and roadmaps are required to further guide adaptation actions in priority sectors and complement this work. Second, the assessment uses a broad range of indicators to cover all adaptation principles and priority actions. While every effort was made to include indicators that were relevant to the purpose of the assessment based on previous applications of the Adaptation Principles and on consultations with national and sectoral experts, the results of the assessment remain closely linked to the choice of indicators, data availability, and expert judgement. Third, although the assessment uses the latest data available, uncertainties remain related to information sources that may rapidly become obsolete and need updating in light of ongoing and emerging studies

and initiatives that may generate more up-to-date or adequate information and data that could be available through further iterations and consultations. This is particularly relevant for climate change data that rely on global sources and modeling efforts—such as the Climate Change Knowledge Portal (CCKP)¹⁴—which may fail to capture the actual materiality of Türkiye-specific risks and future extremes, as provided in local assessments. Fourth, the assessment should be considered in the context of other global risks that may exacerbate existing vulnerabilities when compounded with the effects of climate change (*box 3.1*). Given these caveats and limitations, the results should not be interpreted as an absolute and accurate assessment of Türkiye’s A&R preparedness. Rather, it is intended to serve as a starting point for identifying priority areas for action that can be considered in national climate change and related strategies and plans.

BOX 3.1 >>

Adaptation and resilience in the context of multiple global risks

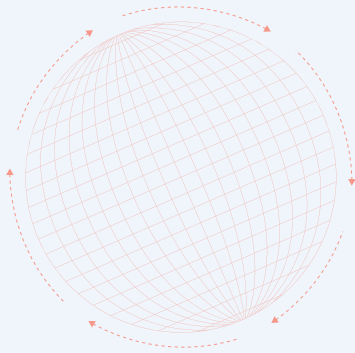
In an increasingly interconnected world, shocks are felt across sectors, borders, and scales, revealing the systemic nature of risks as well as their cascading effects and dynamics (UNDRR and UNU-EHS 2022). The COVID-19 pandemic, as well as recent events in the region such as the war in Ukraine, have highlighted the importance of anticipating large shocks that can have a high disruption potential when compounded with the effects of climate change—for example, on food security, energy poverty and security, and so on. While the present A&R framework was

developed with a focus on natural and climate related hazards and risks, many of the indicators included in the assessment may also be used to assess preparedness against a number of other global risks that have the potential to exacerbate existing vulnerabilities of a country’s economy and population, such as those related to cybersecurity, political turmoil, and terrorism, among others (see WEF 2022). For a broader crisis preparedness assessment, see the Crisis Preparedness Gap Analysis framework (World Bank Group, forthcoming).

14 <https://climateknowledgeportal.worldbank.org/>.



Lay the foundations for adaptation through rapid, robust, and inclusive development



“Policies to reduce poverty and catalyze robust economic development are most effective for reducing vulnerability to climate change. Poverty and the lack of access to basic services—including critical infrastructure, financial services, health care, and social protection—are strong predictors of vulnerability to climate change. No targeted adaptation strategy can be successful without eradicating extreme poverty and ensuring high-vulnerability populations have the financial, technical, and institutional resources they need to adapt.”

—The Adaptation Principles

PRIORITY ACTIONS	
● ● ●	1.1 >> Increase economic productivity and growth, while keeping buffers for shocks
● ● ●	1.2 >> Ensure that economic growth is inclusive

This chapter reviews the progress made toward achieving inclusive economic growth as the foundation for resilience in Türkiye. The assessment includes 23 indicators, corresponding to two priority actions. The overall results indicate emerging progress toward achieving this adaptation principle, with both priority actions also emerging.

●● Priority Action 1.1 >>

Increase economic productivity and growth, while keeping buffers for shocks

INDICATORS >>

●●● Economic growth⁽¹⁾

●●● Adjusted net savings (ANS)⁽¹⁾

●●● Macroeconomic stability⁽¹⁾

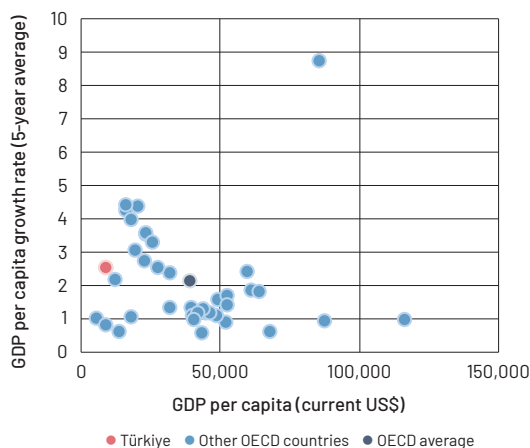
●●● Investment⁽¹⁾

●●● Economic productivity⁽¹⁾

External shocks have affected the rapid pace of economic growth seen since the 1990s in Türkiye, reducing national capacity for building adaptation and resilience. The concurrent effects of macroeconomic volatility and the COVID-19 pandemic have slowed down Türkiye's impressive development progress and led to the largest economic decline seen in over a decade. Between 2015 and 2019,¹⁵ Türkiye's GDP per capita increased at an average annual rate of 2.6 percent, positioning the country in the top tercile of its OECD peers, which experienced average annual GDP per capita growth of 2.1 percent (*figure 4.1*). Türkiye also saw gains in natural and human capital as indicated by an ANS of 13.1 percent,¹⁶ compared to an OECD average of 10.7 percent (*figure 4.2*).

FIGURE 4.1 >>

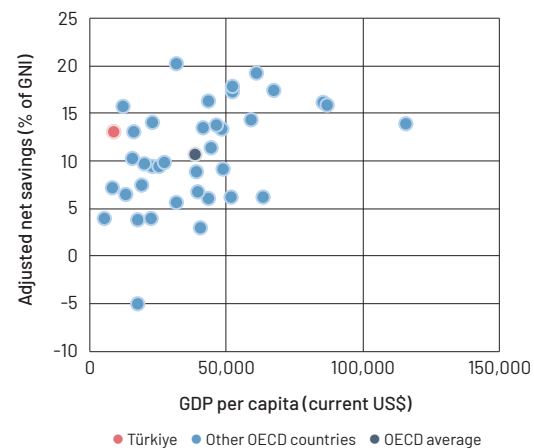
GDP annual growth rate per capita (2015–19 average)



Source: World Development Indicators

FIGURE 4.2 >>

Adjusted net savings (2015–19 average)



Source: World Development Indicators

However, macroeconomic stability was lower in Türkiye (1.01) than in peer countries during the same period (1.06; *figure 4.3*). With a generous stimulus to boost GDP, inflation was almost three times higher in Türkiye than in other OECD countries (Consumer Price Index of 327 vs. 118 average in OECD countries; *figure 4.4*); the fiscal deficit (2.2 percent) almost doubled that of other OECD countries (1.2 percent average); and the current account deficit (2.6 percent) more than doubled the OECD average of 1.2 percent.¹⁷ Throughout this period, the country kept a low general debt (29.2 percent of GDP) compared with the OECD average of 68 percent; and investment—mainly driven by private investment—reached 25 percent of GDP in 2019, compared with the OECD average of 23.4 percent.¹⁸ But public investment has been highly volatile and on a declining trend since 2002, while for economic productivity, Türkiye was in the bottom tercile of OECD countries in 2019,

15 2020 has been omitted from this and other indicators to exclude the effects of COVID-19.

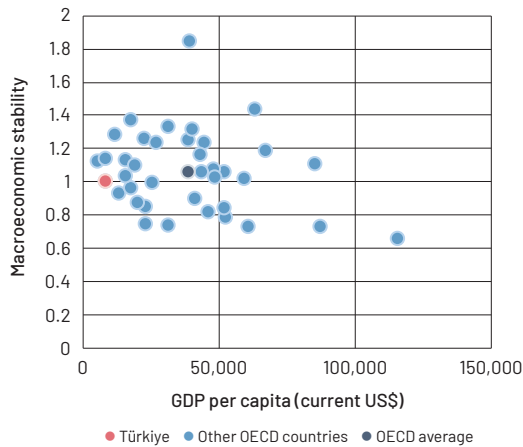
16 ANS is a measure of change in a country's wealth. ANS equals net national savings plus education expenditure, minus energy depletion, mineral depletion, net forest depletion, and carbon dioxide and particulate emissions damage.

17 IMF WEO. Databases www.imf.org.

with a total factor productivity of 0.97 compared with the OECD average of 1.01.¹⁸ Macroeconomic shocks, including the COVID-19 pandemic and more recent geopolitical conflicts in the region, affect Türkiye's economy and capacity to tackle climate change and disasters, as adaptation and risk reduction measures alone cannot reduce vulnerability in a significant manner or create sustained resilience under highly volatile or challenging global economic conditions.

FIGURE 4.3 >>

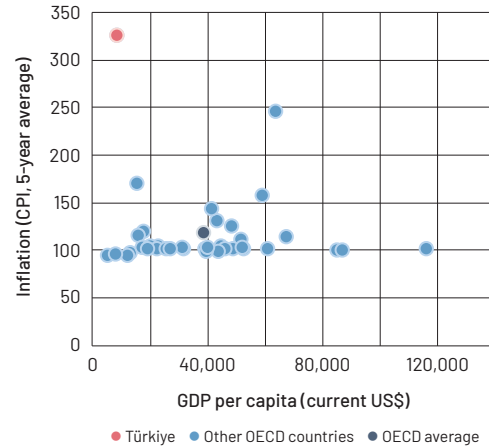
Macroeconomic stability (2015–19 average)



Source: IMF WEO databases

FIGURE 4.4 >>

Consumer Price Index rankings (2015–19 average)



Source: IMF WEO databases

●● Priority Action 1.2 >>

Ensure that economic growth is inclusive

INDICATORS >>

●● Poverty rate⁽¹⁾

●●● Poverty headcount change⁽¹⁾

●●● Shared prosperity⁽¹⁾

●●● Unemployment rate⁽¹⁾

●●● Overall governance⁽¹⁾

●●● Human Capital Index⁽¹⁾

●●● Women's empowerment⁽¹⁾

●●● Access to basic water⁽¹⁾

●●● Access to safe sanitation⁽¹⁾

●●● Access to electricity⁽¹⁾

●●● Access to universal health coverage⁽¹⁾

●●● Access to information and communications technology (ICT)⁽¹⁾

●●● Access to primary and secondary education⁽¹⁾

●●● Access to financial services⁽¹⁾

●●● Access to public services for refugees⁽¹⁾

●●● Social protection coverage⁽¹⁾

●●● Social spending⁽¹⁾

●●● Socioeconomic resilience⁽¹⁾

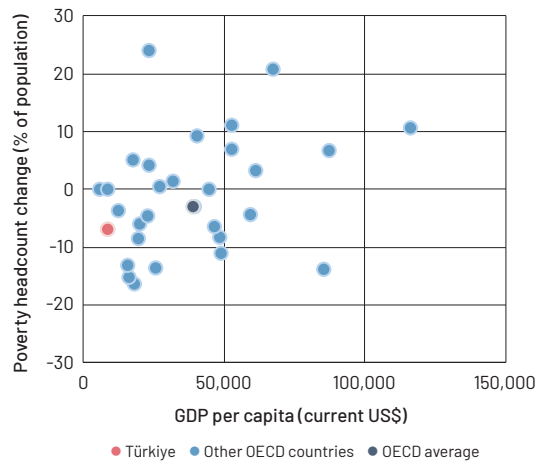
Although Türkiye's high growth performance has benefited the poor, macroeconomic shocks and the health crisis have taken a toll on poverty reduction, with implications for SER and vulnerability to climate extremes and disasters. Poverty rates fell rapidly during the 2000s and, although at a slower pace, continued decreasing during the past decade, from 16.1 percent in

18 GGDC Penn World Tables. www.rug.nl/ggdc/productivity/pwt.

2010 to 15 percent in 2019, representing a 6.8 percent change compared to the OECD average percent change of 2.93 (figure 4.5). The largest decrease was seen before the 2018/19 economic crisis and the COVID-19 pandemic, with 13.5 percent of the population living below the national poverty line in 2016, the lowest poverty rate that decade. However, due to a reversal in poverty reduction arising from economic shocks, poverty started increasing thereafter, reaching 15 percent in 2019 (at national poverty lines). Türkiye saw positive trends in shared prosperity between 2015 and 2019, with the consumption rates of the poorest 40 percent increasing 1.2 percentage points above those of the average population¹⁹ an indication of good progress toward increased well-being. Still, the macroeconomic shocks and health crisis erased about 10 percent of the jobs created since 2005 and led to an unemployment rate of 13.7 percent in 2019, one of the highest among OECD countries (average 7.2 percent; figure 4.6). This represents a setback in the national capacity to invest in building adaptation and resilience.

FIGURE 4.5 >>

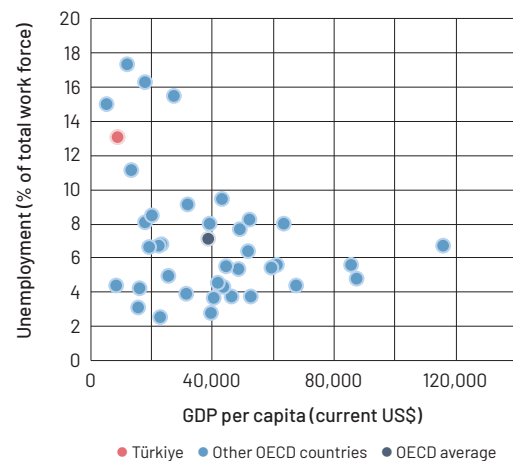
Poverty headcount change (2010–19)



Source: World Development Indicators

FIGURE 4.6 >>

Unemployment rate (2019)



Source: World Development Indicators

Good governance is crucial for creating and sustaining the enabling conditions for inclusive development, adaptation, and resilience, but Türkiye's 2019 World Governance Index score (-0.45) was the lowest among OECD countries and well below the OECD average of 1.05 (figure 4.7). This index aggregates the results of individual indicators for six dimensions of governance: voice and accountability; political stability and absence of violence; government effectiveness; regulatory quality; rule of law; and control of corruption. Türkiye ranked in the bottom tercile of its OECD peers in each of these dimensions. Improving governance can guide the participation, interaction, and collective efforts of multiple stakeholders and sectors to address societal problems, including economic, health, and climate/disaster crises.

Insufficient and ineffective public investment in human capital and gender inequalities affect productivity, economic growth, adaptation, and resilience. Despite significant advances in human capital development, Türkiye only scores 0.65 in the Human Capital Index (HCI), placing it in the lowest tercile of OECD countries (average HCI of 1.05).²⁰ The country invests around 55 percent of its public budget in health, education, and social sector expenditures driven by pensions, but spending levels and efficiency are below the OECD average, leaving significant scope for improving

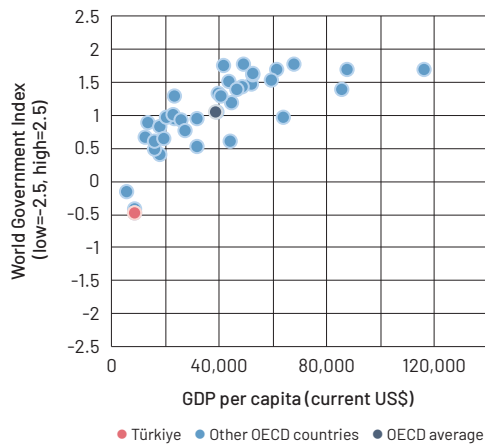
19 World Bank calculations, based on the Income and Living Conditions Survey (Turkstat 2019).

20 World Development Indicators. <https://databank.worldbank.org/source/world-development-indicators>.

human capital outputs to increase productivity and improve the performance of Turkish firms (Erdogan and Del Carpio 2019; World Bank 2021d). Throughout the recent economic and health turmoil, labor force participation has remained highest among people with higher education and lowest among the less skilled population (World Bank 2021d). In 2017, around 33 percent of the working-age population were not in education, employment, or training, having mostly not completed high school, and unable to contribute to the economy or improve their skills (Erdogan and Del Carpio 2019). Women have also borne the largest employment losses during the recent economic shocks, reaching 61 percent of all jobs lost between November 2019 and November 2020 (World Bank 2021d). This is of concern as women’s empowerment, measured by the Global Gender Gap Index, is lower in Türkiye (0.65) than in other OECD countries, where the average is 0.74 (WEF 2021). Similarly, the ratio of female-to-male labor force participation is 47 percent, compared with 80 percent in OECD peer countries (*figure 4.8*). Strengthening the human capital base and creating the conditions to enhance female participation in the labor force improves people’s potential to engage in formal employment and entrepreneurship, expands the talent pool needed for enterprises to grow and succeed, increases household incomes, contributes to poverty reduction, and strengthens household and community capacity to adapt to a changing climate and make better DRM decisions.²¹

FIGURE 4.7 >>

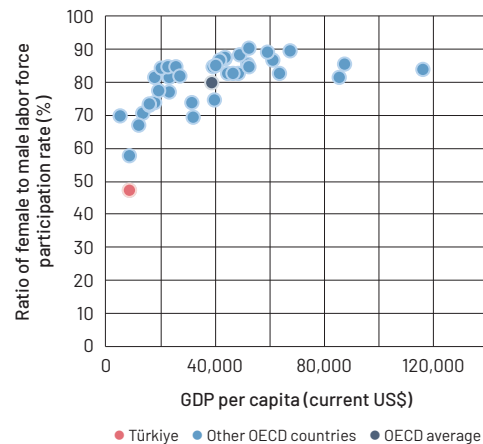
World Governance Index ranking (2019)



Source: World Development Indicators

FIGURE 4.8 >>

Ratio of female-to-male labor force participation (2019)



Source: WEF 2021

Türkiye has made progress in the provision of basic services to all, although some challenges remain. By 2020, there was universal access to electricity, 98.8 percent of the population had access to basic drinking water (ranking in the top tercile of OECD countries for both), 78.8 percent had access to safely managed sanitation (compared with the OECD average of 84 percent),²² and 89 percent of the municipal population was served by urban wastewater treatment plants (MoEUCC 2021). Essential health services covered 74 percent of the population in 2017, lower than most OECD countries (average coverage of 80 percent), and access to primary and secondary education in 2020 was 87.9 and 87.2 percent respectively, compared with 95.7 and 92.1 percent among OECD countries.²² Access to ICT has also improved, reaching 63 percent of the population, though still within the lowest tercile of OECD peers (average 84 percent) (UN 2020).

Improvements in social security and financial systems are needed to strengthen SER (see *box 1.1*) in Türkiye, particularly for the poor. Adequate social security and inclusive financial systems are

21 For a detailed discussion of the nexus between human capital, climate change, and resilience, see Monsalve and Watsa (2020).

22 World Development Indicators. <https://databank.worldbank.org/source/world-development-indicators>.

critical to SER, acting as economic buffers that prevent people from falling into permanent or deeper poverty during disasters and becoming more vulnerable to future shocks. In 2016, SER in Türkiye was estimated at 48 percent, placing the country in the bottom tercile of its OECD peers, where the average SER is 67 percent, and indicating that well-being losses caused by disasters are almost twice as large as asset losses. Further, SER in Türkiye is much lower for the poor than for the average population (Hallegatte et al. 2017). Türkiye is also in the lowest tercile of OECD countries in social protection coverage, social spending, and access to financial services. Social and labor programs cover 49.3 percent of the population, compared with the OECD average of 68.6 percent,²³ and social spending—including transfers and other social benefits—accounts for 12.2 percent of GDP, compared with the OECD average of 20 percent.²⁴ Financial services have expanded in the country, with account ownership reaching 72 percent of the population aged 25 and older, compared with the OECD average of 86 percent.²⁵ But further improvements are needed to achieve universal financial inclusion, especially for credit and insurance. Although Türkiye has remarkable policies and programs to provide adequate coverage of public services to 3.6 million Syrian refugees (UNHCR n.d.), SER can be further strengthened through improvements to the systems that protect the well-being of the country's population from external shocks. There has been recent progress in this regard, with an increase in the number of social assistance programs and the establishment of the Family Support Program, which should enroll a high share of the individuals who are not covered by the social assistance system.

Policy recommendations for strengthening adaptation and resilience

In recent decades, Türkiye has achieved rapid economic growth and attracted increased private investment, while reducing the poverty headcount, advancing the creation of shared prosperity, and increasing access to basic services. But it could do more to lay the foundations for adaptation through rapid, robust, and inclusive development. Based on the results of this assessment, the following recommendations can support the government of Türkiye to further its efforts to do this.

- ✓ **Increase economic productivity and growth, while keeping buffers for shocks.** Undertaking targeted fiscal policy reforms and other measures can help achieve macroeconomic stability and reduce macroeconomic volatility, inflation, fiscal deficit, and current account deficit. Policy and strategic interventions to increase economic productivity to the level of other OECD countries are also crucial. World Bank (2021d), Erdogan and Del Carpio (2019), and the World Bank (2019b) all provide detailed analyses and specific recommendations for potential fiscal and productivity intervention areas. Türkiye could also benefit from considering complementary measures of growth in its national accounting.
- ✓ **Ensure that economic growth is inclusive.** As well as continuing its efforts to reduce the negative effects of recent economic shocks on poverty and unemployment, the government can promote policies that strengthen governance, improve human capital, and reduce inequalities, increasing the efficiency and level of public investment in education, vocational training, and employment skills, and enabling the active participation of women, youth, and disadvantaged groups in the labor force.²⁶ To achieve inclusive economic growth, Türkiye can accelerate its efforts to increase

23 ASPIRE, the World Bank's Atlas of Social Protection Indicators of Resilience and Equity. <https://www.worldbank.org/en/data/datatopics/aspire/country/turkey>.

24 OECD Data. <http://data.oecd.org>.

25 World Development Indicators. <https://databank.worldbank.org/source/world-development-indicators>.

26 World Bank (2019b) discusses specific interventions and policy options for addressing human capital shortcomings, including: providing fiscal incentives for firms willing to invest in improving school/university-work transitions to reduce the incidence of people not in education, employment, or training; regularly monitoring the demand for skills; and revitalizing vocational training institutions that are under-used and poorly resourced.

women’s empowerment and reach the same levels as most other OECD countries, including by reducing of gender disparities in labor force participation.²⁷ Continuing to expand the coverage of basic services will help make safe sanitation, health care, primary and secondary education, ICT, and financial services accessible to all. Supporting digital device ownership and use among vulnerable groups can increase their access to risk information and financial services, while continuing to increase social spending and improving the adequacy and coverage of social protection programs such as through the Türkiye Family Support Programme—and including transitioning from fragmented social programs to a unified, holistic social insurance system in the long term—will further strengthen the country’s socioeconomic resilience (World Bank 2021d).

TABLE 4.1 >>

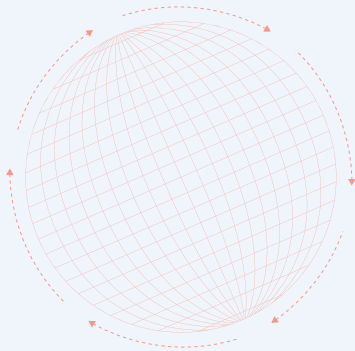
Recommendations for supporting adaptation through rapid, robust, and inclusive development

Priority Action	Policy recommendation	Priority	Lead role	Links to other priority actions	Fiscal implications
1.1	✓ Maintain a stable macroeconomic pathway to preserve the resilience achieved so far and keep buffers for external shocks	Medium to long-term	» MoTF » CBRT	2.5, 5.3	
1.1	✓ Foster economic productivity through fiscal and policy adjustments and incentives, including through skills-building programs and investments involving the private sector	Short to medium-term	» MoTF » MoIT » MoLSS	1.2	\$
1.1	✓ Consider the use of additional measures of growth in national accounting that incorporate aspects of resilience, such as the UN-SEEA	Medium to long-term	» MoTF » SBO	3.8	
1.2	✓ Continue efforts to reduce poverty and unemployment to improve well-being and socioeconomic resilience	Short to medium-term	» MoTF » MoIT » MoLSS » MoFSS		
1.2	✓ Establish a plan to improve overall governance and monitor performance in each of the governance dimensions	Short to medium-term	» MoTF » SBO		
1.2	✓ Increase the level and efficiency of public spending in human capital and create incentives for the private sector to build skills and employ women, youth, and vulnerable populations	Short to medium-term	» MoNE » MoIT » MoLSS	1.1, 3.7	\$
1.2	✓ Accelerate efforts to empower women, including by removing structural barriers that prevent them from participating in the labor force	Short to medium-term	» MoFSS » MoLSS	1.1	\$
1.2	✓ Improve access to services—including universal health coverage, primary and secondary education, ICT, and financial services—to increase resilience	Short to medium-term	» MoH » MoNE » MoLSS » MoIT » PDTO » SBO	2.1, 2.4, 4.2	\$
1.2	✓ Continue ensuring that social protection programs reach the most vulnerable, and create a consolidated, universal social security system incorporating social assistance, cash benefits, and unemployment mechanisms	Medium to long-term	» MoFSS » MoLSS	4.4	\$

Notes: CBRT= Central Bank of the Republic of Türkiye; MoFSS = Ministry of Family and Social Services; MoH = Ministry of Health; MoIT = Ministry of Industry and Technology; MoLSS = Ministry of Labor and Social Security; MoNE = Ministry of National Education; MoTF = Ministry of Treasury and Finance; PDTO = Presidency of Digital Transformation Office; SBO = Presidency of Strategy and Budget Office.

27 Erdogan and Del Carpio (2019) provide a comprehensive list of interventions to increase women’s participation in the labor force, including quality and affordable childcare provision and flexible working arrangements.

●●● Facilitate the adaptation of people and firms



“Private actors—households and firms—have an incentive to increase their resilience and adapt to climate change. However, they face a range of obstacles, from the lack of information and behavioral biases to imperfect markets and financial constraints. Governments need to minimize these obstacles to maximize the economy’s adaptive capacity and prevent (as much as possible and desirable) climate change impacts and natural disasters.”

—The Adaptation Principles

PRIORITY ACTIONS

●●● 2.1 >>

Assess climate and disaster risks, and make this information available

●●● 2.2 >>

Clarify responsibilities and align incentives with A&R objectives

●●● 2.3 >>

Facilitate access to technical solutions for resilience through research and development (R&D) and trade policies

●●● 2.4 >>

Ensure financing is available to all, and provide support to the poorest and most vulnerable people

●●● 2.5 >>

Facilitate structural change in the economic system

This chapter reviews the progress made in creating the enabling environment for the adaptation of people and firms in Türkiye. The assessment includes 23 indicators, corresponding to five priority actions. The overall results indicate nascent progress toward achieving this adaptation principle and three of its priority actions.

●● Priority Action 2.1 >>

Assess climate and disaster risks, and make this information available

INDICATORS >>

●● Hydromet data availability, completeness⁽ⁱⁱ⁾

●●● High-resolution Digital Terrain Model (DTM) data coverage and availability⁽ⁱⁱⁱ⁾

●● National-scale hazard map (covering entire country) availability and completeness⁽ⁱⁱ⁾

●● Local-scale hazard maps (1:10,000 or larger) availability and completeness⁽ⁱⁱⁱ⁾

●● Local-scale climate change scenarios⁽ⁱⁱ⁾

●● Data platform providing easy access to climate and disaster information⁽ⁱⁱ⁾

●●● Community awareness of hazard and vulnerability levels⁽ⁱⁱ⁾

●● Climate and disaster risk assessment for main economic sectors⁽ⁱⁱ⁾

Although Türkiye has established a robust climate observation system that generates crucial information for risk management and advanced its development of a data management infrastructure, limited access to information hinders their use in adaptation. Türkiye has a long and robust database of climate observations, obtained from 1,233 weather stations, 2,045 hydromet, and 956 online stations (MoEUCC 2018b). TSMS and the State Hydraulic Works (DSI, in Turkish acronym) operate the stations, producing and communicating important information to the public, but not all data is accessible without request. Türkiye has developed hazard maps for various hazards²⁸ and a web-based GIS platform—the Disaster Risk Reduction System of Türkiye (ARAS, in Turkish acronym)—hosts and integrates these maps for various uses, including producing risk maps and identifying vulnerable areas that are essential to plan adaptation and risk reduction interventions (AFAD 2020). However, ARAS only offers public access to seismic hazard maps. Access to disaster data is also limited as the repository of historical disaster information, the Turkish Disaster Information Bank (TABB, in Turkish acronym), is inactive and the information is not made publicly available. Without easy access to climate and disaster risk data and information (*box 5.1*), people and firms cannot properly identify their vulnerabilities, assess adequate risk reduction and other adaptation measures, or reassess the effectiveness of those measures as climate change progresses. Nevertheless, Türkiye has made concerted efforts to raise community awareness through public information campaigns on climate change and disaster risk-related issues, with over two million people receiving instantaneous weather-related data and information through a smartphone app developed by TSMS (MoEUCC 2018b). Although there is no specific regulation stipulating public access to climate change information and the country does not have a centralized climate change data platform equipped with adequate information and tools for public use, it is expected that the recently announced National Climate Change Platform and National Climate Change Research Center will cover this gap (World Bank, forthcoming).

High-resolution data could inform effective local adaptation processes but are currently unavailable. Efforts to downscale climate and natural hazard data in Türkiye have been few and geographically fragmented (MoEUCC 2018b; OECD 2019b). But high-resolution DTM information, high-resolution hazard maps, and downscaled climate change scenarios, paired with socioeconomic data at high resolution, could enable a more granular assessment of risks, vulnerability, and impacts to support local risk management strategies and adaptation processes.²⁹ These data are particularly important for urban planning and other areas where risk management decisions are made at high spatial resolution.

28 Türkiye has up-to-date earthquake hazard maps and has been developing flood hazard maps; these are almost completed for the entire country. National-level desertification risk maps are also available at a resolution of approximately 1 kilometer, as well as landslide, rockfall, and avalanche susceptibility maps at 200 and 20-meter resolution. The General Directorate for Spatial Planning under the MoEUCC is also developing 1/10,000 or higher-scale hazard maps within the scope of geological surveys with an aim of becoming the basis for zoning plans.

29 Local-scale climate change scenarios are to be produced as part of the second phase of the Climate Change on Water Resources project, under the leadership of the General Directorate of Water Management.

BOX 5.1. >>

The importance of data and information in adaptation processes

Risks evolve with climate change due to changes in both climate and socioeconomic systems. Decisions to reduce those risks and adapt to changing conditions should be based on the best information available. This information is generated from observations, projections, and historical data.

Observational data include observations of the atmosphere, land, and ocean as well as of socioeconomic processes.

Projected data offer insights into future conditions, delivered in the form of forecasts, predictions, and

projections to meet short, medium, and long-term planning needs.

Historical data is the basis for understanding and learning from past processes and impacts for better decisions in the present and future.

To keep the pace with the changes, quality data and updated information need to be continuously generated, made available at different spatial and temporal resolutions, and delivered in appropriate formats to meet the needs of different users.

Most sectors of economic importance still lack climate and natural hazard risk assessments, limiting the information that people and firms who depend on these sectors need to adapt. Few sectoral risk assessment studies have been developed so far (MoEUCC 2018b). Examples, both led by the World Bank, include the Key Agricultural Product Risk Assessment study (Frankfurt School of Finance & Management 2018), which studies the effects of climate change on agricultural outputs in Izmir; and the Building Resilience in Türkiye report (World Bank 2019c), which evaluated climate and disaster risk impacts to critical infrastructure, lifelines, and agriculture. Other important economic sectors—including manufacturing (18.8 percent of GDP), industry (27.7 percent of GDP), and services (54.6 percent of GDP)—need detailed climate and natural hazard risk assessments, to inform sectoral stakeholders on activities, assets, value chains, and markets that are vulnerable to impacts, and on opportunities that climate change may open up in the sector. These assessments give sectoral decision makers the information they need to plan ahead, adjust, climate-proof their investments, and build the necessary capacities to adapt to change.

●● Priority Action 2.2 >>

Clarify responsibilities and align incentives with A&R objectives

INDICATORS >>

●● Institutional responsibilities for disaster and climate risk management⁽ⁱⁱⁱ⁾

●●● Residual risk target level⁽ⁱⁱ⁾

●● Private sector CCAPs⁽ⁱⁱⁱ⁾

●● Companies integrate adaptation and resilience in sustainability risk reporting⁽ⁱⁱ⁾

Responsibilities for DRM and climate change are clearly defined within government, though the current structure is mostly focused on response and recovery. Laws, regulations, and institutions for emergency and DRM have developed and evolved following major natural disasters across the country (Gülkan 2018). The Disaster Law 7269, dating back to 1959, assigns responsibilities for DRM at different levels but could be updated to mainstream climate and disaster risk

assessment, reduction, and resilience. The Disaster and Emergency Management Presidency (AFAD, in Turkish acronym), created in 2009 under the direct authority of the prime minister, is the country's principal authority for DRM and oversees the preparation and implementation of DRM activities. This includes DRM plans for all hazards except drought, which are managed under agricultural policy frameworks. In terms of climate change, the legal framework is clear in designating MoEUCC as the main institution in charge of Türkiye's climate change agenda, and the recently created Presidency of Climate Change (PCC)³⁰ under MoEUCC as the national focal point to the UNFCCC (*chapter 9*). Provincial government and municipality climate and DRM responsibilities are not yet clearly defined, which often leads to limited action and budgeting at the local level. Setting out clear responsibilities at all levels for managing climate and disaster risks backed up by legislation contribute to ensuring public and private actors are prepared to assume their respective roles and share of costs in adaptation and risk reduction.

Residual risk targets have not yet been defined, leading to uncertainty around the level of risk people and firms are exposed to or the level of protection offered by public instruments and infrastructure. This puts them at a disadvantage when making investments and planning for the future, as residual risks are borne by individuals and organizations. For example, if an acceptable level of protection to a certain hazard is determined by law, the government ensures infrastructure or other mechanisms protect private and public assets up to that level. Individuals and firms then decide on the additional risk reduction measures they need to put in place to address the impacts of hazardous events that surpass that level of protection (Hallegatte et al. 2020). These may include insurance, retrofitting private infrastructure, or even relocation if the residual risk is deemed too high.

The private sector is starting to engage in sustainability, risk reduction, and adaptation planning. The 11th NDP urges companies—including state-owned enterprises (SOEs) to include climate change in their long-term strategies and decision making. But as this is neither incentivized nor made mandatory, effective mainstreaming of climate and disaster risk considerations is unlikely. Less than 10 percent of respondents to the World Bank's Enterprise Survey for Türkiye (2019a) have organization-level strategic climate change objectives and less than 5 percent have a dedicated managerial role with overview of environment or sustainability issues. But voluntary private sector engagement in sustainability risk reporting and CCAP preparation, including risk reduction and adaptation considerations, is starting to emerge. For example, the Banks Association of Türkiye established a sustainability working group that since 2009 has been regularly meeting to share best practices and international developments in this area. The association developed in 2014, and updated in 2021, sustainability guidelines for the banking sector which include adaptation to climate change. It has also produced studies, webinars, publications and online courses on sustainability for the sector. The Capital Markets Board of Türkiye has published the (voluntary) Sustainability Principles Compliance Framework for public listed companies (World Bank 2021f). CCAPs are slowly becoming a substantial tool among large companies in Türkiye for establishing a roadmap to manage climate change risks. For example, several companies—including Istanbul Airport and Garanti BBVA Investor Relations—have developed CCAPs, and the infrastructure and financial sector has also shown interest in assessing and managing adaptation risks via CCAPs. These efforts reflect a growing interest among private sector actors in addressing environmental challenges, including climate change, to ensure the long-term sustainability and profitability of their businesses and their clients' interests.

30 Presidential Decree No. 85, dated October 29 2021, OG No. 31643.

Priority Action 2.3 >>

Facilitate access to technical solutions for resilience through R&D and trade policies

INDICATORS >>

Public R&D spending⁽¹⁾

Private sector R&D spending⁽¹⁾

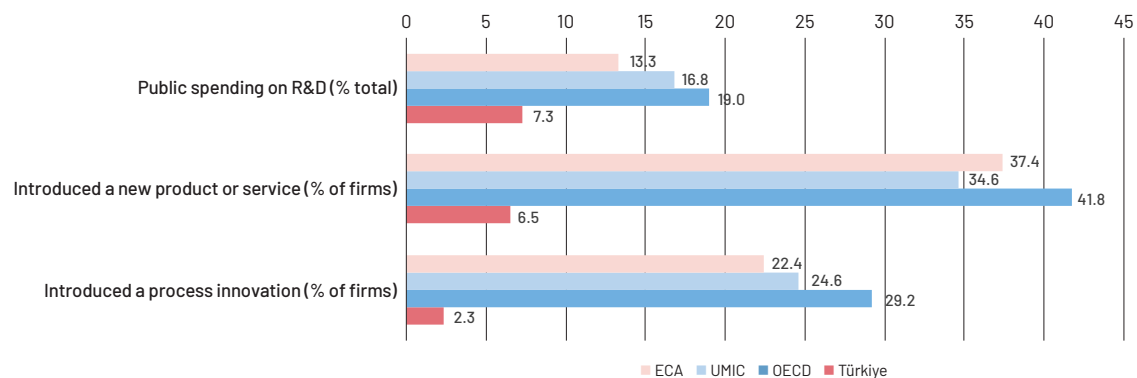
Innovativeness of the private sector⁽¹⁾

Resilience tariff⁽¹⁾

Turkish innovation and spending on R&D lags OECD countries, delaying the availability of technologies people and firms need to adapt to a changing climate. Türkiye is in the middle tercile of OECD countries in terms of public spending on R&D for environmental issues, including on climate change. In 2019, it dedicated about two percent of total government R&D spending to this budget line,³¹ with a growing number of green patents emerging. But Türkiye falls in the bottom tercile of OECD countries for both private investment in R&D and introducing new products, services, or processes (*figure 5.1*)—a proxy for innovation—despite only 0.8 percent of firms identifying customs and trade regulations as trade barriers (World Bank 2019a). More actively engaging the private sector in developing products and services that enable lower costs and more effective responses to climate change is warranted. The demand for these products and services is expected to grow under the European Green Deal, and Türkiye’s private sector could miss important business opportunities by not actively developing, introducing, and commercializing resilience-building solutions needed by every economic sector and level of society. For example, an analysis of the Product Complexity Index, a proxy for the technological sophistication of products and revealed comparative advantage that reveals whether a country exports a product competitively, has identified promising green opportunities for Türkiye to develop, produce, and export products for controlling air pollution, remediating soil and water, and capturing and storing carbon. The analysis found that products for solving wastewater management and water supply issues offer low-hanging fruits for Turkish industry (*figure 5.2*). Furthermore, Türkiye could examine opportunities to reduce or remove tariff and non-tariff barriers for A&R technology transfer and enhance import of resilience technologies to support adaptation action under the EU’s Common Customs Tariff for products within the scope of the Customs Union.³²

FIGURE 5.1 >>

Innovativeness of Türkiye’s private sector



Source: World Bank 2019a

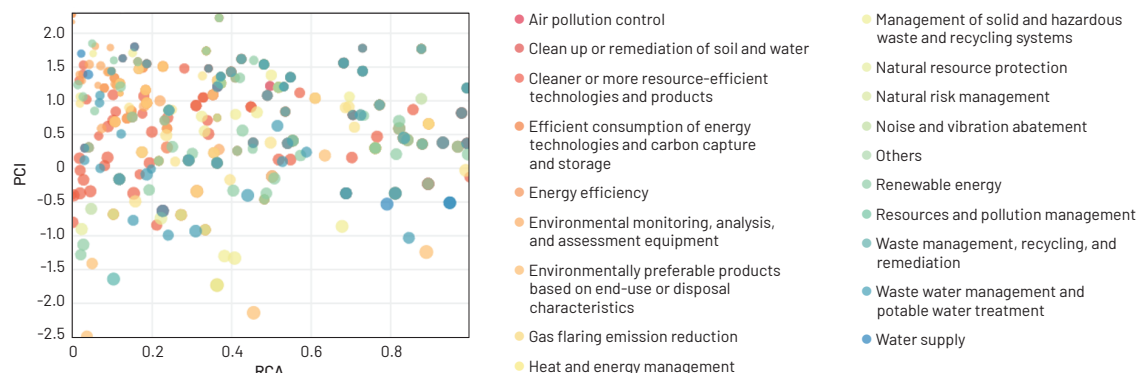
Notes: ECA = Europe and Central Asia; UMIC = upper-middle-income countries

³¹ OECD Data. <http://data.oecd.org>.

³² Technologies that could be relevant to adaptation in Türkiye include those related to: environmental monitoring, analysis, and assessment equipment; agricultural production, water efficiency through irrigation systems, and drought-resistant seeds; water efficiency in agri-processing/manufacturing by improving process water efficiency and the reuse/recycling of process and gray water; wastewater treatment and management; water supply; climate resilience in buildings through a range of technologies and practices to improve water efficiency, improve heat and energy management and minimize flood damage; infrastructure construction with improved resilience performance; solid waste management; and natural resource protection and risk management.

FIGURE 5.2 >>

Green opportunities for Türkiye



Source: Green Transition Navigator
 Notes: PCI = Product Complexity Index; RCA = revealed comparative advantage.

●●● Priority Action 2.4 >>

Ensure financing is available to all, and provide direct support to the poorest and most vulnerable people

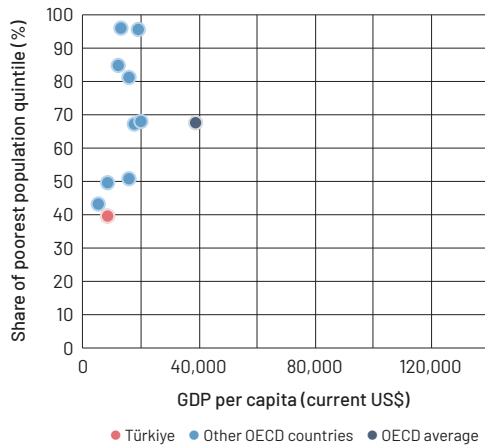
INDICATORS >>

●●● Most vulnerable populations and communities identified ⁽¹⁾	●●● Social protection coverage for the poorest quintile ⁽¹⁾
●●● Access to financial services for the bottom 40 percent ⁽¹⁾	●●● Job opportunities for refugees ⁽¹⁾

Türkiye has made progress in identifying vulnerable populations but can do more to help the poorest adapt to changing climate conditions and continue supporting them during and after shocks. Türkiye provides for people’s urgent and basic needs—such as food, clothing, shelter, and so on—during disasters and emergencies within the scope of the Social Assistance and Solidarity Law No3294. It also supports those identified as vulnerable after emergencies, through additional aid. The country’s application-based electronic social registry system, the Integrated Social Assistance System (ISAS) identifies people and households in need of social protection programs. Thanks to its data inventory, ISAS represents an important tool for targeting immediate support to vulnerable populations during and in the aftermath of emergencies and shocks, as shown during the COVID-19 pandemic. However, people in or close to poverty still need external support to better respond and adapt to climate change. There is also room to improve the buffers that the poorest populations count on to cope with and recover from hazard impacts to prevent them from falling into deeper poverty and becoming more vulnerable to shocks. For example, Türkiye’s social safety net programs only cover 39.6 percent of the poorest quintile, well below the OECD average of 67 percent (figure 5.3). And only 56 percent of the poorest 40 percent have access to financial services—including bank accounts, credit, and insurance—to cope with and build back after a disaster (figure 5.4). Türkiye is also improving its provision of sustainable job opportunities for refugees, which includes skills and language training for 20,000 Syrians under temporary protection, 50 percent of whom are women (World Bank 2015). However, more data and analysis are needed to quantify skills among Syrians under temporary protection as well as policy and legal measures to promote their employment and improve their living conditions and resilience.

FIGURE 5.3 >>

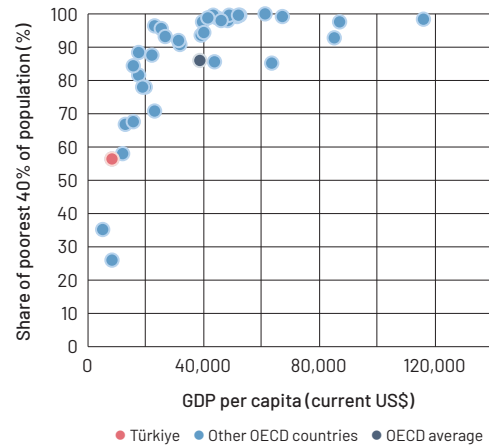
Social safety net coverage for the poorest quintile (2019)



Source: World Development Indicators

FIGURE 5.4 >>

Access to financial services for the poorest 40 percent (2019)



Source: World Development Indicators

●●● Priority Action 2.5 >>

Facilitate structural change in the economic system

INDICATORS >>

●●● Diversification of the economy⁽ⁱ⁾

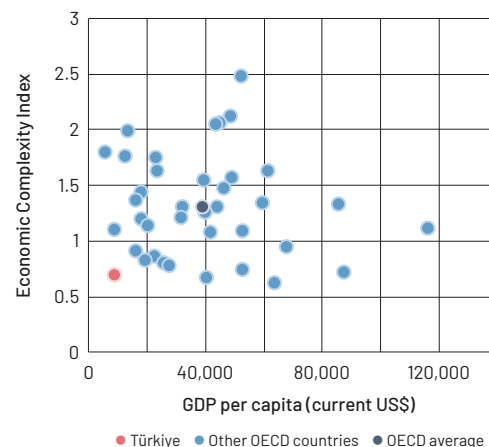
●●● Strategy to manage the decline of sunset sectors⁽ⁱⁱ⁾

●●● Strategy to support the development of sunrise sectors⁽ⁱⁱ⁾

Low diversification of Türkiye's economy increases its exposure to external shocks, including those caused by climate change and disasters. With an Economic Complexity Index³³ ranking of 0.61, it is economically less diversified than its OECD peers, which have an average ranking of 0.93 (figure 5.5). Türkiye's largest goods exports are in moderate-complexity products, textiles, and vehicles, and the technology level of its exports is relatively low. Only 3 percent of Turkish exports are high-tech, and there has been little progress in this field over the last decade. Exports have grown by an annual average of 2.1 percent over the past five years, which has been a drag on overall economic growth, as exports represent a shrinking segment of the economy. But Türkiye has seen a promising pattern of export growth, with the largest contribution coming from high-complexity products, particularly vehicles and

FIGURE 5.5 >>

Economic Complexity Index rankings (1995–2019)



Source: The Harvard Growth Lab

33 Research from the Harvard Growth Lab finds that countries whose exports are more complex than expected for their income level grow faster (<https://atlas.cid.harvard.edu>). Growth can therefore be driven by a process of diversifying knowhow to produce a broader, and increasingly more complex, set of goods and services.


industrial machinery products. Further expanding the export base and diversifying the economy can help reduce exposure to climate impacts and other external shocks, and would also be a win-win for accelerating economic growth.


A comprehensive strategy for addressing productivity losses in key sectors and obstacles to seize the opportunities brought by new climate conditions would further enable the required green transition (World Bank 2019b). As climate change progresses, some sectors will become less productive and competitive (sunset sectors), and economic activity—including employment—will need to shift toward sectors that capture new competitive advantages (sunrise sectors). The sectors that are most negatively affected by climate change in Türkiye are identified in the *Pilot Climate Change Adaptation Market Study* (IFC and EBRD 2013) and addressed in the 11th NDP. Türkiye's response programs to date have included job retraining. It now needs a comprehensive strategy to address the social and economic impacts of climate change on sunset sectors and support the transition to more resilient economic opportunities. Sunrise sectors must also be thoroughly assessed, and high barriers to competition and entrepreneurship addressed (OECD 2016; World Bank 2019a). National research efforts on these issues can contribute to formulating this strategy.

Policy recommendations for strengthening adaptation and resilience

Türkiye has made good progress in establishing a general framework for enabling people and firms to adapt to climate change. Public institutions have generated a good level of data needed for effective risk reduction and adaptation planning, and have established operational structures with clear national-level responsibilities for DRM and climate change. There has been progress in identifying and prioritizing vulnerable groups in need of social protection during crises. Building on this progress and based on the results of this assessment, the following recommendations can help the government of Türkiye further strengthen the capacity of people and firms to adapt to climate and disaster risks.

- ✓ **Assess climate and disaster risks and make this information available.** Facilitating access to crucial climate and disaster information contained in existing but not fully accessible data management infrastructure would enable the production of national and regional risk and vulnerability maps and the use of historical disaster information in decision making. Supporting the generation of more granular information—including local-scale hazard maps and downscaled climate change scenarios—can also facilitate the development of risk reduction and adaptation strategies that are more responsive to local contexts and needs. Developing sectoral climate and natural hazard risk assessments for major economic sectors can further inform the people and firms who depend on them, enabling them to plan appropriate adaptation actions.
- ✓ **Clarify responsibilities and align incentives with A&R objectives.** Defining climate and DRM roles and responsibilities among central and line ministries, provincial governments, and municipalities will provide clarity and leadership, while establishing residual risk targets to clarify the level of protection public instruments and infrastructure provide against hazards can guide people and businesses to engage in additional risk management approaches, averting potential residual damages and losses. Promoting the development of CCAPs will also help firms identify and manage the risks and opportunities climate change poses to their business and encourage them to integrate A&R in their sustainability risk reporting.

-  **Facilitate access to technical solutions for resilience through R&D and trade policies.** Increasing public and private investment in R&D for A&R and incentivizing innovation can help accelerate the generation and availability of technologies that people and firms need to adapt to climate change. Exploring opportunities for reducing tariffs and non-tariff barriers for resilience-related technologies could also bring benefits.

-  **Ensure that financing is available to all and provide support to the poorest and most vulnerable people.** Registering all vulnerable people in the ISAS, expanding access to financial services—including bank accounts, credit, and insurance schemes—to the poorest 40 percent, and expanding the country’s social safety net programs to cover the poorest quintile can help reach the most vulnerable groups.










-  **Facilitate structural change in the economic system.** Making policy and fiscal adjustments to promote economic diversification, developing a comprehensive strategy to address the social and economic implications of climate change on sunset sectors, and elaborating feasibility studies for sunrise sectors and markets to support new, emerging industries and economic opportunities in these sectors would help create a more enabling environment for the private sector to internalize climate change risks in investment decisions, seize opportunities brought by new climate conditions, and transition to more resilient and competitive economic sectors and business models.

TABLE 5.1 >>

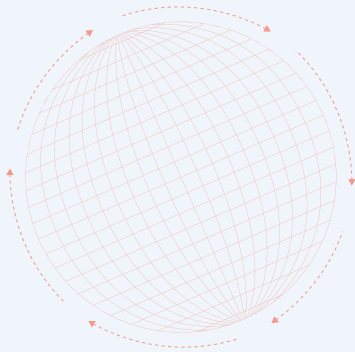
Recommendations for facilitating adaptation by people and firms

Priority Action	Policy recommendation	Priority	Lead role	Links to other priority actions	Fiscal implications
2.1	 Strengthen the generation and access to climate risk and socioeconomic information for people and firms to use in adaptation planning	Short to medium-term	» MoEUCC » AFAD	1.2, 3.1, 3.2, 3.3, 3.4, 3.5	
2.2	 Establish residual risk targets and promote the elaboration of CCAPs for private actors to assess and adopt additional risk management strategies	Medium-term	» MoIT » AFAD » MoEUCC	2.1, 3.2, 3.3, 4.2	
2.3	 Expand the availability of A&R solutions through increased public and private investment in R&D for their development and by assessing opportunities for the reduction of tariff and non-tariff barriers for resilience-related technologies	Short to medium-term	» MoIT » MoT » MoEUCC	1.1, 2.1, 2.5, 3.4	
2.4	 Strengthen the resilience of vulnerable populations by facilitating their access to social protection systems and financial services	Short to medium-term	» MoLSS » MoFSS » MoTF » AFAD	1.2, 4.4	
2.5	 Build a climate-resilient economy by supporting diversification, identifying promising sunrise sectors, and creating a strategy to address the socioeconomic impacts of climate change on sunset sectors	Short to medium-term	» MoIT » MoT » MoEUCC	1.1, 1.2, 2.1	

Notes: AFAD = Disaster and Emergency Management Presidency; MoEUCC = Ministry of Environment, Urbanization and Climate Change; MoFSS = Ministry of Family and Social Services; MoIT = Ministry of Industry and Technology; MoLSS = Ministry of Labor and Social Security; MoT = Ministry of Trade; MoTF = Ministry of Treasury and Finance.



Adapt urban and land use plans and protect critical public assets and services



“Beyond direct support to households and businesses, governments have a transformative role to play in ensuring their country, their economy and their citizens can adapt to climate change. This is particularly the case to ensure the adaptation of important public assets and infrastructure systems such as power systems, roads, water and sanitation, and essential services such as health care, education, safety, and security. Urban and land use plans also influence massive private investments in housing and productive assets, so it is vital these adapt to evolving long-term climate risks to avoid locking people into high-risk areas.”

—The Adaptation Principles

PRIORITY ACTIONS

●●● 3.1 >>

Identify critical public assets and services

●●● 3.2 >>

Design and implement a government-wide strategy to increase the resilience of infrastructure systems and public assets

●●● 3.3 >>

Revise land use plans and urban plans to make them risk-informed

●●● 3.4 >>

Increase the resilience of the agriculture sector and ensure food security

●●● 3.5 >>

Increase the resilience of water infrastructure and water resource management

●●● 3.6 >>

Increase the resilience of the health system

●●● 3.7 >>

Increase the resilience of the education system

●●● 3.8 >>

Increase the resilience of forests and other natural ecosystems

This chapter reviews the progress made in adapting critical public assets and services in Türkiye. The assessment includes 46 indicators, corresponding to eight priority actions. Although the overall results indicate emerging progress toward achieving this adaptation principle, more focus is needed in designing and implementing a government-wide strategy to increase the resilience of infrastructure systems and public assets—the priority action that received the lowest score in the assessment.

●● Priority Action 3.1 >>

Identify critical public assets and services

INDICATORS >>

●● Critical assets and infrastructure identified⁽ⁱⁱⁱ⁾

●● Vulnerability of critical assets and infrastructure assessed⁽ⁱⁱⁱ⁾

●● Logistics Performance Index (LPI)⁽ⁱⁱ⁾

●● Energy Architecture Performance Index (EAPI)⁽ⁱⁱ⁾

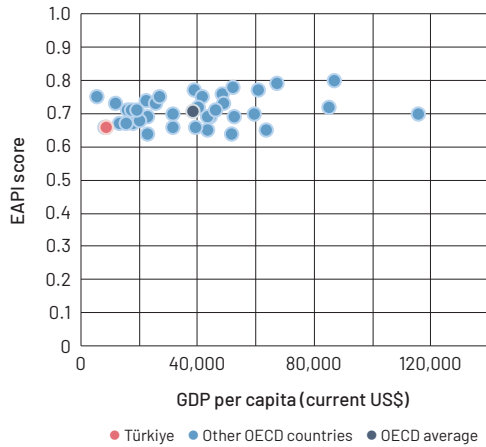
Türkiye has taken steps in identifying critical infrastructure and prioritizing investments to minimize disruptions from climate change and natural disasters. It has established an inventory of public assets and infrastructure and recently started to assess their level of resilience to disasters. There are asset inventories for transport infrastructure (roads, airports, railroads, and ports) and public buildings (80,000 schools and 1,538 hospitals), and the MoEUCC has started using a public structures inventory system (KAYES, in Turkish acronym) to assess the resilience of public buildings against disasters. In 2014, AFAD prepared critical infrastructure roadmaps for 10 sectors, including critical public services and production/commercial facilities. Between 2020 and 2022, Türkiye developed a web-based software for identifying and prioritizing critical infrastructure assets in the health and energy sectors and conducted disaster risk assessments for earthquakes, landslides, rockfalls, avalanches, floods, wind and forest fire risks, and technological disaster risks such as explosions and fire. This allowed for the establishment of a sector-specific disaster-based methodology integrated within the existing critical infrastructure risk analysis system. Türkiye has also developed sector-specific guidelines for government agencies to assess the resilience of critical infrastructures. Accelerating the implementation of these efforts and scaling them up to cover vital assets in all sectors and a wider range of hazards across the entire country would contribute to a complete mapping of critical infrastructure, its vulnerability, and the urgency of retrofitting or investing in other resilience-building actions. Elaborating a national strategy to manage critical infrastructure and systematically assess risk and vulnerability in entire networks and asset inventories, as well as progress in climate impact modelling of transport and other public infrastructure and operations, can form a solid foundation on which to build policies for adaptive management via maintenance and investment programs.

There has been progress in energy security and in the performance of the energy system, but Türkiye can further strengthen its logistics to improve competitiveness and enable faster disaster response and recovery.³⁴ Türkiye ranks in the middle tercile of OECD countries in terms of its national energy system performance (energy efficiency, delivery, access, and environmental performance), as indicated by an EAPI score of 0.66 in 2017, compared to the OECD average of 0.71 (*figure 6.1*). However, its LPI score of 3.15 places it in the bottom tercile of OECD countries, where the average LPI is 3.6 (*figure 6.2*). LPI is a composite index that connects the enabling conditions for logistics performance and trade competitiveness through infrastructure and trade facilitation metrics, including customs, ease of arranging shipments, quality and competence of logistic services, timeliness, tracking, and tracing. Among these, Türkiye scored lowest for customs and border management in 2018 (Vaillancourt and Haavisto 2016; Arvis et al. 2018). With the prospect of more frequent hazard impacts and disasters due to climate change, Türkiye's logistics performance should be further improved, as good logistics enable fast disaster response and recovery.

34 Please note that this analysis does not consider the effects of the Russia-Ukraine war.

FIGURE 6.1 >>

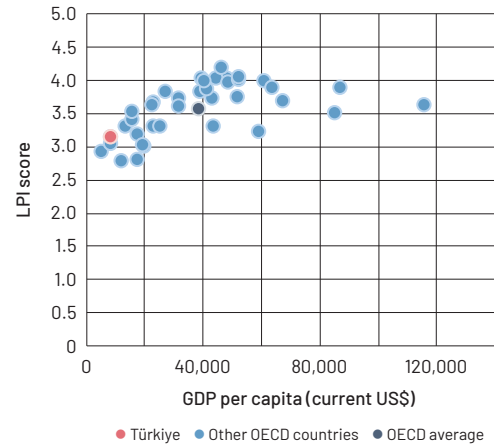
Energy Architecture Performance Index rankings (2017)



Source: WEF 2017

FIGURE 6.2 >>

Logistics Performance Index rankings (2019)



Source: World Development Indicators

●●● Priority Action 3.2 >>

Design and implement a government-wide strategy to increase the resilience of infrastructure systems and public assets

INDICATORS >>

●●● Resilient infrastructure investment needs⁽ⁱ⁾

●●● Long-term resilient infrastructure plan⁽ⁱⁱⁱ⁾

●●● Resilient infrastructure agency⁽ⁱⁱⁱ⁾

●●● Infrastructure maintenance budget⁽ⁱⁱ⁾

●●● Asset management system⁽ⁱⁱ⁾

●●● Construction standards for infrastructure⁽ⁱⁱⁱ⁾

●●● Construction standards and codes for buildings⁽ⁱⁱ⁾

A government-wide, long-term resilient infrastructure master plan can facilitate the resilience-building transformation across the country. Major infrastructure assets in Türkiye are at high risk of natural hazards and climate change impacts. For example, because most of the transport system is exposed to various hazards, the increase in annual investments needed to make all new transport infrastructure resilient by 2030 in Türkiye has been estimated at 10.6 percent above current levels, much higher than the OECD average of 3.6 percent (*figure 6.3*). However, the economic case for transition to resilient infrastructure is significant; the World Bank's *Lifelines* report found that unreliable power and water supply and transport disruptions cost the Turkish economy 2.2 percent of GDP every year (World Bank 2019c). Without action to adapt infrastructure systems, these costs are bound to rise. While incremental spending needs are significant, the gains from making infrastructure more resilient are also higher in Türkiye compared to its OECD peers, as it could reduce annual repair costs by a factor of 7.1, compared to the OECD average of 4.2 (*figure 6.4*). Although there is no overarching coordinating body or dedicated agency for resilient infrastructure in Türkiye, most agencies are responsible for increasing the resilience of infrastructure and assets, using their own resources to do so. The Ministry of Transport and Infrastructure (MoTI) has recently completed a Transport and Logistics Master Plan in line with European Union (EU) standards, laying out a strategy to support a more sustainable, safe, secure, clean, accessible, inclusive, fast, and technologically

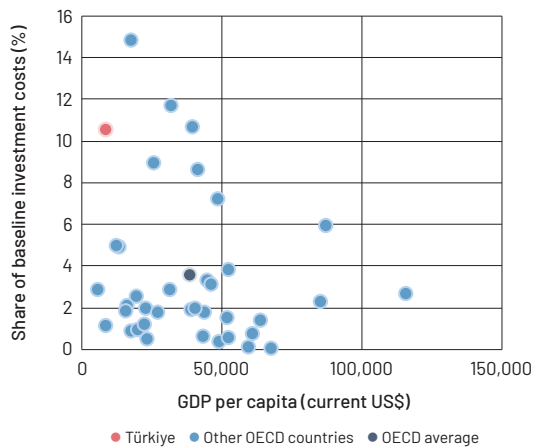
innovative transport sector. But there is no infrastructure master plan that clearly addresses the resilience aspects of all critical infrastructure.

Strengthening public asset management and maintenance is essential for an efficient transition to resilient infrastructure. Stronger management budgets would prevent often postponed maintenance, premature deterioration, shorter economic lifecycles of investments, and late and costly interventions. As infrastructure construction standards do not consider local hazards and criticality, a more effective enforcement mechanism is also needed. More resilient infrastructure requires Türkiye to shift to a preventive approach to infrastructure maintenance and develop an asset management system that can keep an updated inventory of critical infrastructure, its condition, exposure to hazards, maintenance history, and evidence-based maintenance plans. These are both targets in the 11th NDP (2019–23).

In the building and residential sector, well-designed standards and regulations are essential to ensure new investments can cope with the most common hazards. Ensuring resilience of critical public buildings, such as hospitals and schools, is important for strengthening public health and community resilience, and Türkiye has made notable progress in this area, such as introducing differentiated seismic design codes based on building use category. But Türkiye would benefit from further enforcing building codes and standards to ensure that private actors also engage in more resilient construction. The 2019 building code considers wind, snow, and earthquake loads, while construction standards and building permits account for earthquake risks in accordance with the 2018 Turkish Building Earthquake Code. This sets a solid basis for reducing the vulnerability of new constructions to various hazards. Ensuring the enforcement of the seismic code in all buildings constructed after 2020, for example, could result in a 17 percent reduction in annual economic losses caused by earthquakes by 2050 (Rao et al. 2022; *box 6.1*). But time-consuming procedures and limited enforcement mechanisms constrain the application of building codes and standards. It may also be necessary to complement these with financial tools to help households manage the higher upfront costs of increasing resilience (World Bank Group 2022). Solving these constraints can effectively scale up the adoption and protection of resilient structures across municipalities and population groups.

FIGURE 6.3 >>

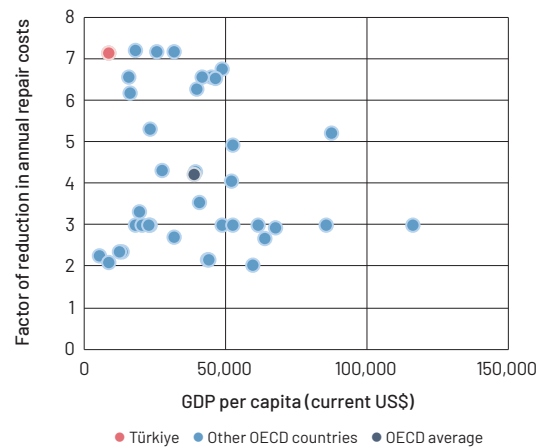
Required investment increases for a transition to resilient transport infrastructure by 2030



Source: Hallegatte et al. 2019

FIGURE 6.4 >>

Reduction in annual repair costs through resilient infrastructure



Source: Hallegatte et al. 2019

Reducing risks and increasing resilience to earthquakes by enforcing building codes



Earthquakes are the most devastating natural disasters in Türkiye. They accounted for 92.6 percent of damaged buildings and 95.9 percent of demolished buildings between 1900 and 2018 (Öcal 2019). On August 17, 1999, a severe series of earthquakes with a moment magnitude of 7.6 caused severe damage in Marmara, an industrialized and densely populated urban region. The earthquake's fatality rate was in the range of 14.3 per thousand, while direct wealth losses amounted to 1.5–3.3 percent of GDP (World Bank 1999).

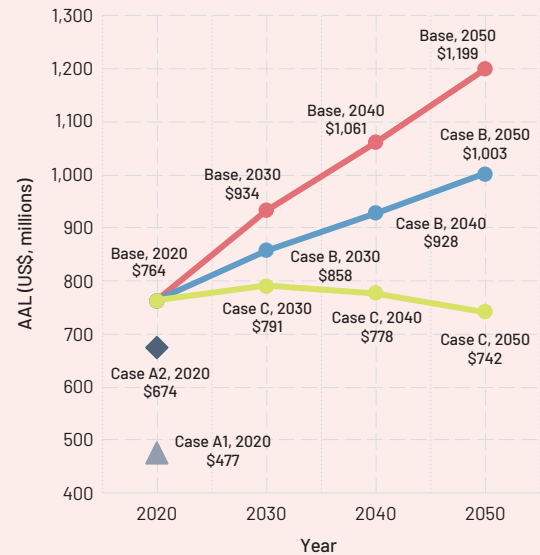
Earthquakes will continue to pose a considerable threat to Türkiye's economic development. Located in a complex collision zone between plates, Türkiye will continue to be prone to earthquakes. In 2020, the average annual economic loss (AAL)^a for the Turkish building stock (**figure 6.5**, Base 2020)—including damage to structural and nonstructural elements and building contents—was estimated at US\$762.5 million (April 2020), representing about 0.146 percent of the country's GDP and about 0.074 percent of the building stock's total replacement value. Residential buildings contribute most to national risk (US\$620.2 million), followed by commercial buildings (US\$71.6 million), industrial buildings (US\$29.6 million), educational institutions (US\$6 million), and health buildings (US\$1.6 million). Most of the AAL (US\$630.2 million of US\$762.5 million, or 82 percent) comes from the building stock of Türkiye's highly urbanized metropolitan districts. In absolute terms, the housing stock built between 1990 and 2000 has the highest value (US\$223.4 million), followed by the 1980–89 stock (US\$169.1 million). The average number of annual deaths is 219.

Türkiye has regularly updated its building code to mitigate the effects of earthquakes, but until the 1999 earthquake, only a portion of existing buildings complied with it (Ilki and Celep 2012). The Turkish Seismic Design Code has been updated seven times since it was established in 1940, most recently in 2018/19 (Sucuoglu 2018; Atmaca et al. 2019). But only a portion of existing buildings followed the seismic design code until the 1999 earthquake, a milestone in terms of public awareness, which deeply affected the public and builders in terms of potential threats to human lives and the economy.

Retrofitting pre-2000 buildings has the greatest potential to improve Türkiye's resilience. Upgrading buildings constructed before 2000 to the latest seismic design standards, would decrease the AAL of the 2020 Turkish building stock by about 38 percent, for a total of US\$477 million (**figure 6.5**, Case A1, 2020). Retrofitting only post-2000 buildings would reduce AAL more moderately by almost 12 percent, for a total of US\$674 million (**figure 6.5**, Case A2, 2020). The literature suggests a range of 0–3 percent of the incremental cost to implement a more ambitious building code for new buildings (Multi-Hazard Mitigation Council 2019). Much of the literature estimates the cost of retrofitting at 7 percent, but it could be as high

FIGURE 6.5 >>

Risk trajectory for Türkiye's national-level AAL under three scenarios



Source: Based on Rao et al. 2022

Notes: Base, 2020 represents the AAL of existing buildings in 2020; Case A1 (Case A2) estimates the AAL when pre-2020 (post-2020) buildings are adapted to the 2019 seismic building design. Base (Case B) represent the AAL when all new buildings do not adhere (do adhere) to the 2019 design code. Case C represents the scenario where the 2019 code for new buildings is applied and 10, 25 and 50% of the pre-2020 building stock is retrofitted in 2030, 2040, and 2050, respectively, targeting buildings with the highest AAL potential.

as 11.5 percent when combined with a 50 percent reduction in overall thermal energy consumption (Bournas 2018).

Enforcing the 2019 building seismic design code for all new construction after 2020 would result in a significant decrease in the projected risk trajectory. Simulations suggest that by 2050, in a scenario where all buildings constructed after 2020 are aligned with the 2019 seismic building design code, the AAL would be US\$1,003 million (**figure 6.5**, Case B, 2050). Enforcing this code would reduce the AAL by 17 percent compared to a scenario without implementation, in which the AAL would be US\$1,199 million (**figure 6.5**, Base, 2050).

Resilience can be further enhanced through proactive retrofit objectives. Retrofitting 10, 25, and 50 percent retrofit of the pre-2020 building stock in 2030, 2040, and 2050 respectively, while also targeting buildings with the highest AAL can significantly improve the resilience of Turkish buildings. For 2020–50, this strategy would keep AAL below US\$800 million (**figure 6.5**, Case C) in a steadily growing building stock. This combined implementation and retrofitting strategy would increase the resilience of the Turkish building stock in terms of AAL by 38 percent in 2050.

^a AAL is calculated using the sum of the multiplication of the exposure (damage when an earthquake occurs) by the annualized frequency (probability of earthquake occurrence per year) for each earthquake intensity.

●● Priority Action 3.3 >>

Revise urban and land use plans to make them risk-informed

INDICATORS >>

●●● Institutional and regulatory framework for urban and land use planning ⁽ⁱⁱ⁾

●● Identifying areas that are at risk ⁽ⁱⁱ⁾

●● Number of qualified planners per capita ⁽ⁱⁱⁱ⁾

●● Quality of urban plans ⁽ⁱⁱⁱ⁾

●●● Financing for implementing urban plans ⁽ⁱⁱⁱ⁾

Risk-informed urban and land use planning in Türkiye can be further supported by strengthening the related institutional and regulatory framework. Mainstreaming climate and disaster hazards and risks into planning is well defined for urban areas in the MoEUC's Urban Development Strategy (KENTGES, in Turkish acronym) (MoEU 2010). However, Law No3194 on Land Development Planning and Control has yet to be updated to integrate climate change and disaster resilience. KENTGES implementation can be further strengthened by increasing efforts to identify areas at risk of various hazard impacts, improving the technical capacity of registered urban planners to integrate disaster risk considerations in their activities (although Türkiye has a high number of urban planners per capita, there is no formal certification program to help identify those with DRM qualifications), and securing the incremental financing needed for implementing disaster risk mitigation measures in urban settings, as these may often exceed available public budgets for executing urban development plans in the absence of public-private partnerships (PPPs). While Türkiye has made progress in identifying buildings at risk of flooding in creek beds and suitable reserve areas for new settlements, disaster risk considerations are often absent from municipal planning processes or included but without sufficient community engagement (World Bank, forthcoming). The range of hazards considered in land use and urban planning needs to be expanded, more broadly communicated to inform new public and private investments and risk mitigation decisions. With high levels of urbanization and increasing exposure to climate hazards, there is good potential for the Turkish population to benefit from such progress.

●● Priority Action 3.4 >>

Increase the resilience of the agriculture sector and ensure food security

INDICATORS >>

●●● Food vulnerability ⁽ⁱ⁾

●● Climate-smart agriculture strategy ⁽ⁱⁱ⁾

●● Agriculture early warning systems ⁽ⁱⁱ⁾

●●● Agriculture insurance ⁽ⁱⁱ⁾

●● Ex-post assessment of drought impacts ⁽ⁱⁱ⁾

●● Public agricultural research expenditure ⁽ⁱⁱ⁾

●● Agricultural land irrigated ⁽ⁱ⁾

As Türkiye's food production systems are highly vulnerable to climate change, a comprehensive strategic and coordinated approach to adaptation is needed across the sector. Türkiye scores 0.34 in the Notre Dame Global Adaptation Initiative (ND-GAIN)³⁵ food vulnerability score, which captures the vulnerability of the country's food production, demand, nutrition, and population

35 <https://gain.nd.edu>.

to climate change. This score places Türkiye's food production systems among the most vulnerable in OECD countries, which average 0.26 (*figure 6.6*).³⁶ In view of Turkish agriculture's high exposure to climate hazards, adaptation to climate change is a priority in both the National CCAP (2011–23) and National Climate Change Adaptation Strategy and Action Plan (2011–23). But the sector has yet to develop a comprehensive climate change adaptation strategy, including for mainstreaming CSA at the local level, despite the benefits for buffering the effects of climate variability and climate change on agricultural production, and the improvements it could bring to coordinating, implementing, and monitoring mitigation and adaptation actions across the sector (*box 6.2*). An overarching vision for climate adaptation and resilience in the agriculture sector would ensure that the different DRM planning frameworks are aligned with policy objectives, measures are streamlined, and stakeholder roles and responsibilities are well identified (Bagherzadeh and Shigemitsu 2021).

The MoAF's General Directorate of Water Management has made progress in developing basin-level drought management plans for all water user sectors—including agriculture—to plan and direct recovery, intervention, and other efforts before, during and after a drought. As of 2022, plans have been prepared for 10 of Türkiye's water basins, and all 25 basins are expected to be covered by the end of 2023. However, these drought management plans and EWS have yet to become fully operational to support risk reduction and decision making at farm level. The National Strategy and Action Plan for Combating Agricultural Drought, implemented through Provincial Drought Action Plans, aims to expand the use of risk assessments and drought mitigation measures, including irrigation. Since 2015, efforts to generate information for crop and yield forecasting and deliver it to farmers have been implemented through the agriculture monitoring and information system (TARBIL, in Turkish acronym). This system is being improved through approaches for delivering tailored climate services for the sector, including early warning and irrigation management information, which are currently being piloted (MoEUCC 2018b). These are promising developments, as a fully operating TARBIL, alongside improved price forecasting systems, could offer key information to different actors in agricultural value chains for reducing the impacts of meteorological and other external shocks.

There is a strong commitment toward advancing R&D in agriculture, including for adaptation, but public investment and collaboration with the private sector remain at emerging stages. The Agricultural Research Master Plan (2016–20) includes actions related to adaptation and the assessing climate impacts on agriculture. But during 2017–19, overall R&D in the sector only reached about 5 percent of the total General Service Support Estimate (the annual monetary value of gross transfers to services provided collectively to agriculture). This is well below the spending of many OECD countries. To obtain tangible results, further avenues for collaboration with the private sector and an increase in the public budget allocated to R&D are warranted.

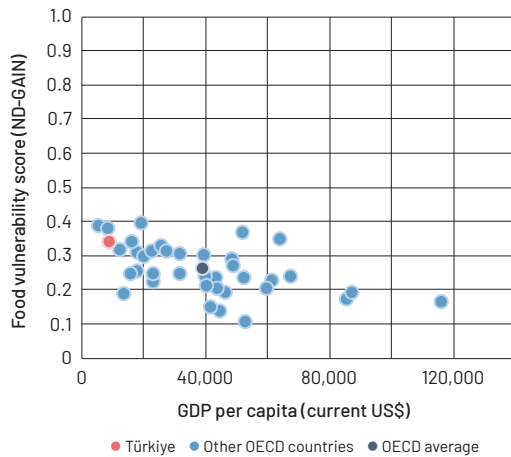
An effective agricultural insurance system is in place and increasingly adopted by farmers, protecting them against climate variability, climate change, and other natural hazards. The Agricultural Insurance Pool (TARSIM, in Turkish acronym), established in 2005, offers a variety of products to mitigate the financial impacts of natural hazards on agriculture. TARSIM is built on a public-private joint initiative, with the government covering 50 to 70 percent of the total insurance premium (Frankfurt School of Finance & Management 2018). In 2019, there were more than 2.5 million active policies, insuring over TL 124.3 billion. TARSIM payments to farmers for production losses have also increased in the past years, from TL 841 million in 2016 to TL 2.5 billion in 2021 (TARSIM 2019, 2022), protecting the well-being of farmers from climate extremes and other hazards and supporting their recovery after impacts.

³⁶ In 2019, Türkiye also ranked 41st among 113 countries in the Global Food Security Index (<http://foodsecurityindex.eiu.com>) which considers food affordability, availability, quality, and safety, natural resources, and resilience. However, it descended to the 48th place in 2021, performing particularly low on food affordability.

Türkiye has made major investments in irrigation that are critical for building resilience against climate variability, but improvements in the efficiency of irrigation systems are still needed. More than a quarter (26 percent) of arable land in Türkiye is equipped for irrigation (over 60,000 square kilometers), slightly more than the OECD average of 25.3 percent (FAOSTAT; World Bank 2020b). Although efforts have been made to modernize irrigation systems—for example, by expanding piped irrigation from 6 percent of the irrigated area in 2003 to 29 percent in 2020—they are often fragmented, inefficient, and outdated, with the total area equipped for irrigation that is actually irrigated stagnating at 52,800 square kilometers since 2008 (FAOSTAT). Improving their condition is a high priority, given that irrigation uses approximately 77 percent of available water in an already water-stressed country and the demand for freshwater is rising (*figure 6.7*). Under the most pessimistic climate change scenario, water demand could exceed water availability by 2030 (MoEU 2016). Irrigated agriculture is the most affected sector, which has particularly bad implications for the 2.5 percent of the population that faces severe food insecurity.³⁷

FIGURE 6.6 >>

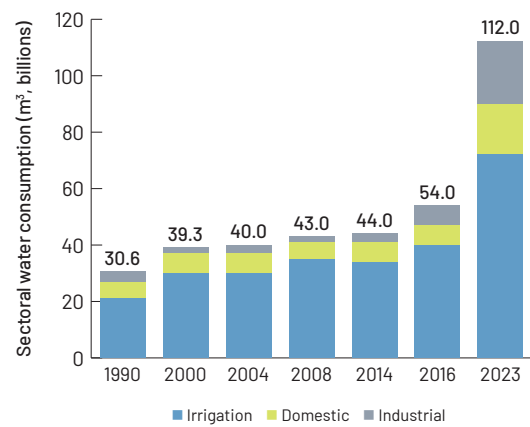
Food vulnerability score (2019)



Source: ND-GAIN

FIGURE 6.7 >>

Freshwater consumption in Türkiye, by sector (observed and projected values)



Source: MoEU 2016

37 Global Food Security Index (GFSI). <http://foodsecurityindex.eiu.com/>.

Adaptation and resilience in Türkiye's agriculture



Agriculture plays an important role in Türkiye's economy but is vulnerable to a range of climate-related risks. The agriculture sector accounted for about 6.7 percent of GDP in 2020, employed 18 percent of the workforce, and made up more than 10 percent of total exports (including food, beverage, and tobacco manufacturing). About 55 percent of Türkiye's land area is used for agriculture, and the sector is the country's largest water user, accounting for more than 85 percent of total freshwater abstractions, compared with the OECD average of 42 percent (OECD 2020). Türkiye is exposed to a range of natural hazards, including floods, drought, frost, avalanche, forest fire, desertification, earthquakes, and landslides. Of these, drought and storms have severe impacts on the agricultural sector. For example, the 2007–08 drought led to sectoral losses of US\$1.4–2.2 billion (Bagherzadeh and Shigemitsu 2021). Limited annual rainfall (574 millimeters)—below the OECD average and compounded by the uneven distribution of precipitation across time and space—causes more intense and frequent droughts in the central, southern, and southeastern regions (Santos et al. 2016), while floods and landslides are more prominent in other parts of the country. In the mid-to-long term, climate change patterns and associated water stress are expected to significantly impact agricultural yields and the viability of producing certain crops (particularly water-intensive ones) in specific regions, posing a major threat to Türkiye's farmers (Dudu and Çakmak 2018).

The agriculture sector's vulnerability to climate change can exacerbate food price pressures and overall food security concerns resulting from limited affordability (Frankfurt School of Finance & Management 2018). In recent years, Türkiye has experienced severe droughts: 2020 was the driest in the previous five years, and 2021 saw the warmest months in the past half-century.

This has driven groundwater levels across the country to the lowest percentiles, affecting crop production (Patel 2021). With rising temperatures and extreme weather events, land degradation through topsoil erosion is also a serious threat to the sector. Water erosion has displaced 642 million tons of soil in Türkiye (ÇEM 2018), leading to high risk of land degradation and desertification across one-third of the country's territory (Uzuner and Dengiz 2020). Similarly, organic matter, which regulates soil structure and the nutrient and water absorption capacity of the soils, is also sensitive to rising temperatures and precipitation, and its depletion can significantly reduce agricultural productivity. Constrained by acute water stress, compromised soil quality, and severe storms in some regions, Türkiye exhibits a higher food vulnerability compared to the OECD average.

Extreme weather events and exposure to increased temperatures can also adversely affect animal and plant health, resulting in increased propensity for disease incidence. Climate-related events can create even more favorable conditions for the emergence of existing and introduction of new plant diseases and infectious and/or vector-borne animal diseases and zoonoses. Türkiye has experienced recent outbreaks including 997 outbreaks of *peste des petits ruminants* between 1999 and 2018 and 180 outbreaks of lumpy skin disease in 2019 and 5 in 2020 (EFSA Panel on Animal Health and Welfare 2015). Other animal diseases prevalent in the country include brucellosis, which affects around 1.43 percent of the animal population, tuberculosis, and foot-and-mouth disease. Overall, these diseases cause significant economic losses in the Turkish livestock sector and can represent important risks to human health.

The effects of climate change on Türkiye's agriculture are

compounded by the sector's complex social characteristics, requiring strong institutional and cross-sectoral coordination. Millions of farmers face difficulties in sustaining their livelihoods due to a lack of capacity to manage climate risks as well as insufficient infrastructure and institutional support. There is a lack of awareness and knowledge on adaptation to climate change in agriculture among public agencies, financial institutions, and farmers' organizations. This leads to insufficient demand in developing tailored financing instruments for climate-smart solutions or mainstreaming innovative adaptation strategies in the sector. Deep regional income disparities and social divides further hinder access to skilled labor in rural areas, constraining the dissemination of resilient technology and innovation, while a high degree of farm fragmentation^a poses a substantial challenge to farm infrastructure investments such as large-scale pressurized irrigation. Deeper stakeholder engagement with farmers (including smallholders) is needed to enhance their capacity to prevent, prepare for, and respond to climate-related challenges, to minimize their impacts on farmers, supply chain actors, and consumers. Institutionally, Türkiye's agricultural DRM framework for droughts—including the Strategy for Combatting Agricultural Drought and Action Plan—falls mostly under the general directorates of the Ministry of Agriculture and Forestry (MoAF). While multiple policy frameworks are in place for drought governance, including disaster response plans, five-year development plans, CCAPs, agriculture and water policy frameworks, responsibilities among relevant agencies remain to be further clarified and coordinated in an integrated manner. Recent institutional changes have attached the DSI and the General Directorate for Water Management (SYGM, in Turkish acronym) to the MoAF, strengthening the ministry's

^a The average farm in Türkiye occupies 5.9 hectares (2001 census data), compared with 12 hectares in the EU and 180 hectares in the United States. The mid-point of total land distribution (50%-50% benchmark) falls within the same farm-size class (10–20 hectares).



capacity to secure water resources for agriculture in the face of climate uncertainty.

Building climate resilience in the agriculture sector against drought and other natural hazards is a key adaptation challenge for Türkiye. Climate change impacts on the agriculture sector are expected to exacerbate in the coming decades, requiring improved risk management, planning, and adaptive innovation. A set of priority actions to reduce vulnerability to, transfer, and cope with climate-related risks are at the core of effective adaptation strategies in the agriculture sector. Türkiye has identified agriculture as a core priority in its National Climate Change Adaptation Strategy and Action Plan (2011–23) and has been investing in building adaptation through, for example, R&D efforts on drought-and-disease tolerant plant varieties, EWS, supporting improved agricultural practices, and expanding protected agriculture, yet these efforts would need to be scaled up in the years ahead, as climate-related challenges intensify. The Agricultural Insurance Pool TARSIM is a strategic risk-transfer instrument established in 2005 to compensate and minimize farmers' financial losses due to climate and other natural risks, with more than US\$14 billion insured in 2021 (TARSIM 2022). It provides subsidized insurance services for crops, greenhouses, cattle, sheep and goats, beehives, aquaculture, and poultry and has seen a significant increase in compensation levels paid to farmers against losses. Still, there is potential to improve stakeholders' access to farm loss data, which are limited to use by policymakers and insurers (Bagherzadeh and Shigemitsu 2021). Improved private sector access to ex-post and ex-ante risk-related data can increase awareness of climate vulnerability

in the agriculture sector and inform investments in risk transfer mechanism design. For example, the Next Generation Drought Index, a new global platform spearheaded by the World Bank, provides early and high-quality drought risk information that can be used to assess the expected impacts of an unfolding drought event early on, helping establish a timely response and facilitating the development of multiple instruments for drought-risk reduction (World Bank 2022).

Protecting soil health by adopting sustainable soil and land management practices is essential for strengthening adaptation, agricultural productivity, and food security. Conservation and better soil and land management has emerged as a key priority for climate change adaptation and mitigation both globally^b and in Türkiye, where the government has taken important regulatory actions to address issues of soil and land degradation^c and implemented grant schemes for farmers to encourage soil conservation and good agricultural practices such as organic agriculture. Further enhancing institutional capacities to provide key services such as laboratory-based animal and plant disease surveillance and diagnosis, strengthening land and water information systems, enhancing understanding of the impacts of climate change on agriculture at local levels, and identifying tailored solutions anchored in strong R&D efforts and institutional innovation will be key to enhancing agricultural planning and effective land use, including approaches to encourage the production of crops with low water needs in water-restricted regions. Coping with climate change through social safety nets and food reserves, among others, are other complementary measures to help farmers and rural villagers overcome the impacts of a changing

climate, while building resilience and adaptive capacity.

CSA can facilitate a triple-win for sustainable agriculture development, climate change adaptation, and GHG emission reductions in Türkiye. CSA is an integrated approach to managing landscapes—cropland, livestock, forests, and fisheries—that addresses the interlinked challenges of food security and accelerating climate change (World Bank 2021a). CSA aims to simultaneously achieve three outcomes: enhanced resilience, increased productivity, and reduced GHG emissions. Examples of CSA range from traditional practices, such as organic farming, to NbS, such as conservation agriculture and ecosystem-based approaches to production, and modern technologies. These include alternate wetting and drying, which can minimize energy and water use while improving crop yields, and precision agriculture, which applies digital technologies for improved decision-making in crop and livestock production based on real-time data, and can therefore effectively respond to climate risks and emergencies, contributing to enhanced crop production and efficient input use. Protected agriculture simultaneously increases adaptation and productivity, while generating important input-use efficiencies. Investments in expanding and modernizing irrigation systems and effective water use and storage are top priority triple-win solutions for scaling up adaptation in the Turkish agricultural sector. Recent International Finance Corporation estimates suggest that investing in CSA in four emerging economies in Europe, including Türkiye, could generate an US\$80 billion market while reducing 15.1 million tons of GHG emissions and generating 2.5 million jobs (IFC 2021).

^b For example, in November 2021, the EU launched the EU Soil Strategy for 2030, *Reaping the benefits of healthy soils for people, food, nature and climate*.

^c Law No5403 on Soil Preservation and Land Utilization, issued in 2005, sets the rules and principles for determining land and soil resources and their classification, preparing land use plans, preventing non-purpose use, and establishing the requirements to ensure land and soil preservation.

●● Priority Action 3.5 >>

Increase the resilience of water infrastructure and water resource management (WRM)

INDICATORS >>

●● WRM strategy incorporating climate change considerations⁽ⁱⁱ⁾

●●● Dedicated WRM agencies⁽ⁱⁱ⁾

●● National water information system (NWIS)⁽ⁱⁱ⁾

●●● Water productivity⁽ⁱⁱ⁾

●●● Untreated water discharge⁽ⁱⁱ⁾

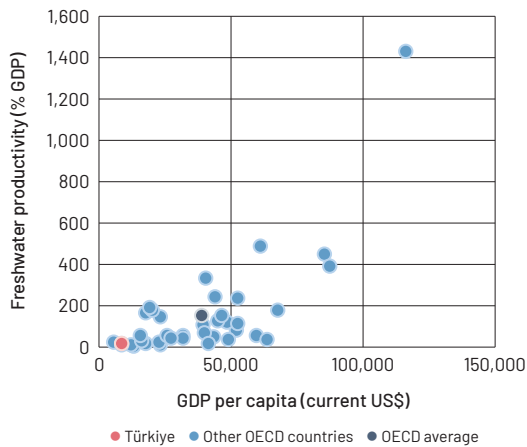
The General Directorate of Water Management is progressively developing climate change-informed WRM plans in Türkiye, has already assessed potential climate change impacts on surface and groundwater for its 25 river basins and identified adaptation measures, and has developed drought, flood management, and sectoral water allocation plans for several basins. The prospects for implementing these and other plans that are under development are promising, as Türkiye has a good WRM governance system, with competent agencies and the technical capacity to analyze and monitor climate risks to guide adaptation processes in WRM (box 6.3). The National Watershed Management Strategy (2014–23) and National Water Plan (2019–23), prepared by the General Directorate of Water Management, provide an overarching WRM strategy that integrates the results of the WRM plans, including climate change considerations, with responsible institutions intended to implement the actions included therein. However, Türkiye’s WRM governance framework remains somewhat fragmented, with a number of administrative and legislative shortcomings that limit efficiency in core functions. There is a need for further review and strengthening of the governance framework to improve efficiency and effectiveness, by completing sector reforms, including enacting the Draft Water Law, which has been pending parliamentary approval since 2016.

Türkiye has also advanced the development of an NWIS with multiple modules that capture data and information on, among other things, water quality and quantity, allocations, loss and leakage, natural disasters, and climate change (World Bank 2020b). The participation of all institutions relevant to WRM in sharing and uploading their georeferenced information in the NWIS and granting public access to these data and information would contribute to the system’s long-term sustainability and use in development, adaptation, and resilience interventions. A pilot project in Gaziantep Province, “Preparation of Drinking and Potable Water Safety Plan from Source to Tap”, will also serve as a guide across the country for municipalities and local water administrations to undertake risk management and emergency action plans, including climate change projections.

Addressing declining water quantity and quality is essential for reducing the vulnerability of the country’s scarce water resources to economic pressures and climate change. Water security for high-value economic sectors in Türkiye is already low, as indicated by a Water Productivity Index of US\$20 per cubic meter, much lower than the OECD average of US\$156.4 (figure 6.8). Türkiye’s available freshwater per capita is only half the global average (World Bank Group 2022) and is expected to drop further with population growth and climate change (figure 6.9). Securing water availability for agriculture, industrial processes, services (including energy provision and tourism), and households under current water allocation regimes is a major adaptation challenge, which is compounded by water quality issues. One-third of Türkiye’s rivers suffer from pollution from land sources (domestic, industrial, and agricultural), particularly phosphorus and nitrate contamination, which can enhance the eutrophication of freshwater bodies as temperature rises (MoEUCC 2018a; World Bank 2020b). Groundwater salinization, due to over-extraction and sea level rise, is also

FIGURE 6.8 >>

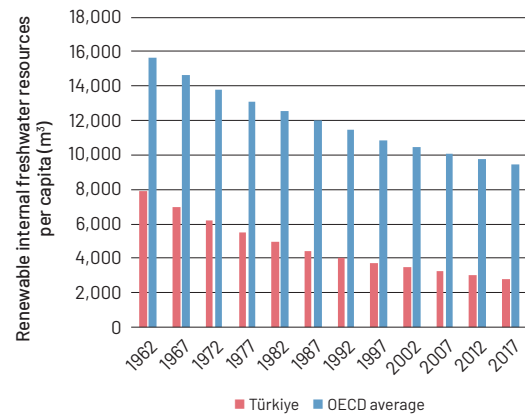
Water Productivity Index rankings (2016)



Source: World Development Indicators

FIGURE 6.9 >>

Renewable freshwater resources per capita in Türkiye (1965–2017)



Source: World Development Indicators

BOX 6.3 >> DEEP DIVE 3

Water management challenges and A&R opportunities in Türkiye



Water is an important natural capital for Türkiye but is under increasing stress. Türkiye is experiencing local and regional water shortages due to significant population increase, spatial and temporal heterogeneity, and increasing water use in development sectors. The country relies heavily on its internal water resources (227 square kilometers per year) and suffers from freshwater scarcity—holding only half of the global average freshwater resources per capita. More than half of its river basins are under water stress. Some of its more populated cities, such as Istanbul, have less than 500 cubic meters of freshwater access per year for each of its millions of inhabitants. Türkiye is ranked 78th among 147 countries in the Water Scarcity Index, which indicates a low performance in water resource storage and water quality (Çapar 2019). Climate change will exacerbate existing water scarcity conditions, with a significant water deficit expected in all sectors in the next decade (figure 6.10), especially in urban areas, agriculture, and industry. This deficit will also represent major costs to the Turkish economy: a World Bank assessment has been estimated that a 10 percent reduction in water supply due to climate change could cost Türkiye

6 percent of GDP and about US\$50 billion in monetary losses (Taheripour et al. 2020). Although the study only considers climate change impacts on the agriculture sector, the economic impacts of growing water scarcity are significant and will deepen. Negative impacts are also likely in other key sectors, such as energy—as water is needed for cooling and hydropower production—and industry.

Floods and drought remain and will continue to represent considerable threats to Türkiye's economic development, even in the most optimistic climate scenario. Potential drying associated with rising temperatures, changes in precipitation patterns, and reduced seasonal snow storage represents significant risks for Türkiye's development. Drought and excessive water abstraction has already resulted in various wetlands and lakes drying, with major socioeconomic and environmental consequences. Almost half of Türkiye's famous salt lakes—including Lake Tuz (Hansen 2021), Ereğli Marshes, and Bafa Lake—have dried out and are transforming into salt basins. The depth of Beyşehir Lake, Türkiye's largest

freshwater lake, has gone from 24 meters 25 years ago and to less than 9 meters today (FAO 2017). Turkish shorelines, particularly in the Central and Eastern Black Sea, the Northern Aegean Sea, and Eastern Mediterranean, are negatively affected by flooding, coastal erosion, and seawater intrusion (UNDP 2022a). According to a 2016 climate change assessment, water resources are expected to decrease from the currently estimated 112 billion to about 86 billion cubic meters by 2050 in an optimistic climate scenario (MoAF 2016b). Considering its crucial role in food security, green energy, tourism, and industry, water is among the key resources that could become a binding constraint for green growth in Türkiye.

The combined effects of climate change and marine pollution pose significant risks for the quality of Türkiye's freshwater resources. Approximately 15 percent of Türkiye's residential wastewater is discharged untreated or partially treated, and about 40 percent of industrial wastewater (excluding cooling water) is discharged untreated into natural water bodies. Water quality was the most

BOX 6.3 >> DEEP DIVE 3 CONTINUED

important environmental problem for more than a third of the cities assessed in 2018 by the MoEUCC (MoEUCC 2018a). One-third of Türkiye's lakes and about half of its rivers are considered "contaminated" or "highly contaminated" by phosphorus and nitrogen. Municipal wastewater with excessive nutrients from fertilizer, human and animal waste, and other sources pollutes freshwater, emits carbon dioxide via the biological breakdown of organic matter, and depletes oxygen from open waters. Higher temperatures further increase the possibility of harmful algae blooms, which impact aquatic life and the self-remediation ability of freshwater ecosystems, including wetlands. The degradation of these ecosystems further impacts biodiversity and other essential ecosystem services, such as weather regulation, flood mitigation, and recreational services. The recent Marmara Sea mucilage outbreak is a striking example of the combined effects of climate change and low water quality and their potential to damage the fisheries, tourism, and health sectors.^a

Türkiye has made progress in strengthening climate resilience for WRM, but trade-offs persist regarding impacts on ecosystems, local communities, and carbon emissions. The government has assessed the impacts of climate change on the groundwater and surface waters of Türkiye's 25 river basins and identified adaptation activities (MoAF 2016b). It has also conducted vulnerability assessments

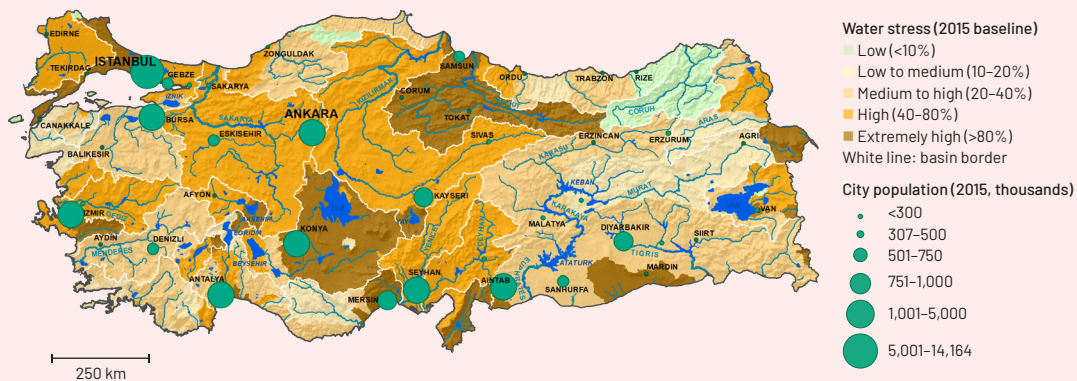
and modelling and is considering and integrating climate adaptation into river basin management plans, drought management plans, flood management plans, and sectoral water allocation plans (MoEUCC 2018b). But it should also consider other socioecological impacts of water infrastructure interventions—for example, although building dams and reservoirs may bring adaptive benefits, if not carefully designed, they can also have negative impacts on local residents and ecosystems (OECD 2017). Through the *Adaptation to Climate Change in Water Resources* project, the General Directorate of Water Management expects to reveal the actual costs and benefits of rainwater harvesting, gray water use and water pricing activities, and share the results with all metropolitan cities. However, at basin level, more comprehensive risk assessments and stakeholder engagement are needed to identify synergies and trade-offs across basin management and related plans (Hommes et al. 2016). Despite their socioeconomic value, water-related services (including water supply and wastewater treatment) are energy-intensive—for example, though pumping and irrigation—which increases GHG emissions. Low performing water service delivery, including outdated infrastructure, leads to low water productivity (US\$20 per cubic meter, compared to an OECD average of US\$156.4). More research is needed to bridge the water productivity gap and identify enhanced management solutions.

Institutional arrangements to ensure effective water governance and climate resilience can be strengthened through improved cross-sectoral collaboration and stakeholder engagement. Opportunities for climate change adaptation in the water sector include increasing water-energy use efficiency, promoting circular economy approaches, modernizing aging hydraulic infrastructure, adopting NbS, and harnessing water energy innovations (World Bank Group 2022). Implementing these strategies can generate co-benefits for food security, climate change mitigation, DRM, ecosystem health, and sustainable development, but requires concerted coordination among and enhanced institutional capacity of management agencies with varied water management mandates. Two dedicated WRM agencies are in place and operational within the MoAF: the DSI, in charge of operational investments in the water sector, and the SYGM, in charge of WRM and policy across water subsectors and impact assessment (MoEU 2011; World Bank 2020b). Each metropolitan municipality also has a general directorate of water and wastewater administration (SKI, in Turkish acronym) to manage water supply and sanitation services. Better coordination across government levels and agencies and deeper engagement of multiple stakeholders in decision making will be key for fulfilling the potential of water governance for climate-resilient development.

^a *Climate Change 'Sea Snot' Killing Türkiye's Marmara Sea*. News article available at: <https://www.aljazeera.com>.

FIGURE 6.10 >>
Water stress across Türkiye (2015–40)

a. Water stress baseline with population (2015)





b. Projected water stress under a business as usual scenario (2040)



c. Difference in water stress between 2015 and 2040



Source: WRI Aqueduct Global Water Risk Mapping Tool

Note: Water stress estimates were calculated using the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use.

a latent risk for coastal aquifers. Reducing the vulnerability of scarce water resources in Türkiye is therefore urgent and depends on improving water use efficiency and other aspects of WRM at the sectoral level as well as on proactive and effective control of freshwater pollution from land sources. Aware of this situation, the government of Türkiye has engaged in extensive research to improve water usage efficiency and raise the water productivity index and enacted legal provisions to prevent water losses in the water supply network infrastructure and in agricultural irrigation; it is also conducting sector-based studies on water efficiency in industrial facilities.³⁸

38 <https://www.tarimorman.gov.tr/SYGM/Link/13/Su-Verimlilik>.

●● Priority Action 3.6 >>

Increase the resilience of the health system

INDICATORS >>

●● International Health Regulations (IHR) average score⁽ⁱ⁾

●●● Health expenditure as percent of GDP⁽ⁱⁱ⁾

●●● Health sector emergency response plan⁽ⁱⁱⁱ⁾

●●● Health risk communication^(iv)

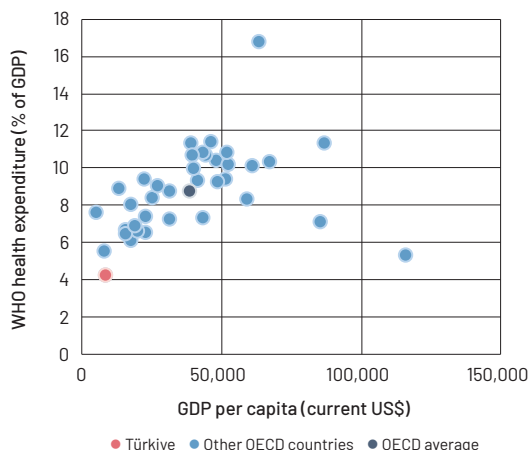
●●● Surge demand health capacity^(v)

●●● Medical countermeasures stockpiles^(vi)

Strengthening Türkiye's health system with enhanced national investments to improve health care access and quality and to better cope with surge demand during emergencies can enhance its preparedness for the increasing frequency of natural disasters, including pandemics. The World Health Organization's (WHO) global health expenditure database shows that, between 2015 and 2019, Türkiye invested an average of 4.2 percent of its GDP per year on health care, compared to an OECD average of 8.8 percent (*figure 6.11*). This lower level of health system investment also impacts access and quality of health care: the global Healthcare Access and Quality Index shows that Türkiye ranks low among OECD countries (Fullman et al. 2018). It is, however, making progress in other areas of its health system. It ranks in the middle tercile of OECD countries in the WHO International Health Regulations (IHR) score, with a score of 88 compared with an average of 83 across the OECD³⁹ (*figure 6.12*). The IHR⁴⁰ provides a measure of national performance on 13 capacities needed to detect, assess, notify, report, and respond to public health risk and acute events of domestic and international concern. The Ministry of Health (MoH) has developed a national health sector emergency response plan, the Hospital Disaster and Emergency Response Plan Preparation Guide (MoH 2021), and benefits from excellent health risk communication mechanisms, with an IHR score of 80, compared with the OECD average of 71.5. It has good medical countermeasures stockpiles—including vaccines, therapeutics, and diagnostics—and mechanisms for procuring and distributing them.⁴¹ However, there is still space for Türkiye to

FIGURE 6.11 >>

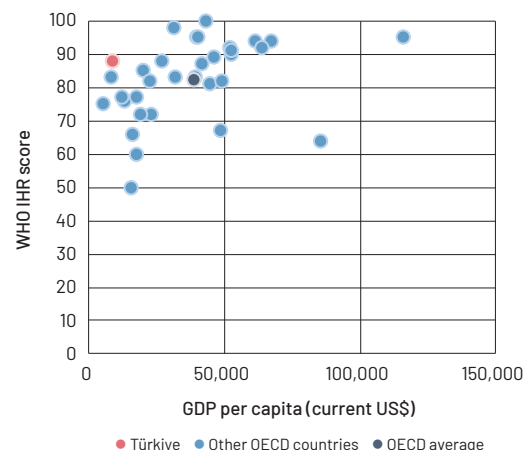
WHO Global Health Expenditure Database (2015–19)



Source: WHO IHR

FIGURE 6.12 >>

WHO IHR average scores (2020)



Source: WHO IHR

39 This score is the average for all 13 capacities included in the State Party Self-Assessment Annual Reporting Tool (SPAR).

40 <https://www.who.int/westernpacific/health-topics/international-health-regulations>.

41 <https://extranet.who.int/e-spar>.

increase the number of health workers to meet surge demand in emergency situations and further strengthen the provision of timely health services during and after disasters. While the WHO recommends 4.45 doctors, nurses, and midwives per 1,000 population for routine services plus a 30 percent surge capacity and one field epidemiologist per 200,000 people, Türkiye only has 1.9 doctors and 2.4 nurses per 1,000 inhabitants (2019). This is one of the lowest among OECD countries.⁴² Strengthening the health care workforce can reduce the vulnerability of people and health system operations to a rapidly increasing frequency of health emergencies under climate change. These may be caused by slow-onset events, such as drought effects on nutrition and increasing vector-borne disease, or sudden hazard impacts, including floods and heatwaves. Evidence shows, for example, that in Antalya, people with congestive heart failure are admitted to the emergency services more frequently in hot months (MoEUC 2018b).

●● Priority Action 3.7 >>

Increase the resilience of the education system

INDICATORS >>

●● Disaster-proof schools⁽ⁱ⁾

●● Operational standards for use of schools as shelters⁽ⁱⁱ⁾

●●● Safe and continued learning environment⁽ⁱⁱⁱ⁾

●●● Resources to enable remote learning⁽ⁱ⁾

●●● A&R included in the education curriculum⁽ⁱⁱⁱ⁾

Assessing disaster risks and retrofitting school buildings will enable their use as emergency shelters. AFAD has set clear standards for emergency shelter operation and access (AFAD 2022). But the majority of public school buildings still need to be assessed against disaster risks to reduce the vulnerability of children and school staff to earthquakes and other hazard impacts while at school, and enable the use of these buildings as safe emergency shelters in the aftermath of disasters (UNISDR 2015b). To advance in this area, the MoNE has established safety precautions criteria for school inspections. These include criteria for fire, earthquakes and other natural hazards, as well as criteria to increase the access of persons under temporary protection (asylum seekers and refugees) to educational opportunities. Nevertheless, risk assessments and the implementation of corresponding retrofitting measures are urgently needed to enable AFAD and the MoNE to place new shelters in all schools. These interventions will provide vulnerable people with safe places and the necessary basic resources to survive hazard impacts.

Measures to ensure minimum educational disruptions due to disasters are in place but ICT skills and low access to home computers do not allow all students to fully tap into the potential offered by the government's online education services. The MoNE has initiated necessary interventions for increasing the resilience of school buildings and maintaining continuity of education during emergencies and in disaster zones. During the COVID-19 pandemic, public schools used the distance education services provided by the Digital Education System, including lessons delivered through television and mobile and computer technology for students with access (World Bank 2021d). But only 50 percent of Turkish households have access to a computer, compared with the OECD average of 80 percent (*figure 6.13*) and only 7.5 percent of teachers have good ICT skills, compared to the OECD average of 17.7 percent, which are crucial for remote teaching. Therefore, the digital divide acts as a barrier to education continuity during emergencies.⁴³

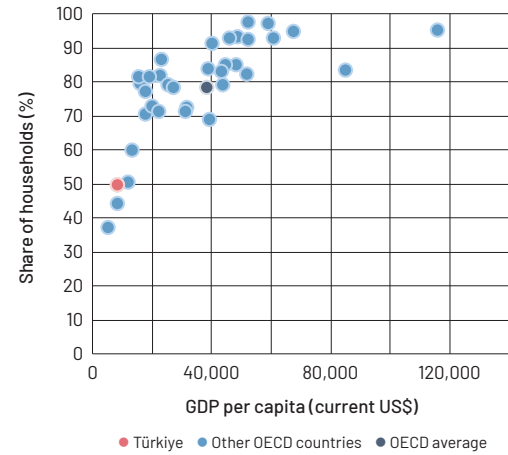
⁴² OECD Data. <http://data.oecd.org>.

⁴³ Due to lack of more recent information, the analysis is based on 2017 data. It is recognized that more recent data would better reflect the progress Türkiye has made in this aspect through and after the COVID-19 pandemic.

Türkiye is making efforts to educate teachers and students on basic climate and disaster awareness concepts, but there is no age-specific climate change and DRM curriculum. Several climate awareness programs have been developed at national and state level, such as the Global Climate Change Mitigation Course that is delivered in public education centers. Within the scope of the Disaster Ready School project, the TSMS, MoNE, and AFAD trained more than 50,000 teachers in basic disaster awareness concepts in 2019 and strengthened learning processes on meteorology, climate change and DRM in primary and secondary schools. The MoNE and AFAD also developed the Disaster Awareness Education Course Program that is currently taught in public education centers. The MoNE and MoEUCC are also collaborating in providing environmental awareness and climate change training for teachers and, as of 2022, the “environmental education” elective course for grades 7 and 8 will be taught under the name of “environmental education and climate change” to students from grade 6. Other environmental programs with a focus on climate change for schoolchildren being implemented include: the Zero Waste Project executed under the leadership of the first lady, and the Clean School and Clean Energy Project, started in January 2022, which will implement mitigation, adaptation, and environmental protection actions in schools. Strengthening the climate change and DRM curriculum at all formal and nonformal education and training levels will help generate a clearer understanding of risk, risk reduction, and adaptation options. It also opens the opportunity for children and youth to act as agents of change and contribute to resilience building.

FIGURE 6.13 >>

Households with home computer access (2017)



Source: OECD Data

●● Priority Action 3.8 >>

Increase the resilience of forests and other natural ecosystems

INDICATORS >>

- Use of NbS for adaptation and resilience⁽¹⁾
- Forests and climate change strategy⁽¹⁾
- Blue economy strategy⁽¹⁾
- Natural capital accounting⁽¹⁾

- Land degradation⁽¹⁾
- Biodiversity Habitat Index⁽¹⁾
- Ecosystem Services Index⁽¹⁾

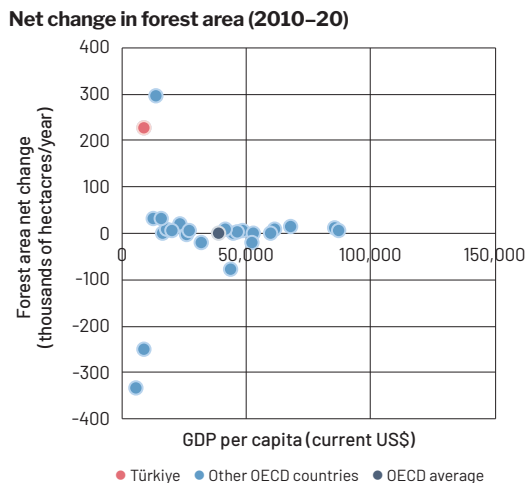
Nature-based solutions have yet to be mainstreamed in national adaptation strategies and plans, despite their growing global recognition as cost-effective adaptation and risk reduction measures with multiple benefits. Both the National Climate Change Adaptation Strategy and Action Plan (2011–23) and the National Climate Change Strategy (2010–23) developed by the MoEUCC include short-, medium-, and long-term goals to incorporate climate change into forests and other natural ecosystems management and planning, which are the responsibility of the MoAF. The General Directorate of Forestry’s (OGM, in Turkish acronym) strategic plan

includes several actions relevant for climate change adaptation, but there is no detailed climate change vulnerability assessment or budgeted climate change adaptation plan for the forest sector. Türkiye's National Climate Change Adaptation Strategy and Action Plan (2011–23) provides for actions to integrate adaptation considerations in marine and coastal zone management, but the country has yet to develop a comprehensive blue economy strategy to ensure the health of marine and coastal ecosystems and strengthen their role in climate adaptation and resilience (box 6.4).

Türkiye has made progress toward natural capital accounting to keep track of the quantity and quality of its natural assets but has not integrated the System of Environmental Economic Accounting (SEEA) framework into its national accounts system. The country has established a reasonable statistical system for its natural capital, which provides access to physical data and accounts of key natural resources and other statistics on air, water, wastewater, waste, environmental, and other expenditures since 1990 (Statistical Commission 2018). But the existence and availability of these data has not yet informed decision making or led to the creation of policies that involve the sustainable use of natural resources as a powerful tool for adaptation and sustainable economic growth.

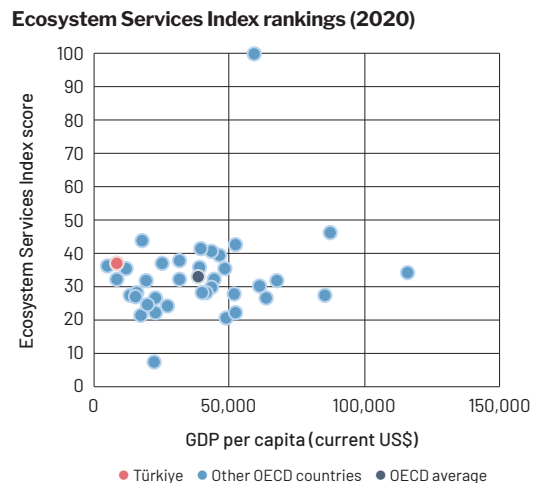
Türkiye has made efforts to protect its ecosystems and their essential services, including carbon sequestration, water regulation, and pollination, but more efforts are needed to ensure adaptation benefits. The country is rich in biodiversity, hosts a wide range of ecosystems including forests, mountains, steppes, wetlands, coastlines, and seas, and accommodates about 11,000 plant species, a third of which is endemic (IUCN 2018). It is one of the few countries where the area of forest lands is increasing (FAO 2020; figure 6.14)—from 20.2 million hectares in 1973 to 23.1 million in 2021 (OGM 2021). Through forest management and harvested wood products, the forestry sector offsets 10 to 20 percent of total GHG emissions (TurkStat 2022). Türkiye ranks above its OECD peers in the Yale Ecosystem Services Index, which measures the state of forest, grassland, and wetland ecosystems, scoring 37.1, compared with the OECD average of 33.1 (figure 6.15). But it has been less successful in protecting its biodiversity from habitat loss, degradation and/or fragmentation, as shown by the Yale Biodiversity Habitat Index, which places it 175th out of 180 countries, with a score of 15.1, compared with the OECD average of 75.8 (figure 6.16). This is partly due to severe land degradation processes, for which it is in the middle tercile of OECD countries, with 9 percent of the total land surface degraded in 2015 compared with the OECD average of 11.5 percent (figure 6.17) and 32 percent of the national

FIGURE 6.14 >>



Source: FAO 2020

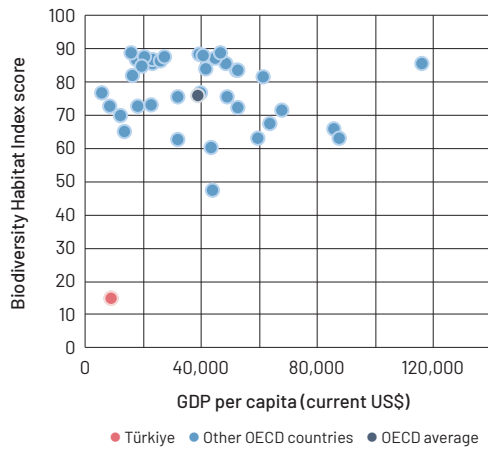
FIGURE 6.15 >>



Source: Yale University Environmental Performance Index

FIGURE 6.16 >>

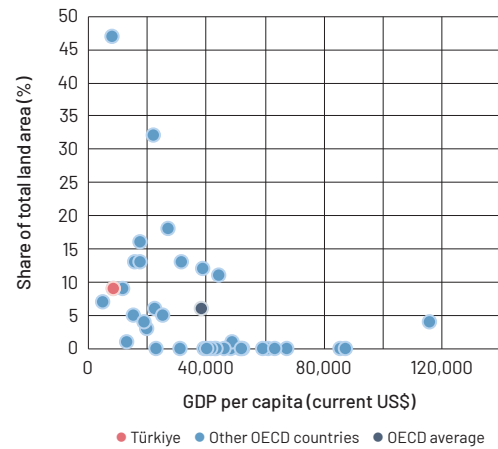
Biodiversity Habitat Index rankings (2020)



Source: Yale University Environmental Performance Index

FIGURE 6.17 >>

Land degradation as share of total land area (2015)



Source: Sachs et al. 2021

BOX 6.4 >> DEEP DIVE 4

Türkiye's marine and coastal ecosystems as key sources of NbS for A&R



Türkiye has a wealth of coastal natural capital that can support a vibrant blue economy. The Turkish peninsula is 8,333 kilometers long and is bordered by four seas: the Mediterranean, the Black Sea, the Aegean Sea, and the Sea of Marmara. This rich and diverse coastline delivers valuable benefits to a large number of coastal inhabitants and supports a wide range of economic activities. Although coastal cities cover less than 5 percent of Türkiye's total surface area, they comprise 51 percent of the population, 80 percent of industrial activities and 90 percent of tourism income (Albayrakoğlu 2011). The main economic and social activities in these coastal zones largely depend on marine and coastal ecosystems and their underlying functions for supporting key economic sectors such as tourism and fisheries, creating and sustaining jobs, fostering industries and trade, and providing food and protection against storms and other natural hazards.

Climate change is expected to significantly impact Türkiye's blue economy. Sea level rise is expected to damage economic assets and activities in coastal areas that are nationally important for economic productivity. According to a recent study, potential losses from sea level

rise and storm surges could cost Istanbul US\$200 million annually until 2030, increasing up to US\$10 billion annually by 2100 (Abadie et al. 2016). Moreover, the resulting changes to marine processes and functions are projected to have serious impacts on key economic sectors such as tourism and fisheries, which are highly reliant on climate-sensitive resources. The anchovy population has already diminished as a result of seawater warming in the much cooler northern Black Sea regions (Tekinay and Guroy 2007). Future projections indicate that, with the exception of sprat, all fish stock could decrease in all the Black Sea regions. Climate-driven changes are also expected to have long- and short-term impacts on aquaculture, one of Türkiye's fastest-growing industries where production is projected to reach 600,000 metric tons in 2023, with a value of around US\$2 billion (Çoban et al. 2020).

Türkiye's coastal and marine ecosystems are increasingly threatened by climate change and anthropogenic stressors. Warming temperatures and ocean acidification are weakening the oceans' and coasts' ability to provide critical ecosystem services such as coastal protection, food, and carbon storage. By absorbing about one-third of

carbon dioxide emissions worldwide, oceans play a vital role in mitigating global climate change, with the value of carbon sequestration over the entire Mediterranean basin estimated at €337.3 million per year (Melaku Canu et al. 2015). But Türkiye has seen an increase in coastal pollution in recent years and climate change may exacerbate its detrimental effects. Nutrient overload, caused by excess agricultural runoff and urban and industrial wastewater, is causing serious harm to coastal marine ecosystems and represents the main cause of marine eutrophication. According to several experts, the massive mucilage outbreak in the Marmara Sea during the summer of 2021 is linked to nutrient pollution combined with complex temperature and water exchange impacts from climate change.

Realizing the potential of Türkiye's blue economy is likely to be increasingly challenging under climate change in the coming decades. Climate change impacts are likely to increase dramatically toward the end of this century and risk further compromising the already fragile health and resilience of marine ecosystems and their ability to sustainably support the prosperity of Türkiye's blue economy. Maintaining a robust blue economy will

BOX 6.4 >> DEEP DIVE 4 CONTINUED

therefore depend on swift efforts to adapt to a changing climate, and NbS represent particularly sustainable and cost-effective strategic approaches that incorporate ecosystems within climate efforts and can be rapidly implemented. NbS are actions to protect, sustainably manage, and restore natural and modified ecosystems that effectively and adaptively address societal challenges, simultaneously providing human well-being and biodiversity benefits (IUCN 2016).

NbS approaches can play a significant role in building a resilient and sustainable Turkish blue economy. Traditionally, Türkiye has addressed coastal risks through a strategy of hard coastal protection structures, or *gray infrastructure*. In recent years, there has been worldwide increasing attention on the role of marine and coastal habitat protection and restoration as a climate change adaptation strategy and an innovative, economically sound, and effective coastal zone management approach. Coastal ecosystems deliver valuable protective benefits by providing a natural buffer against coastal waves and erosion, while generating multiple co-benefits for employment generation, public health, well-being, and so on ([table 6.1](#)). With their high carbon sequestration and storage capacity, undisturbed blue carbon ecosystems—that is, carbon sequestered and accumulated in wetlands, saltmarshes, and seagrasses—are particularly efficient in mitigating climate change.

Healthy wetlands represent a cost-effective NbS strategy, yet they are

increasingly threatened by human activities. NbS are often cheaper than traditional gray infrastructure approaches, such as dikes, dams, storm barriers, and sea walls (Debele et al. 2019). Wetlands, for example, regulate floods and protect water resources during droughts. A study shows that wetland restoration can yield benefit-to-cost ratios above 3.5 on average—meaning that every US\$1 spent on wetland restoration generates more than US\$3.50 in direct flood-reduction benefits—while many gray solutions have benefit-to-cost ratios near or below one-to-one and are expensive to implement at scale (Reguero et al. 2018). Natural and constructed wetlands can also help filter and treat waterborne pollutants found in sewage, industrial effluent, storm water runoff, or graywater treatment. There are 4,205 wetlands in Türkiye, covering a total area of 1,582,086 hectares, according to the wetland management information system created within the scope of the National Wetland Inventory Project. However, between 1910 to 2014, the number of natural wetlands decreased from 1,299 to 900, a loss of 21.2 percent (291,339 hectares) of the original total natural wetland surface (Ataol and Onmuş 2021). The rapid loss of wetlands highlights the urgent need for increased conservation and restoration efforts of these ecosystems, as they represent a promising and cost-effective NbS strategy for Türkiye to help address environmental and climate change adaptation challenges while supporting a thriving blue economy.

Marine protected areas (MPAs) represent an effective NbS approach to

support efforts toward climate change adaptation and mitigation. MPAs provide the natural infrastructure, such as storm protection, to reduce human vulnerability in the face of climate change and represent an important tool for fish nursery and recovery, and for supporting the protection of blue carbon ecosystems. According to a World Wide Fund for Nature report, one year before the 2020 deadline, Türkiye had not fulfilled the 2020 Convention on Biological Diversity Aichi target of designating at least 10 percent of its territorial and offshore waters as MPAs. By 2019, it had only designated 6.77 percent of its territorial waters up to 12 nautical miles, and 3.38 percent of its offshore waters up to 200 nautical miles. The report also notes that strengthening the effectiveness of Türkiye’s MPA network is a priority as they have no on-site management units and a very limited budget for patrolling and monitoring activities (Gomei et al. 2019).

Including NbS such as marine and coastal ecosystems in Türkiye’s NDC could significantly contribute to meeting its climate change adaptation and mitigation goals. Despite growing international recognition of their potential, research has found that uptake of NbS remains limited globally (Browder et al. 2019). This also applies to Türkiye, which needs to further enhance the uptake of NbS within existing climate adaptation and mitigation frameworks. Enabling policy conditions are needed to pave the way for action and finance, alongside demonstration projects on how NbS can make adaptation and resilience more cost-effective.

TABLE 6.1 >>

Examples of NbS as a natural buffer in coastal areas

Sandy beaches and dunes	Maintaining robust beaches and dunes (e.g. with artificial replenishment) can help prevent waves and storm surges from breaching inland or developed areas. Vegetation on dunes can also help prevent erosion by trapping and stabilizing sand.
Coral and oyster reefs systems	Coral and oyster reef systems can help break waves and dissipate their energy before they reach the coastline. Coral reefs are estimated to reduce non-storm wave heights by an average of 70%.
Seagrass	Seagrass can help stabilize sediment and regulate water flow and currents that cause coastal erosion in shallow areas. Seagrass beds are estimated to reduce non-storm wave heights by an average of 36%.
Coastal wetlands and salt marshes	Coastal wetlands and salt marsh ecosystems can help increase water storage, prevent erosion by stabilizing sediment and decrease wave heights and velocity. Salt marshes have been shown to reduce non-storm wave heights by an average of 72%.

Sources: Browder et al. 2019; Narayan et al. 2016

territory at high risk of land degradation and desertification (Dengizb and Uzunera 2020). Aware of this problem, Türkiye has implemented a series of erosion control, afforestation, and pasture rehabilitation works and developed monitoring and decision-support systems for land degradation and desertification.

Policy recommendations for strengthening adaptation and resilience

Türkiye has advanced in creating favorable conditions for managing climate and disaster risks in its infrastructure, urban, agriculture, water, health, and education systems, and in its natural ecosystems. But these efforts are often fragmented. The challenges that lay ahead call for more cohesive and comprehensive strategic approaches and ongoing strengthening of institutional capacities, while scaling up, in a coordinated manner, the generation and implementation of resilience-building solutions to multiple hazards across sectors, geographies, and population groups. Based on the results of this assessment, the following recommendations can help the government of Türkiye strengthen A&R implementation to adapt urban and land use plans and protect critical public assets and services.

- ✓ **Identify critical public assets and services.** Scaling up efforts to finish mapping critical infrastructure and identify assets that are at risk from climate change and natural hazards across sectors will help the government prioritize retrofitting and other resilience-building investments. To accelerate this process, it can consider designing and implementing a national strategy to manage critical infrastructure and systematically assess risk and vulnerability in entire networks and critical asset inventories. It could also benefit from identifying and planning interventions to improve its logistics performance, particularly in terms of customs and border management, to reach the level of most OECD countries, enhance competitiveness, and enable fast emergency response and disaster recovery.
- ✓ **Design and implement a government-wide strategy to increase the resilience of infrastructure systems and public assets.** Although transitioning to resilient infrastructure in Türkiye may require higher investments than in most OECD countries, it can also lead to greater long-term savings. A resilient infrastructure master plan can guide the transition across sectors and assist in planning for and assigning appropriate budgets, including maintenance budgets. A master plan could integrate the design and implementation of an asset management system for systematically monitoring the condition, hazard exposure, and maintenance records of critical infrastructure. Integrating local hazards and criticality into construction standards and improving the enforcement of codes and standards in new public and private buildings and constructions would also strengthen the resilience of Türkiye's infrastructure.
- ✓ **Revise urban and land use plans to make them risk informed.** Mainstreaming climate and disaster hazard risks into relevant legislation, scaling up efforts to identify urban areas at risk of multiple hazards, and strengthening the DRM knowledge and implementation capacity of registered urban planners will ensure plans are risk informed. Broader risk communication based on downscaled climate change scenarios can also help inform new public and private investments in urban areas, contribute to more resilient municipal planning, and increase community engagement in risk reduction. Considering financing is also important, as implementing risk reduction and climate resilience measures in urban and land use plans will require appropriate funding, particularly in the absence of PPPs.

- ✓ **Increase resilience of the agriculture sector and ensure food security.** This is critical as the vulnerability of Türkiye's food production systems is among the highest in the OECD. A comprehensive climate change adaptation strategy that includes CSA approaches, assigns clear roles and responsibilities, and guides adaptation in all agriculture subsectors can facilitate a resilience transformation in the sector. The strategy could help ensure that end-to-end climate services rapidly expand and EWS are fully operational to support risk-informed decisions by farmers and other value chain actors. Placing special emphasis on R&D efforts and funding will help identify and implement innovative adaptation solutions, and scaling up the use of insurance and other risk management mechanisms in collaboration with the private sector will help make them widely available and accessible for farmers. A thorough assessment of irrigation systems and a timebound and budgeted plan could also reduce inefficiencies.
- ✓ **Increase the resilience of water infrastructure and water resource management.** Developing an overarching WRM strategy that integrates climate change considerations and builds on and enables the implementation of existing subnational plans would facilitate this goal. Türkiye has a good WRM governance system and could benefit from promoting institutional participation and information sharing in the NWIS to strengthen the system and improve WRM decision making, including decisions related to water quality and allocation. Strengthening policy and regulatory instruments is also necessary to encourage improvements in water productivity and treating wastewater before discharge. Investments in multipurpose water storage, NbS, and other water-related solutions to climate risks in agriculture and other sectors can create multiple benefits, such as reducing water pollution from land-based sources.
- ✓ **Increase the resilience of the health system.** Building on the lessons of the COVID-19 pandemic, Türkiye can improve its health system's capacity to prepare for and cope with major emergencies. This involves ensuring that the sectoral response plan remains up to date, harnessing new technologies to manage reliable information for decision making and public awareness, and strengthening human resources. Increasing health expenditures and introducing policies to enhance surge demand capacity to the level of other OECD countries would help the country be better prepared to cope with more frequent disasters.
- ✓ **Increase the resilience of the education system.** This involves conducting risk assessments at most school buildings and implementing the necessary retrofitting works to protect students and enable all schools to be used as emergency shelters. To safeguard the country's human capital from disaster-related disruptions in education, Türkiye can consider expanding and strengthening its digital education system to lay the foundation for future digital learning in and out of the classroom. This requires strengthening teachers' ICT skills and establishing mechanisms to increase vulnerable populations' access to home computers and the Internet. Türkiye could also consider further strengthening awareness on climate change and DRM in formal and non-formal education curricula to enhance people's knowledge and ability to reduce risks from an early age.
- ✓ **Increase the resilience of forests and other natural ecosystems.** Designing and implementing sustainable ecosystem management strategies will help ensure ecosystems maintain their functions and continue to provide essential goods and services in the future. Türkiye could benefit from officially recognizing NbS as a cost-effective response to climate and development challenges and creating a national strategy to mainstream NbS in policies and strategic processes across sectors. Elaborating a blue economy strategy could be key, as this would benefit coastal and marine ecosystems, as well as coastal populations and economies. Integrating natural capital accounting and ecosystem service valuation into development planning and decision

making could also support national green and resilient growth objectives. Efforts to protect the country's biodiversity and natural ecosystems from further depletion are also needed, including actions to reduce the drivers of environmental degradation and initiatives to increase the extent of protected areas to cover under-protected ecosystems and habitats in line with international conventions.

TABLE 6.2 >>

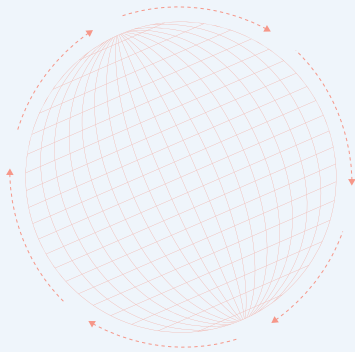
Recommendations for adapting urban and land use plans and protecting critical public assets and services

Priority Action	Policy recommendation	Priority	Lead role	Links to other priority actions	Fiscal implications
3.1	✓ Map all public assets and identify critical infrastructure to enable strategic risk reduction investments	Medium-term	» MoEUCC » AFAD » MoTI » MoAF » MoNE	3.2	
3.2	✓ Design, fund, and implement a masterplan to progressively increase the resilient infrastructure stock	Medium-term	» MoIT » AFAD » MoEUCC	3.1	\$
3.3	✓ Identify high-risk areas for multiple hazards to support urban, land use, emergency, and other planning processes	Short-term	» MoEUCC » AFAD » Local govts.	2.2, 3.2, 3.4, 3.7, 3.8	
3.4	✓ Design and implement a comprehensive adaptation strategy for the agriculture sector to improve food security under climate change	Short to medium-term	» MoAF » MoEUCC	2.1, 2.3, 4.3, 6.3	\$
3.5	✓ Design, fund and implement an overarching WRM strategy to ensure water availability and quality under climate change	Short-term	» MoEUCC » MoAF	3.4, 6.3	\$
3.6	✓ Strengthen the health care system and workforce to enhance surge capacity to cope with higher demands due to climate change and during emergencies	Medium to long-term	» MoH		\$
3.7	✓ Make education infrastructure climate and disaster proof and create the enabling conditions for vulnerable populations to access online quality education in the aftermath of disasters	Medium to long-term	» MoNE	1.2	\$
3.8	✓ Recognize the value of terrestrial, coastal and marine ecosystems and apply NbS for adaptation and economic growth	Medium to long-term	» MoEUCC » MoAF » Local govts. » SBO » MoTF	1.1, 3.8	\$

Notes: AFAD = Disaster and Emergency Management Presidency; MoAF = Ministry of Agriculture and Forestry; MoEUCC = Ministry of Environment, Urbanization and Climate Change; MoH = Ministry of Health; MoNE = Ministry of National Education; MoTF = Ministry of Treasury and Finance; MoTI = Ministry of Transport and Infrastructure; SBO = Strategy and Budget Office.



Help firms and people manage residual risks and natural disasters



“While effective risk mitigation can go a long way in reducing losses and damages, some natural shocks are too extreme and intense to be prevented. Governments must develop strategies to ensure that when disasters do occur, people and firms can cope without devastating long-term consequences, and can recover quickly.”

—The Adaptation Principles

PRIORITY ACTIONS	
●●●○	4.1 >> Save lives (and money) with hydromet, early warning, and emergency management systems
●○○○	4.2 >> Provide all firms and households with risk management instruments
●●●○	4.3 >> Develop the insurance sector, building on public-private partnerships
●●●○	4.4 >> Build a social protection system and make it responsive to shocks
●●●○	4.5 >> Help firms develop business continuity plans (BCPs) and financial preparedness
●●●○	4.6 >> Be prepared to build back better after disasters, with contingency plans and financing

This chapter reviews progress made in helping people and firms to effectively manage residual risks and natural disasters in Türkiye. The assessment includes 25 indicators, corresponding to six priority actions. Although the overall results indicate emerging progress toward achieving this adaptation principle, more efforts need to be made to provide firms and households with risk management instruments—the priority action that received the lowest score in the assessment.

●● Priority Action 4.1 >>

Save lives (and money) with hydromet, early warning, and emergency management systems

INDICATORS >>

●●● Daily weather forecasts ⁽¹⁾	●● EP&R training ⁽¹⁾
●●● Impact-based forecasting (IBF) ⁽¹⁾	●● Emergency service and shelter capacity ⁽¹⁾
●●● Early warning systems (EWS) for natural hazards ⁽¹⁾	●● Effective coordination mechanism for crisis response ⁽¹⁾
●● Early warning communication and dissemination ⁽¹⁾	●●● Community emergency response plans ⁽¹⁾
●●● Emergency preparedness and response (EP&R) management system ⁽¹⁾	

Türkiye has robust meteorological forecasts and EWS for natural hazards, operating and delivering key risk management information to save lives and avert damages. TSMS delivers short, medium, and long-term meteorological forecasts (from hourly to seasonal forecasts), conducts drought analyses, and runs a drought monitoring system. There are EWS for forest fires, environmental radiation, and flash floods (in some regions). The Meteorological Communication and Distribution System shares meteorological information across government agencies and the public receives warnings through appropriate channels, including SMS, telephone, radio, and a country-wide alarm system (MoEUCC 2018b; AFAD 2019; MoD 2019). The Istanbul Earthquake Rapid Response and Early Warning System, comprising 10 real-time strong-motion stations along the coast and more than 100 strong-motion stations inside buildings, reports tremors to the Turkish seismological agency for the immediate activation of established protocols when required. These end-to-end climate services, including EWS, strengthen risk management and adaptation decisions in the country, enabling users to assess upcoming changes, adjust their activities to short and mid-term weather conditions, and respond to imminent shocks. IBF, currently unavailable in Türkiye, could further improve these systems by incorporating risk assessments and generating information on specific impacts to be expected from hazardous events for better emergency preparedness and response.

Türkiye has an effective nationwide EP&R management system, but needs to further strengthen the capacity of its emergency services to perform well under increasingly challenging disaster conditions. It has built a comprehensive legal, regulatory, strategic, and planning framework for DRM. Roles, responsibilities, and coordination mandates are clearly defined, with the 2015 National Disaster Response Plan outlining principles for preparedness, response, and recovery among agencies and at different levels of government. In general, the capacity of emergency services has increased since the 1999 Marmara earthquake. There are now 26 regional and 55 provincial logistical centers with emergency stocks and in 2019, 12,407 personnel were mobilized to respond to emergencies (AFAD 2020). But recent forest fires and the challenging emergency response environment created by the COVID-19 pandemic have shown that these resources may be insufficient. This calls for detailed EP&R needs assessments that integrate the rising frequency and intensity of climate and disaster events. AFAD's Disaster and Emergency Training Center also need to expand its services to ensure the country's DRM personnel have the skills they need to effectively perform under rapidly changing conditions. Türkiye must also develop and implement community response plans to strengthen local-level emergency preparedness.

●●● Priority Action 4.2 >>

Provide all firms and households with risk management instruments

INDICATORS >>

●●● National strategy for managing residual climate and disaster risks ⁽ⁱⁱⁱ⁾

●●● Financial instruments uptake to cope with shocks ⁽ⁱⁱⁱ⁾

Türkiye has a range of DRM instruments, but household resilience to shocks is constrained by the absence of a national strategy for residual risk management and low social protection coverage. Although the government has achieved a substantial penetration of catastrophe insurance, it has not established residual risk targets. And without these, households and firms have only circumstantial information on the buffers they need to cope with and rebuild after climate extremes and other disasters. In Türkiye, 53.7 percent of households have compulsory earthquake insurance, which also covers fires, explosions, landslides, and tsunami risk caused by earthquakes.⁴⁴ However, the scheme's payouts do not always cover the full losses, and uptake of insurance against other hazards is low. A nationwide survey shows that only 21 percent of more than 3,000 respondents had taken additional disaster insurance beyond earthquakes (AFAD 2020). With low social protection coverage and remittances representing only 0.1 percent of GDP in 2019 (lower than the OECD average of 0.9 percent),⁴⁵ the AFAD survey indicates that most of the population relies on their own resources to withstand and recover from shocks caused by non-seismic hazards. This has major implications for the resilience of poor households, whose assets and well-being are eroded by the costs of increasingly frequent climate events.

●● Priority Action 4.3 >>

Develop the insurance sector, building on public-private partnerships

INDICATORS >>

●●● Non-life insurance penetration ⁽ⁱ⁾

●●● Building stock insurance ⁽ⁱⁱ⁾

●●● Private sector disaster risk insurance ⁽ⁱⁱⁱ⁾

Türkiye has created effective insurance schemes based on public-private joint initiatives to support recovery efforts in the aftermath of disasters, which can serve as good practice examples for many other countries. These include TARSIM, created in 2005 to cover an expanding scope of multiple risks and products for agricultural activities, and the Turkish Catastrophic Insurance Pool (TCIP), established in 1999 as a compulsory earthquake insurance scheme for dwellings in municipal areas. TCIP offers protection at affordable premiums up to a maximum compensation limit that is reviewed annually. Beyond this limit, households can buy additional property insurance coverage from non-life insurance companies. TCIP has become an example for many developing countries as a model of a successful collaboration between domestic insurance providers and the government to reach people and firms with compulsory earthquake insurance (OECD 2015).

Domestic disaster insurance markets are effective mechanisms for extending disaster insurance coverage across households and businesses but have not yet attracted the demand required to

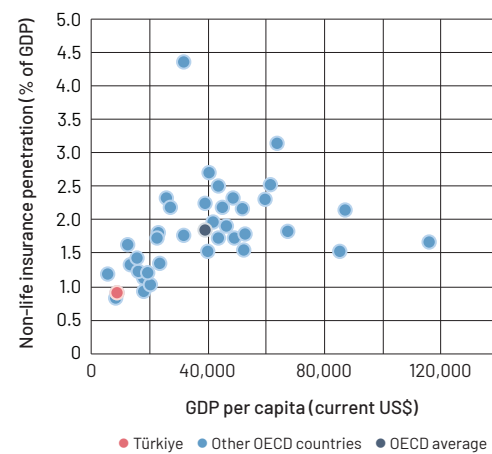
44 <https://dask.gov.tr/en/interactive-earthquake-map> (accessed on July 8, 2022).

45 World Development Indicators, <https://databank.worldbank.org/source/world-development-indicators>.

sufficiently absorb disaster losses across all economic sectors and segments of society. The 11th NDP establishes targets to extend the TCIP model to cover all hazards as a way to leverage private sector capital. New products can be developed to protect small and medium-sized enterprises (SMEs) against business interruption. The need for such products was well evidenced by the COVID-19 crisis. The 11th NDP's insurance expansion targets are important in view of the magnitude of potential future climate-related losses; 86 percent of such losses in Türkiye between 1980 and 2019 were uninsured, with resulting fiscal impacts on public finances (OECD 2019a). However, the viability of such products must be further explored and tested. Their implementation is likely to take time to generate widespread results as in general, developing markets for new insurance products, including compulsory insurance, faces low pick-up rates even when insurance premiums are subsidized (Hallegatte et al. 2020). Non-life insurance penetration in Türkiye (including disaster insurance policies) reached 0.91 percent of GDP between 2008 and 2017, which is well below the OECD average of 1.83 percent (figure 7.1). Of the 17.5 million disaster policies issued by the 32 insurance companies working in the sector in 2019, 9.5 million were compulsory earthquake insurances and 8 million were for non-seismic natural disasters. However, over 60 percent of the building stock remains uninsured against earthquakes, posing risks to 6.7 million people and potential material losses in the range of US\$90–120 billion in the event of a 7.5 magnitude earthquake (Swiss Re 2018).

FIGURE 7.1 >>

Non-life insurance penetration (2008–17 average)



Source: IMF Climate Change Indicators Dashboard

●● Priority Action 4.4 >>

Build a social protection system and make it responsive to shocks

INDICATORS >>

●● Social registry coverage and targeting⁽ⁱ⁾

●● Interoperable social protection and DRM information systems⁽ⁱⁱⁱ⁾

●●● Multiple social protection delivery mechanisms⁽ⁱⁱⁱ⁾

●● Adaptive social protection⁽ⁱⁱ⁾

Türkiye has made progress in building a robust social protection system that uses multiple channels to transfer resources to vulnerable households during crises, but interoperability with DRM information systems can be improved. People and households in need of social protection programs are effectively targeted through ISAS, an application-based system that, in 2022, offered 120 different web services and stored data of 18.6 million households and 59.1 million people (74 percent of the population). ISAS links applicants' data to the databases of 28 government agencies to determine their eligibility for social protection programs. The system's interoperability also allows access to home address and bank account information, enabling the rapid and targeted delivery of financial, cash and in-kind social protection support, which is critical for reducing well-being losses in eligible households during crises. However, ISAS is not

yet interoperable with AFAD's systems. The COVID-19 pandemic represented the first attempt at informing DRM actions with social protection data, but experienced data and operational constraints as vulnerable populations not registered in ISAS could not receive the support they needed. Although Türkiye has made progress in creating adaptive social protection systems (box 7.1), efforts are still needed to improve beneficiary identification and enrollment, set up a contingent plan to scale up social protection during emergencies, and implement skills-building interventions to enhance beneficiaries' income-generation opportunities during the recovery phase (Smith and Bowen 2022).

BOX 7.1 >>

Towards adaptive social protection systems in Türkiye

Since 2003, Türkiye has made considerable progress toward establishing a strong social protection system, making social assistance a consistent priority. Based on the analysis of vulnerability criteria, the system supports citizens in need through its 49 social assistance programs or schemes, including project support programs, which focus on supporting access to basic income, housing, food, education, and health (the most widespread of which is for paying universal health insurance premiums). There are 16 long-term cash transfer programs for households (three for foreigners, including Syrian refugees) and most other programs use one-time transfers for households to mitigate emerging risks. Although spending on social assistance in Türkiye (1.4 percent of GDP) is lower than the average in low-income countries (1.5 percent of GDP), the country stands out for its high level of targeting resources to poor and highly vulnerable households, with emphasis on selected groups and categories. Income support transfers to direct beneficiaries is the most common modality of support. This includes, among others, conditional cash transfers to promote children's access to education and health; cash transfers to widows, older persons, persons with disabilities, and home-based caretakers of older persons and persons with disabilities; and in-kind transfers of food (mainly in the form of soup kitchens) and coal to vulnerable households.

In 2019, the government announced new social assistance programs, including universal birth support, electricity bill support for the poor, and transfers for families with multiple births (World Bank 2021e).

In 2022, it also initiated or enhanced various programs supporting vulnerable populations were initiated or enhanced, including the Natural Gas Consumption Support Program, the Preschool Support Program, the Electricity Consumption Program for Chronic Patients, and the Family Support Program, which will assist people who do not qualify for social assistance during times of duress.

Despite some challenges, Türkiye's social protection system has proven to be responsive to shocks. ISAS has become an example of how technological progress can enhance the efficiency and effectiveness of social protection implementation and delivery mechanisms, integrating all the steps related to managing social assistance—including application, eligibility, delivery, and auditing—into one easily accessible online portal. Through ISAS, and with international support, Türkiye rapidly scaled social protection to respond to the Syrian refugee influx, resulting in their enrollment in social assistance and employment services (Bowen et al. 2020). ISAS also enabled the implementation of the Pandemic Social Support Program, delivering almost TL 11 billion of assistance to 7.2 million individual households since the beginning of the COVID-19 pandemic (Presidency of the Republic of Türkiye 2022). Through ISAS and its well-established institutional arrangements and partnerships for the rapid and flexible implementation of social assistance programs, Türkiye is well poised to offer vulnerable populations the safety nets they need when affected by large shocks, including those caused by climate extremes and change.

●● Priority Action 4.5 >>

Help firms develop business continuity plans and financial preparedness

INDICATORS >>

●● Firms with business continuity plans⁽¹⁾

●●● Access to finance for firms⁽¹⁾

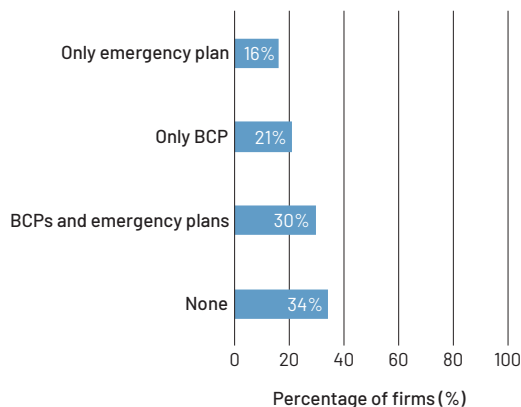
●●● Generator ownership⁽¹⁾

●●● Revenue lost due to outages⁽¹⁾

Firms in Türkiye are starting to draw up BCPs as they are increasingly needed to guarantee the efficient maintenance of business operations during disruptions caused by climate extremes and other external shocks. BCPs are an important risk reduction and resilience-building instrument that enables firms to understand the way threats may affect every aspect of their operations and plan risk avoidance or mitigation measures well before a hazard strikes. A survey conducted with 780 firms at the early stages of the COVID-19 pandemic in March 2020 found that 34 percent of respondents, mainly SMEs, had neither a BCP nor a contingency plan in place (figures 7.2 and 7.3) and only 39 percent were prepared for telecommuting, having the required infrastructure and digital means in place (Business for Goals 2020). But firms in Türkiye are aware of the costs of more common disruptions and proactively apply risk management approaches to avoid losses. For example, in 2019, 19 percent of Turkish firms owned a power generator, compared with the OECD average of 16.4 percent (figure 7.4). They also experience higher losses due to power outages than other OECD countries, losing 1.8 percent of yearly sales, compared with the OECD average of 0.95 percent (World Bank 2019a). To start their adaptation process, businesses—particularly small firms—can start a BCPs by systematically establishing procedures to deal with hazards they are familiar with, and plan to reduce the risks of other hazards that may cause more frequent disruptions in the future. To support firms, AFAD developed the Guidelines on Preparation and Implementation of Business Continuity Plans for Organized Industrial Zones (OIZs), which aim at supporting OIZs to rapidly adapt to disruptions caused by any emergency (including disasters) while maintaining business operations and product/service delivery while also protecting people, assets, and overall reputation. The guidelines focus on area-based BCPs but offer options for individual businesses to adapt them to a firm or asset level. AFAD tested the guidelines with OIZs in Hatay (İskenderun) and Kocaeli Provinces and is promoting the elaboration of BCPs for all the country's OIZs as part of its goal to achieve disaster-resilient industrial organizations and a strong, resilient domestic economy.

FIGURE 7.2 >>

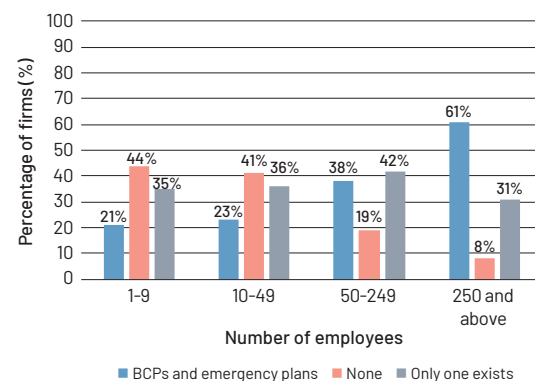
Firms in Türkiye with a BCP or emergency plan (2020)



Source: Business for Goals 2020

FIGURE 7.3 >>

Firms in Türkiye with a BCP or emergency plan, by number of employees (2020)

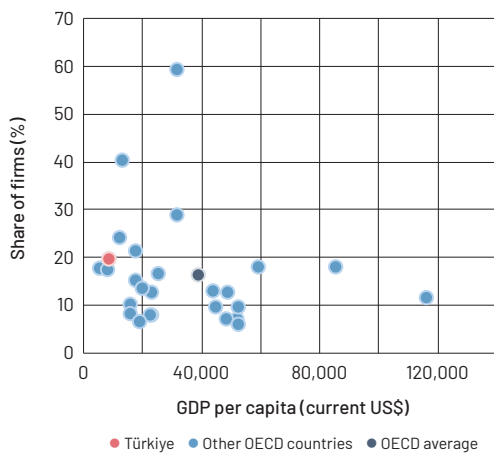


Source: Business for Goals 2020

Financial preparedness against climate and disaster risks requires access to financial resources and instruments, which are often inaccessible to Turkish firms. Almost 30 percent of firms in Türkiye identify access to finance as the biggest obstacle to their business, compared with the OECD average of 9 percent (*figure 7.5*). Access to finance is a problem across all firm sizes and is considered a bigger issue than tax rates. Barriers to scaling up finance for adaptation are high in Türkiye and related to the fundamental issue that most planning and investment decisions do not internalize potential climate change impacts, the perception that adaptation actions are complex and expensive, and the disconnect between the beneficiaries of the actions on the one hand, and the parties that bear the cost on the other (World Bank 2021f).

FIGURE 7.4 >>

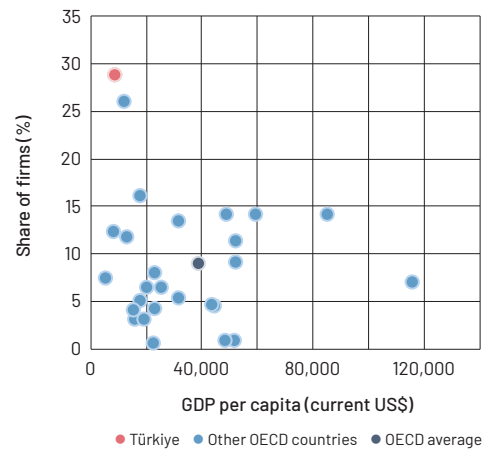
Firms in Türkiye that own a power generator



Source: World Bank 2019a

FIGURE 7.5 >>

Firms where financial issues are the major constraint to BCP development (2021)



Source: World Bank 2021f

●● Priority Action 4.6 >>

Be prepared to build back better after disasters, with contingency plans and financing

INDICATORS >>

●● Resilient recovery and reconstruction principles and guidelines⁽ⁱⁱⁱ⁾

●● Emergency procurement planning and procedures⁽ⁱⁱⁱ⁾

●● Reconstruction time⁽ⁱⁱⁱ⁾

Türkiye is relatively well prepared to build back better in the aftermath of disasters but needs to strengthen resilient recovery procedures and budgets. Disaster recovery also represents an opportunity to reduce vulnerability and build resilience to future shocks, especially those that are expected to become more frequent under climate change. But this requires being prepared because reconstruction efforts need to be conducted rapidly to avoid further losses and suffering among the affected population. Preparations include having resilient recovery and reconstruction requirements and standards (including for land-use and zoning) and plans ready for implementation, including preapproved contracts with qualified contractors for recovery operations. Türkiye acknowledges the need for resilient recovery planning in its 11th NDP, has recently developed post-disaster guidelines for development agencies to strengthen

its recovery readiness framework, and has a better record in reconstruction time after major disasters compared with other countries in the region. While the reconstruction of 75 percent of the assets destroyed in the aftermath of a 200-year earthquake would take approximately two years in Türkiye, it would take 2.3 years in Bulgaria, 2.8 years in Greece, 4.9 years in Croatia, 5.5 years in Armenia, 8 years in Georgia and 8.75 years in Albania (World Bank 2021c). But the country still needs to advance further in preparing resilient recovery and reconstruction principles and guidelines, elaborating guidance documents for emergency procurement procedures, and allocating investment budgets for resilient recovery.

Policy recommendations for strengthening adaptation and resilience

Through effective climate services (weather forecasting and EWS), a good EP&R management system and multiple social protection delivery mechanisms, Türkiye has strengthened the capacity of its people and firms to prepare for and cope with climate and other shocks. To further develop this capacity and accelerate A&R implementation, the following recommendations can help the government of Türkiye further strengthen its efforts to ensure people and firms can manage residual risks and natural disasters.

- ✓ **Save lives (and money) with hydromet, early warning, and emergency management systems.** The government can develop IBF systems that can enhance the quality and effectiveness of climate services by incorporating risk assessments and generating information on specific impacts to be expected from hazardous events for better emergency preparedness and response, reduce the digital divide to enable universal access to EWS, and reinforce the capacity of emergency services to deal with increasingly complex hazard situations. Acting on the recommendations of detailed EP&R needs assessments by hazard type can help build this capacity, while strengthening AFAD's Disaster and Emergency Training Center will ensure it effectively updates and improves individual emergency response personnel's skills through ongoing training. Designing and implementing community response plans can also help strengthen local-level emergency preparedness.
- ✓ **Provide all firms and households with risk management instruments and further develop the insurance sector, building on public-private joint initiatives.** The government can do this by promoting greater insurance coverage against climate-related risks and assessing alternative financing mechanisms—such as compensation. This includes conducting a feasibility study for developing insurance products against other perils and for different target beneficiaries to protect people, firms, and their assets (including building stock), and public finances from more frequent climate extremes and disasters.
- ✓ **Formulate a national strategy for managing residual climate and disaster risks.** Once it has established residual risk targets, the government could formulate a national strategy and promote measures to support the uptake of insurance and increase access to other financial mechanisms to enable households and the private sector to cope with hazard impacts that exceed residual risk targets.
- ✓ **Strengthen social protection systems and make them responsive to shocks.** Improving beneficiary identification and enrollment in the social protection registry and enhancing its interoperability with DRM systems are the first steps toward creating an adaptive social protection system. Türkiye could also consider setting up a contingency plan to scale up social protection during emergencies.

- ✓ **Help firms develop BCPs and financial preparedness.** Creating incentives and supporting the elaboration of BCPs, particularly among SMEs, would help reduce damages and losses during disruptions caused by climate and other natural hazards. Türkiye can also design and implement interventions to reduce the barriers that limit firms' access to adaptation finance.
- ✓ **Be prepared to build back better after disasters, with contingency plans and financing.** To do this, the government can prepare resilient recovery and reconstruction principles and guidelines, elaborate guidance documents for emergency procurement procedures, allocate investment budgets for resilient recovery, and incorporate enhanced standards in recovery, reconstruction, and resettlement plans to further enhance the resilience of post-disaster efforts.

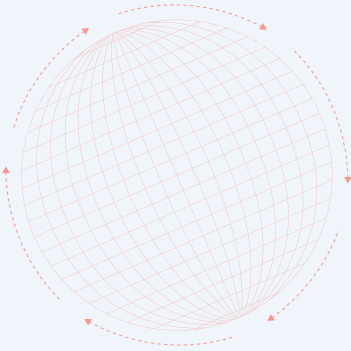
TABLE 7.1 >>

Recommendations for helping firms and people manage residual risks and natural disasters

Priority Action	Policy recommendation	Priority	Lead role	Links to other priority actions	Fiscal implications
4.1	✓ Develop IBF systems to strengthen the quality and effectiveness of existing climate services	Medium-term	» MoEUCC	3.4	\$
4.1	✓ Strengthen emergency response staff capacity to improve the effectiveness of interventions under increasingly complex emergency situations	Short-term	» AFAD » Line ministries » Local govts.		
4.2	✓ Formulate a national strategy for managing residual risks once residual risk targets have been established	Short to medium-term	» AFAD » MoEUCC » MoIT	2.1, 2.2, 3.2, 3.3	
4.3	✓ Promote a greater insurance coverage and diversify available risk financing instruments against climate-related risks for households and firms and further promote private capital mobilization through risk transfer	Medium to long-term	» MoTF » MoIT » AFAD	3.4, 4.2	\$
4.4	✓ Advance in the establishment of adaptive social protection systems by expanding beneficiary identification and enrolment in ISAS, ensuring its interoperability with DRM systems and setting up a contingency plan to scale up social assistance during emergencies	Medium to long-term	» MoLSS » MoFSS » MoTF » AFAD	1.2, 4.3	\$
4.5	✓ Create incentives for firms to elaborate and implement BCPs to reduce and avoid losses during disruptions caused by hazardous events	Medium-term	» MoIT » MoTF » AFAD		\$
4.6	✓ Prepare procedures for building back better after disasters to reduce future vulnerability and speed up recovery time	Medium to long-term	» AFAD » MoTF » SBO		

Notes: AFAD = Disaster and Emergency Management Presidency; MoEUCC = Ministry of Environment, Urbanization and Climate Change; MoFSS = Ministry of Family and Social Services; MoIT = Ministry of Industry and Technology; MoLSS = Ministry of Labor and Social Security; MoT = Ministry of Trade; MoTF = Ministry of Treasury and Finance; SBO = Strategy and Budget Office.

●○○ Manage financial and macrofiscal issues



“The impact of climate change on the economy will affect activity and tax revenues, and strong impacts on major sectors (especially exporting ones) can affect a country’s trade balance and capital flows. The combination of these factors may result in new risks for macroeconomic stability, public finances and debt sustainability, and the broader financial sector. Governments will need to manage these risks, considering the many channels involved. However, the macro-level impacts of climate change are extremely uncertain, and all quantified assessments should be considered as a partial approximation and used in a way that considers both this uncertainty and the possibility of surprises.”

—The Adaptation Principles

PRIORITY ACTIONS

- 5.1 >>
 Include contingent liabilities from natural disasters and environmental shocks in the planning and budgeting process
- 5.2 >>
 Develop a financial strategy to manage contingent liabilities, combining multiple instruments
- 5.3 >>
 Anticipate and plan for long-term macroeconomic impacts
- 5.4 >>
 Communicate and mitigate the disaster and climate risk exposure of the financial sector

This chapter reviews progress made in managing financial and macrofiscal impacts of climate change and disasters in Türkiye. The assessment includes 14 indicators, corresponding to four priority actions. The overall results indicate nascent progress toward achieving this adaptation principle, as half of the priority actions assessed are at an early stage of development.

●● Priority Action 5.1 >>

Include contingent liabilities from natural disasters and environmental shocks in the planning and budgeting process

INDICATORS >>

●●● Climate and disaster risks are assessed and considered in fiscal policies⁽ⁱⁱ⁾

●● Institutional arrangements for public financial management during emergencies⁽ⁱⁱ⁾

●● Contingent liabilities are quantified and included in budget documents⁽ⁱⁱ⁾

Climate change and disasters pose major risks and contingent liabilities to public finances, but these have not been comprehensively assessed and appropriately included in national budgets in Türkiye. Through impacts on people, firms, public assets, and services, climate change and disasters have the potential to cause systemic damage to well-being and the national fiscal space. More frequent extreme events will force an increase in emergency relief and recovery spending, and cause a decrease in tax revenues. Public finances will also suffer from the progressive need to respond to slow climate change effects, such as those related to sea level rise and long-term health and labor productivity changes. While effective adaptation strategies can help reduce some of these risks, addressing the related contingent liabilities in public budgets ex ante is fundamental to build fiscal resilience (Bellon and Massetti 2022; Aligishiev et al. 2022). Türkiye has neither comprehensively assessed the fiscal risks of climate change and disasters across sectors nor calculated or included the associated contingent liabilities in national budgets, although some estimates exist to support this process. For example, the World Bank calculated the explicit contingent liability of public asset losses from climate events to be in the order of US\$140 million annually (World Bank 2021d). Conducting similar with the best information available for key sectors—such as agriculture, water, transport, and other critical infrastructure—and under several climate change scenarios can enable Türkiye to plan and implement the necessary measures to reduce the risks of climate and disaster risks on the country’s public finances.

Institutional arrangements for public financial management during emergencies are in place but would benefit from better coordination. Regulations related to Emergency and Disaster Management issued in 2009 (Official Gazette: 27261) establish a presidential budget appropriation procedure for disaster and emergency management; and the Disaster and Emergency Expenditures Legislation (2011) sets protocols for the transfer and management of disaster and emergency budget appropriation, and to track disaster relief expenditures. But better coordination between the MoTF, SBO, AFAD, and local administrations could improve the effectiveness of emergency actions and finance.

●● Priority Action 5.2 >>

Develop a financial strategy to manage contingent liabilities, combining multiple instruments

INDICATORS >>

●● National climate and disaster risk financing (DRF) strategy⁽ⁱⁱⁱ⁾

●● Emergency budget allocation⁽ⁱⁱⁱ⁾

●● Use of climate and disaster risk financial instruments⁽ⁱⁱⁱ⁾

●● Process to manage ex-post financial assistance inflow⁽ⁱⁱⁱ⁾

Türkiye does not yet have a comprehensive national DRF strategy, although several financing instruments are available for response and reconstruction after disasters. A DRF strategy can help countries prepare for the timely mobilizing of sufficient funding in the aftermath of disasters, define risk financing priorities, and elaborate on a risk-layering approach which includes combining multiple financing instruments to cost-effectively cover government contingent liabilities. It can also define effective delivery channels for disaster funding to reach the people and regions most affected in a timely manner.


Türkiye has a range of financial instruments available for dealing with disasters, including: a 2 percent contingency reserve in the annual budget; the Disaster Reserve Fund under the MoTF; AFAD’s budget; and insurance mechanisms. These include general mechanisms, such as the TCIP, which covers various types of hazards, and sector-specific ones, such as TARSIM for agriculture. The 2021 Central Management Budget Law also enables emergency budget reallocation in disaster situations, and Türkiye has used international financing for emergency response, recovery, and reconstruction in the past (World Bank 2021d). Together, these instruments provide a strong basis for the country to cope with and bounce back from disasters, but their limitations should be assessed to improve their effectiveness. This includes exploring cost-effectiveness in using budget reallocations (in terms of their speed, transparency and cost) versus, for example, borrowing; and exploring the sufficiency of funding in disaster reserve funds and mechanisms available to the government for covering its liabilities to the TCIP in case of a major disaster.


Financial preparedness for disasters can help accelerate disaster recovery, prevent people from falling into poverty, ensure the delivery of critical services, and safeguard the economy. As a country prone to natural disasters, Türkiye needs to ensure it has sufficient financing instruments in place to cost-effectively cover all major risks and associated liabilities, and to plan ahead in view of likely increasing post-disaster funding needs under climate change. It has been estimated that financial instruments combined with contingent planning can increase the speed of reconstruction and reduce consumption losses by almost 50 percent in the aftermath of a natural disaster that destroys 5 percent of assets in the country ([box 8.1](#)).


Priority Action 5.3 >>

Anticipate and plan for long-term macroeconomic impacts

INDICATORS >>

 **Proportion of tax revenues from high-vulnerability sectors⁽ⁱⁱ⁾**

 **Debt sustainability or financial sector assessment program considers climate and disaster impacts⁽ⁱⁱ⁾**

 **Long-term plan to diversify tax revenues⁽ⁱⁱ⁾**

Government revenues in Türkiye are at significant risk of climate change due to their high dependence on a narrow range of sectors that are vulnerable to climatic impacts. Agriculture, manufacturing, tourism, infrastructure, and related services are among the most important productive sectors in terms of employment and tax contribution. But they are also highly exposed to climate impacts. While publicly available disaggregated data on tax revenue sector classification are not available (that is, 2- or 3-digit classification), when using the aggregated level, the proportion of tax revenue at risk from climate and disaster risks can be significant. And if considering indirect impacts on labor productivity and supply chain disruptions, actual

exposure could be even larger (World Bank 2021d). In its latest economic reform package, Türkiye has outlined a long-term plan to diversify its economy, broaden its tax base and rates, and increase tax revenue (MoTF and Presidency of the Republic of Türkiye 2022). But better integration of climate change and disaster risk considerations could strengthen tax reform processes and contribute to better hedging natural hazard risks on public finances.

Debt sustainability and financial sector assessments that consider climate impacts have not been conducted yet; but these are critical for understanding the potential macroeconomic implications of climate change and strengthening macrofiscal preparedness (World Bank 2021d). For example, increasing debt to cover the incremental costs of climate change can pose risks on credit scores, interest rates, and foreign investment. These assessments can be conducted under various climate change scenarios and would give decision makers the information they need to plan and implement appropriate policy, regulatory, and strategic actions to minimize the potential long-term impacts of climate change and disasters on macroeconomic variables, including GDP, debt levels, and trade balance.

●●● Priority Action 5.4 >>

Communicate and mitigate the disaster and climate risk exposure of the financial sector

INDICATORS >>

●●● Integration of climate and disaster risks into business processes by banks, insurers, and large investors ⁽¹⁾	●●● Quantified estimates of exposure to natural hazards required for banks, insurers, and large investors ⁽¹⁾
●●● Specific disaster and climate risk requirements in bank, insurer, and large investor regulations ⁽¹⁾	●●● Climate and disaster risk stress tests for banks, insurers, and large investors ⁽¹⁾

Despite the lack of specific regulatory requirements for banks, insurers, and large investors to address and report climate and disaster risks, Türkiye’s banking system is taking steps toward improving its disclosure of climate and environmental sustainability and management. National regulatory and supervisory bodies have not yet carried out an initial assessment of the financial and banking sector’s exposure to the risks posed by climate change and natural hazards, and there are no regulations to ensure that the financial firms identify, quantify, and disclose these risks in their investment portfolios and adequately manage vulnerabilities. But progress is emerging in these areas: the Banking Regulation and Supervision Agency’s (BRSA) Sustainable Banking Strategic Plan emphasizes regulatory gaps and requirements; the Central Bank of the Republic of Türkiye (CBRT) has established a Green Finance Department to address climate-related financial risks; and the government is updating its accounting framework to align with the International Financial Reporting Standards, which are being updated to include sustainability disclosure standards. There is also emerging progress at private sector level. As of 2018, 21 of the 53 members of the Banks Association of Türkiye—which own 86 percent of total assets in the Turkish banking sector—have developed a sustainability or environmental and social policy document. Of these, 14 (80 percent of the sector) have sustainability reporting practices, and 15 (62 percent) have environmental and social risk management systems in place. Many are developing green financial products, and one, the Industrial Development Bank of Türkiye (TSKB, in Turkish acronym), has elaborated a climate risk report (World Bank 2021f), in which it identifies and categorizes the direct and indirect risks of climate hazards to its operations and details a plan to address physical and transition risks from climate change (TSKB 2021), setting good adaptation planning practice to be mainstreamed across Türkiye’s financial sector.

Stress tests enable financial institutions to assess the resilience of their portfolios to climate change, but they are not mandatory and have not been conducted in Türkiye. This is partly due to the lack of information and guidance provided by regulatory authorities and (prudential and capital market) supervisors for integrating climate risk considerations in their operational frameworks, limiting their ability to regulate and monitor the adequate implementation of climate risk assessments, including stress testing (World Bank 2021f). This is a critical gap, as the Turkish banks' loan portfolios are geographically concentrated and exposed to significant physical risks, including climate risks. For example, 45 percent of bank loans (US\$205.5 billion as of 2021 Q3) are concentrated in the Istanbul, Tekirdag, and Kocaeli, areas, which have elevated drought and seismic risks, and in 2021, massive forest fires hit Antalya and Muğla, where most tourism sector loans are concentrated (World Bank Group 2022). Some banks, such as TSKB, are independently considering implementing stress testing and scenario analysis of their portfolios to inform their strategic planning, implement vulnerability reduction measures, and strengthen their operations' long-term resilience to climate change and other natural hazards (TSKB 2021). Garanti BBVA has analyzed the vulnerability of its renewable energy portfolio to drought, floods and other extreme weather events, and implemented a climate stress test methodology to measure compliance with the Paris Agreement of carbon-intensive sectors in its loan portfolio. From a systemic perspective, however, such good practices should be integrated in specific requirements to ensure regulatory compliance and coherence for banks, following clear guidance by financial regulators for mainstreaming climate and disaster risks.

BOX 8.1 >> DEEP DIVE 5

Macrofiscal and monetary policies for adaptation and resilience



Türkiye is vulnerable to natural disasters that can generate substantial damages to public and private sector infrastructure capital. Earthquakes and floods are the predominant natural disasters, and earthquakes the most destructive. For example, floods in 1998 were responsible for over US\$1 billion in damages, while an earthquake in 1999 caused close to US\$30 billion in damages (GFDRR 2016).

Türkiye will continue to be vulnerable to natural disasters. It sits on one of the world's most active seismic regions, and the population faces material risks and large potential physical asset damage. Global Earthquake Model modeling (Rao et al. 2022) shows that, even in an optimistic scenario where infrastructure is significantly retrofitted to the latest standards, damage can still exceed 2.5 percent of the capital value of

infrastructure. Climate change implies that Türkiye is likely to face more frequent floods, with losses to agriculture and infrastructure. Estimates from the Global Assessment Report on Disaster Risk Reduction show that damage from future floods may cost up to US\$1.5 billion for a 1-in-20-year event and over US\$12.5 billion for a 1-in-1,500-year event (UNISDR 2015a). Alternative estimates using EM-DAT data^a suggest that a 1-in-250-year flood could cost Türkiye US\$140 billion in 2080.

Direct asset losses are only part of the damage, as destroyed infrastructure capital makes the remaining non-infrastructure capital less productive, reducing total capital stock and productivity. Examples include the inoperability of machinery in a warehouse when external infrastructure is damaged, or economic losses due to transportation delays from

road destruction. In addition to the complementarity between infrastructure and other elements, or network effects, redirecting investments to rebuilding and other indirect economic responses can amplify initial asset damage.

The welfare impacts of disasters increase more rapidly with direct asset losses. Macroeconomic responses can reduce the welfare impacts (proxied by discounted consumption loss) of minor disasters, but they can also magnify them when direct asset losses exceed the economy's absorptive capacity. The welfare response depends on: the pre-existing economic situation (fiscal space and financial constraints), the economy's ability to reallocate resources to reconstruction (worker and machinery supply are limited by location and number), and the monetary policy response to uncertainty.

^a www.emdat.be.



Appropriate macrofiscal and monetary policies offer cost-effective opportunities to mitigate the welfare impacts of major disasters. Summarized below, Hallegatte et al. (2022) use the World Bank Macrostructural Model (MFMod) for Türkiye to simulate the effects of two policies: monetary policy (MP) suspension and increased resource mobilization.

Figure 8.1 compares the welfare losses for associated direct losses due to natural disasters under two policy conditions: suspended and unsuspended. Natural disasters tend to reduce the supply of goods and services in an economy, often leading to higher prices. In both cases (active and lagged MP),

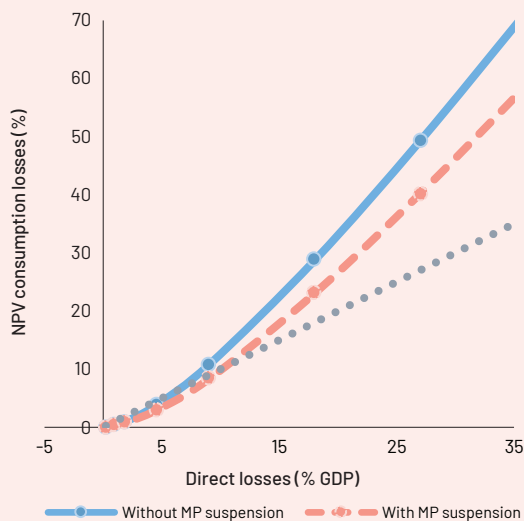
welfare losses exceed direct losses, but losses are greater for a price-responsive MP than a suspended response. In this simulation, MP should still respond to price increases, but in a suspended fashion when the indirect effects of inflation—such as wage or cost price adjustments—materialize and not when the shock occurs. This suspension makes the economy more resilient to the economic consequences of a natural disaster shock because the threshold beyond which consumption losses exceed asset losses increases from 6 to about 11 percent.

Figure 8.2 compares welfare losses with the ability to rebuild damaged capital. For small direct damages, the ability to rebuild up

to 20 percent of destroyed assets each year can result in welfare losses that are less than the direct damages. However, the welfare costs exceed the direct damage once the 20 percent capacity limit is reached. For severely constrained rebuilding responses—such as an inability to mobilize resources for rebuilding due to financial constraints or a small construction sector—welfare losses can be about twice the direct losses. Although the quantitative values should be read with caution, this simulation shows that being able to mobilize resources quickly for reconstruction increases the economy’s resilience to the extent that the threshold beyond which consumption losses exceed asset losses increases.

FIGURE 8.1 >>

Direct losses from natural disasters against net present value consumption losses in Türkiye

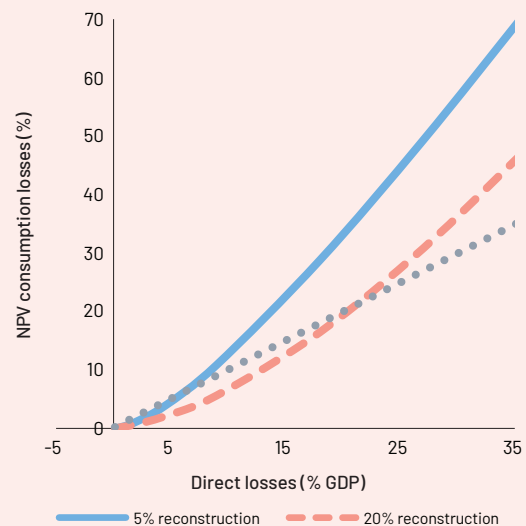


Source: Hallegatte et al. 2022

Notes: NPV = net present value. The scenario with MP suspension represents a situation in which monetary authorities do not react to the economic consequences of a natural disaster shock in the first year. The gray dotted line represents the 45-degree line. A curve below the line means that the economy can absorb the shock, relying on its ability to borrow and reallocate resources, so that losses in final consumption are simply equal to the replacement cost of lost capital.

FIGURE 8.2 >>

Direct losses from a natural disaster against NPV consumption losses in Türkiye



Source: Business for Goals 2020

Notes: 5 and 20% represent the percentage of investment resources that the government can divert to reconstruction instead of investing in new capital stock. The gray dotted line represents the 45-degree line. A curve below the 45-degree line means that the economy can absorb the shock, relying on its ability to borrow and reallocate resources, so that losses in final consumption are simply equal to the replacement cost of lost capital.

Policy recommendations for strengthening adaptation and resilience

Climate change and natural hazards pose significant risks to fiscal sustainability as well as public and private financial management in Türkiye. Addressing those risks through policy and regulatory interventions at various levels is essential for the sustainability of public finances and for the financial sector to build resilience to sudden disaster impacts and incremental climate change costs. Based on the results of this assessment, the following recommendations can help the government of Türkiye further strengthen the management of financial and macrofiscal issues related to climate and disaster risks.

- ✓ **Include contingent liabilities from natural disasters and environmental shocks in the planning and budgeting process.** Conducting a comprehensive and thorough assessment, based on science and across sectors, of the financial risks of climate change and disasters can inform public and private financial institutions of the potential impacts and repercussions, including risk to public assets and the fiscal space, and thus enable appropriate financial planning and budgeting. Strengthening the coordination between central ministries and local administrations can also improve the effectiveness of emergency response and finance.
- ✓ **Develop a financial strategy to manage contingent liabilities, combining multiple instruments.** Reviewing existing financing instruments for disasters in Türkiye—including their internal transfer and delivery channels—can improve response and recovery effectiveness and efficiency in future disaster events. The review should focus on ensuring that the country has and is ready to use a wide range of financial instruments to cover identified and unforeseen contingent liabilities, including the Contingency Emergency Response Components mechanism for World Bank-financed projects, to protect fiscal balances against sudden and long-term climate change and disaster impacts. Reviewing the cost-effectiveness and delivery of existing emergency budget reallocation systems and other financial inflows, and ensuring that emergency and social protection spending needs are sufficiently covered by available financial instruments and integrated ex-ante in national budgets, can also help Türkiye prepare for more frequent climate hazard impacts.
- ✓ **Anticipate and plan for long-term macroeconomic impacts.** Collecting and analyzing disaggregated tax revenue data by sector will allow Türkiye to better estimate the proportion of tax revenues at high risk of climate and natural hazard impacts. Diversifying the tax base away from vulnerable sectors would provide more reliable revenue, while integrating climate change and disaster considerations in subsequent tax reforms would ensure planned interventions are resilient to climate change and disasters. Türkiye could also consider carrying out a public finance review to assess potential climate change and disaster implications on public debt levels to better plan debt sustainability measures, and building the capacity of regulatory authorities to include climate and disaster risks into their operational frameworks.
- ✓ **Communicate and mitigate the disaster and climate risk exposure of the financial sector.** Issuing and enforcing regulations for financial institutions would enable them to identify, test, manage, and report climate and disaster risks in their investment portfolios. Developing expertise on climate risk modeling for the financial sector and encouraging the systematic evaluation of risks and the implementation of stress tests in financial portfolios can also facilitate the adoption of sustainability practices, including those for adaptation and resilience within and beyond the financial system.

TABLE 8.1 >>

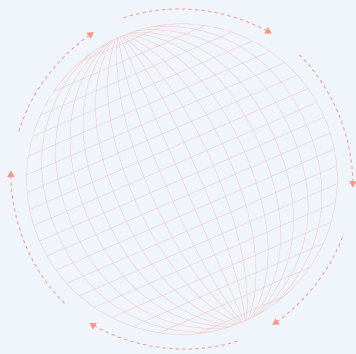
Recommendations for improving financial and macrofiscal management of disaster and climate change risks

Priority Action	Policy recommendation	Priority	Lead role	Links to other priority actions	Fiscal implications
5.1	✓ Assess the macroeconomic impacts of disasters by comprehensively assessing disaster risks, understanding how disasters translate into contingent liabilities and therefore fiscal risks, and using these data to inform government budget planning, such as the Medium-Term Development Strategy	Short-term	» MoTF » SBO » CBRT » BRSA » MoEUCC	5.2, 5.3	
5.2	✓ Based on the understanding of disaster risk, design a cost-effective national disaster risk finance strategy adopting a risk layering approach to meeting post-disaster costs	Medium-term	» AFAD » MoTF » SBO » Local govts.	4.2, 4.6, 5.1	
5.3	✓ Diversify the tax base away from climate-exposed sectors and assess potential climate change and disaster implications on debt levels to reduce macrofinancial risks	Medium to long-term	» MoTF	2.3	\$
5.4	✓ Incentivize and regulate climate risk assessment, management, and disclosure of private financial institutions to reduce macroeconomic risks	Medium-term	» MoTF » BRSA		

Notes: AFAD = Disaster and Emergency Management Presidency; BRSA = Banking Regulation and Supervision Agency; CBRT = Central Bank of the Republic of Türkiye; MoEUCC = Ministry of Environment, Urbanization and Climate Change; MoTF = Ministry of Treasury and Finance; SBO = Strategy and Budget Office.

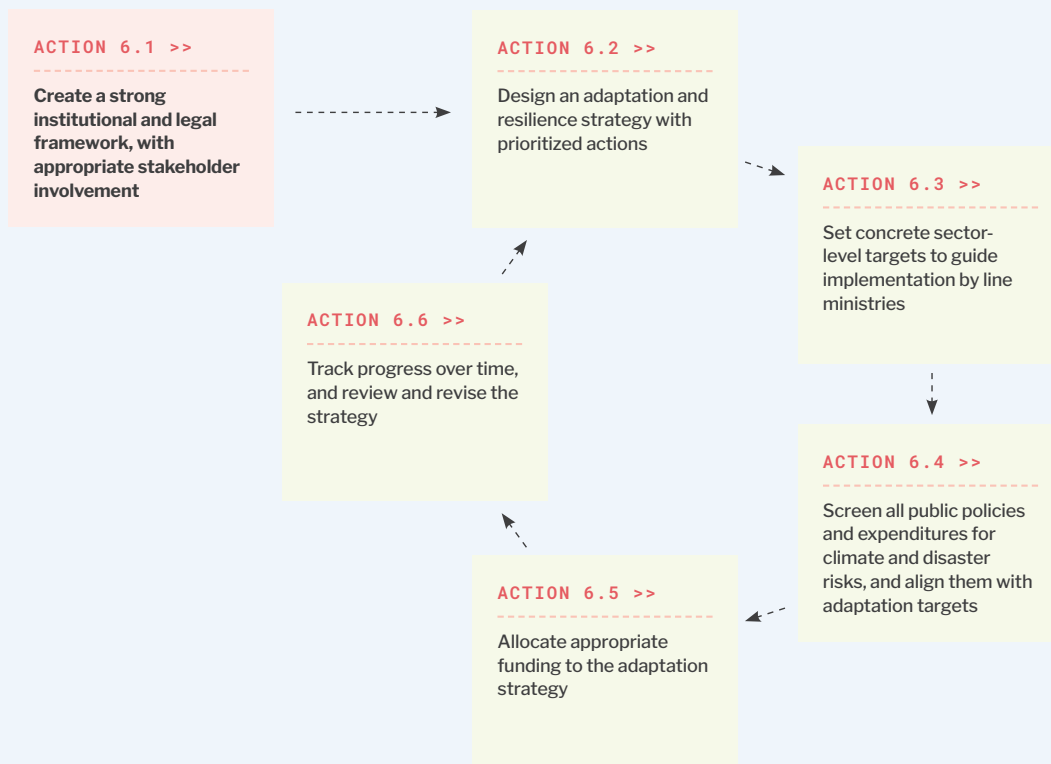


Application: Prioritization, implementation, and monitoring progress



“To effectively implement adaptation and resilience actions, governments must first establish the right institutional and legal framework for robust implementation (Action A.1 [6.1]) and then design a concrete multisectoral adaptation and resilience strategy that clearly identifies and prioritizes actions in line with available resources (Action A.2 [6.2]). A concrete set of intermediate targets and milestones is essential to implement the strategy in each sector (Action A.3 [6.3]). Governments should actively mainstream and integrate resilience in all public policies, rather than limit their consideration of resilience to climate-related actions (Action A.4 [6.4]). With priority actions defined, they need to raise, allocate and track adequate financial resources to implement the strategy (Action A.5 [6.5]). Finally, once implementation is underway and new information and challenges emerge, they will need to make regular strategy adjustments and course corrections to strengthen the approach (Action A.6 [6.6]). Overall, the key to successful implementation is ensuring that all government departments adopt and mainstream the strategy in all their decisions, and that governments continuously monitor and evaluate the impact of their decisions and actions, so they can address any challenges and adjust their actions accordingly.”

—The Adaptation Principles



PRIORITY ACTIONS

- 6.1 >>**
Create a strong institutional and legal framework, with appropriate stakeholder involvement

- 6.2 >>**
Design an A&R strategy with prioritized actions

- 6.3 >>**
Set concrete sector-level targets to guide implementation by line ministries and local governments

- 6.4 >>**
Screen all public policies and expenditures for climate and disaster risks and align them with adaptation targets

- 6.5 >>**
Allocate appropriate funding to the adaptation strategy

- 6.6 >>**
Track progress over time, and review and revise the strategy

This chapter reviews progress made in prioritizing, implementing, and monitoring A&R action in Türkiye. The assessment includes 24 indicators corresponding to six priority actions. Although the overall results indicate that Türkiye has established a sound strategic framework with key elements for the design of an A&R strategy, this adaptation principle is still emerging and progress is needed in half of its priority actions, particularly in relation to prioritization and implementation.

●● Priority Action 6.1 >>

Create a strong institutional and legal framework, with appropriate stakeholder involvement

INDICATORS >>

- | | |
|---|---|
| Climate change law⁽¹⁾ | Government coordination mechanism for A&R policies and actions⁽¹⁾ |
| A&R governance framework⁽¹⁾ | Effective stakeholder involvement⁽¹⁾ |

Türkiye has made progress in creating a strong institutional and legal framework for climate change and adaptation action, but overall climate governance can be further strengthened. Legal instruments are necessary to ensure that adaptation and resilience become an essential part of decision making and operational planning across government agencies at all levels. Türkiye regulates climate change issues through several articles embedded in different laws, including the Environment Law, the Soil Protection and Land Use Law, and the Energy Efficiency Law. It is preparing a framework law on climate change, which it needs to set legal grounds for emission targets, and to further specify functional competencies, improve coordination at horizontal and vertical levels, and strengthen accountability, stakeholder engagement, legislative oversight, and

judicial review (World Bank, forthcoming). Importantly, it ratified the Paris Agreement on October 7, 2021, announcing its net zero target by 2053. It also restructured the Ministry of Environment and Urbanization (MoEU)—now the MoEUCC—incorporating the new PCC, with a mandate to coordinate all national and international matters related to climate change. Türkiye has interministerial coordination mechanisms and recently established a National Climate Council, which works through technical committees to guide policy making on key climate change issues. These are promising steps in the right direction toward setting a strong legal and operational basis for cross-sectoral coordination and implementation of adaptation and resilience in Türkiye. However, the country's overall climate governance by the legislative, executive, and judiciary authorities could be further strengthened. Although the regulatory framework provides sufficient grounds for the courts to review climate action and for the public to bring climate change-related cases to the court, a framework law on climate change could strengthen the authority of courts to review climate actions (World Bank, forthcoming). For example, there is no precedent of a climate change-related legal action in Türkiye and, although the judiciary deals often with legal issues that relate to environmental protection and environmental impact assessments, the legal framework and procedures used for these assessments do not cover climate change. And although Parliament has a standing Environment Committee, it is not assigned with powers to review government action on climate change, including international commitments and national strategies and action plans. Parliamentary oversight relies on the performance audits of the Turkish Court of Accounts (TCA) conducted on public institutions' plans and strategies, as well as thematic audits based on policy themes, but performance audits on climate change policies and plans have yet to be conducted and are not included in TCA's Audit Strategic Plan (2019–23). A scrutiny committee is needed to oversee the performance of government action in relation to climate change commitments (World Bank, forthcoming).

An interministerial coordination mechanism for adaptation and resilience is in place and guides climate change policies and actions. The Climate Change and Air Management Coordination Board, established in 2001, is the main intergovernmental coordination and stakeholder engagement body and played a critical role in consolidating the views of different parties and contributing to signing the Paris Agreement (World Bank, forthcoming). In October 2021, it was restructured through the same Presidential Decree that created the PCC and has a stronger legal basis. Renamed the Climate Change and Adaptation Coordination Board (CCACB), it acts as a coordination body for ministries, business associations, and other stakeholders, and is tasked with determining policies, strategies, and monitoring and evaluating plans and actions related to climate change. Led by the Minister of MOEUCC, members include high-level representatives from key ministries and agencies, three business associations—TOBB, TŪSĪAD, and MŪSĪAD—and the Turkish Union of Municipalities (UMT), having expanded its membership from 13 to 21. After its restructuring in 2021, the PCC also assumed secretariat functions, which were previously carried out by the Climate Change and Adaptation Department under the MOEUCC's General Directorate of Environmental Management. Although civil society and professional organizations have no representation in the CCACB, they can participate in ad hoc working groups with public bodies, private sector representatives, and independent experts. The working groups prepare background research and documentation to inform CCACB decisions. Before its restructuring, the board had established seven working groups, which include: GHG emissions reduction; GHG inventory; the effects of climate change and adaptation;⁴⁶ financing; technology development; training awareness and capacity building; and air management. But the mandate, procedures, and scope of the CCACB's, PCC's and the ad hoc working groups' work could be further clarified through secondary legislation, as their broad definitions may increase ambiguities on how climate change policies and strategies are determined, activities are monitored, and their impacts are evaluated (World Bank, forthcoming).

⁴⁶ This working group is responsible for the following topics: water resources, agriculture and food security, DRM, human health, ecosystem services, biodiversity and forestry, tourism, climate change projections and systematic observations, economic impacts of countermeasures, and transport infrastructure.

Stakeholder participation in climate change, adaptation, and resilience discussions and decision making is emerging and can be further strengthened. To date, climate change mitigation and adaptation strategies and action plans have mostly been prepared through ad hoc participatory processes and contain uncertain measures for addressing stakeholder participation during implementation. As stakeholder engagement in developing strategies and planning action is not regulated, the frequency and depth of engagement vary. The government ensures stakeholder engagement through their participation in the CCACB and ad hoc working groups on climate change policy design and implementation issues. In addition to government agencies, the three largest business organizations and UMT are members of the board, civil society organizations and professional associations are not represented; they can only participate through the PCC ad hoc working groups. Although engagement with non-ministerial actors in the operation of the ad hoc working groups has been limited to date, they are expected to become more open to nongovernmental stakeholders under the new CCACB structure. The board would benefit from expanding its membership to include civil society organizations and from more open communication and information sharing with the public, by making meeting minutes and decisions available on its official website, as in the absence of information, the effectiveness of CCACB operations remains unclear (World Bank, forthcoming). The Research Committee on Identifying Measures to be taken for Minimizing the Effects of Global Climate Change, Fight Against Drought and Efficient Use of Water Resources under the Turkish Grand National Assembly (TGNA) effectively engages stakeholders through a broad participatory process of consultation on adaptation and resilience matters. The committee held 25 meetings, with hearings attended by a wide range of stakeholders, to prepare a report presented to the Plenary of the Parliament in 2021 before Türkiye ratified the Paris Agreement. In February 2022, in a major step toward engaging civil society in climate change processes, the government convened its first Climate Change Council in Konya to establish a roadmap for Türkiye to reach net zero emissions by 2053 in line with the Paris Agreement. Over 1,000 representatives of government agencies, academic institutions, businesses, nongovernmental organizations, farmers, and activists attended the five-day event where participants engaged in specialized working groups, contributed to setting medium and long-term strategic targets, and drafted recommendations (UNDP 2022b). Strengthening the regulatory basis of the Climate Change Council as a regular stakeholder engagement mechanism and harmonizing it with the mandates of the PCC and CCACB would contribute to ensuring the periodicity and predictability of meetings, diversity of stakeholder participation, and government responsibility on how it considers stakeholder inputs in climate change decision making (World Bank, forthcoming).

●●● Priority Action 6.2 >>

Design an A&R strategy with prioritized actions

INDICATORS >>

●●● National Climate Change Adaptation Strategy ⁽¹⁾
●●● National communications and biennial reports ⁽¹⁾

●●● Long-term strategy ⁽¹⁾
●●● Nationally determined contribution ⁽¹⁾

Türkiye has established robust climate change strategies, and its forthcoming update provides an opportunity to identify gaps in implementation and establish ambitious goals to strengthen adaptation and resilience in the short and longer run. It has consistently included priority measures and targets for adaptation and resilience in the National Climate Change Strategy

(2010–23) and National Climate Change Adaptation Strategy and Action Plan (2011–23), though it could strengthen their alignment with the five-year NSPs. Türkiye submits its national communications and biennial reports to the UNFCCC (for example, MoEUCC 2019a) on a regular basis, and these have played a critical role in communicating the country’s emerging needs for adaptation and resilience. A comprehensive completion review of the current strategy, and assessment of progress made with adaptation in the past decade, will be crucial for identifying gaps in implementation, improving monitoring and evaluation (M&E) efforts, and informing the new priorities and objectives set forth in the updated strategy. Establishing both short- and longer-term ambitious goals and targets will be important to ensure that both the updated NDC and forthcoming LTS have strong A&R components.

●● Priority Action 6.3 >>

Set concrete sector-level targets to guide implementation by line ministries and local governments

INDICATORS >>

●● NDP incorporates A&R targets ⁽ⁱⁱ⁾	●● Clear A&R functions assigned between national and local authorities ⁽ⁱⁱ⁾
●● Tasking of central ministries (economy, finance, and planning) to tackle climate change issues ⁽ⁱⁱ⁾	●● Regional priority setting and implementation ⁽ⁱⁱ⁾
●● Sectoral A&R priority setting and implementation ⁽ⁱⁱ⁾	●● Local climate change action ⁽ⁱⁱ⁾

Mainstreaming A&R implementation at sectoral level is still at emerging levels in Türkiye. While an A&R strategy will set forth priorities and targets from a whole-of-government perspective, sectoral ministries should lead the planning, funding, and implementation of A&R actions in close collaboration with local governments. This requires defining clear roles and responsibilities for targets. Parliamentary approval and support and oversight from central ministries can significantly improve the strategy’s authority, reaffirm national interest in cross-sectoral and sectoral targets, and strengthen the ownership and accountability of the actors involved. In Türkiye, the 11th NDP clearly acknowledges the need for adaptation planning and capacity building, but the former is often not mainstreamed in sectoral strategies and plans. While the National Climate Change Adaptation Strategy and Action Plan (2011–23) identifies A&R actions for various sectors such as WRM, agriculture and food security, and DRM, among others, line ministries have yet to develop comprehensive sectoral climate change strategies and adaptation plans, and as a result, sectoral A&R actions are not always prioritized or effectively implemented (OECD 2019b). For example, the 2019–23 Strategic Plan of the Ministry of Energy and Natural Resources has a strong focus on energy security and efficiency but does not address climate adaptation. The 2019–2023 Strategic Plan of the MoIT acknowledges the effects of climate change as a threat; but it sets no related targets. Furthermore, while central ministries and agencies—such as, the MoTF and SBO—are generally involved in A&R planning and policy development, they have not been tasked with clear roles and responsibilities, often resulting in weak collaboration and oversight with line ministries on these aspects (World Bank, forthcoming). These areas warrant improvements in planning, funding, and implementing an effective A&R strategy.

Local action on adaptation and resilience in Türkiye is also at emerging levels. Climate change is not regulated in the law stipulating the services provided by municipalities (Law of Municipalities No5393, Law of Metropolitan Municipalities No5216), or regulations on DRM expenditures. As such, there is no clear organizational structure and functional assignment of A&R policies and actions between national and local authorities and administrations, including legal grounds for enforcement. The MoEUC has completed and published Regional Climate Change Action Plans (BIDEP, in Turkish acronym) for Türkiye’s seven geographical regions, which include detailed sectoral assessments and provide A&R measures for each region (World Bank, forthcoming). Provinces and regions have also recognized the need for adaptation and have started making investments to support adaptation initiatives. As of June 2020, 10 metropolitan municipalities had voluntarily drafted CCAPs and a number of cities are preparing theirs, a practice the MoEUC plans to expand to all municipalities and regions through a recent communique. While these plans mainly cover GHG inventories and actions focused on mitigation, some CCAPs—including those of Istanbul, Bursa, and Denizli municipalities, and the district municipality of Kadıköy—have clear adaptation components. But these efforts remain at a preliminary stage, and local governments need further resources to carry out activities required to mitigate and adapt to climate change (World Bank, forthcoming). National policies and legislation that govern Turkish municipalities’ activities and expenditure management are still to be updated to facilitate actions on climate adaptation.

●●● Priority Action 6.4 >>

Screen all public policies and expenditures for climate and disaster risks and align them with adaptation targets

INDICATORS >>

●●● Disaster- and climate-informed public investment management⁽⁴⁾

●●● SOEs identify and consider climate- and disaster-related risks⁽⁴⁾

●●● Green taxonomy considering A&R⁽⁴⁾

A&R policy objectives are not reflected in public investment cycles and expenditures. Mainstreaming climate change considerations in public investment management across institutions and projects is key to building resilience by making adaptation and risk reduction cost-effective and common practice. This is highlighted in the National Climate Change Adaptation Strategy and Action Plan (2011–23), and the 11th NDP calls for the country’s SOEs to integrate climate change in their long-term strategies and decision making. But there are no legal or regulatory requirements for mainstreaming climate change policy objectives into public financial management instruments, the investment cycle, or overall infrastructure governance. The SBO’s 2020–22 Investment Program Preparation Guidelines include some climate screening requirements, such as preparing environmental impact assessments and factoring the environmental impact of proposed projects into economic analyses. But core infrastructure governance processes, regulations, strategies, and planning do not integrate climate change policy objectives (World Bank, forthcoming). In the absence of legal and regulatory requirements, mainstreaming adaptation in the Public Investment Program is a challenge, as financial performance may outweigh institutions’ and companies’ climate concerns.

Green budgeting and green taxonomies can be useful tools for decomposing green and non-green investments in Türkiye. About 14 OECD countries⁴⁷ practice some form of green budgeting,

⁴⁷ Australia, Canada, Colombia, Denmark, France, UK, Ireland, Italy, Luxembourg, Mexico, Netherlands, Norway, Portugal, and Sweden.

from evaluating the environmental impacts of budgetary and fiscal policies to assessing their coherence in meeting national and international commitments related to sustainable growth. Green budgeting is practiced heterogeneously across these countries, with countries such as France employing comprehensive tagging against green objectives and others such as Colombia tagging against green objectives that nest within a broader framework for high-level priorities—that is, budgeting for the Sustainable Development Goals (OECD 2021). Systematic screening of projects against climate change and disaster risks through a green taxonomy can also help separate green from (un)sustainable assets and economic activities, and could catalyze further investments by considering the objectives of the EU Sustainable Finance Taxonomy in Türkiye’s regulatory framework (World Bank 2021f).

●●● Priority Action 6.5 >>

Allocate appropriate funding to the adaptation strategy

INDICATORS >>

●●● National budget allocates funding for A&R actions ⁽ⁱⁱ⁾	●●● Environmental protection spending ⁽ⁱⁱ⁾
●●● Subnational governments budget for A&R actions ⁽ⁱⁱ⁾	●●● Private sector A&R financing ⁽ⁱⁱ⁾

There is significant scope for improving public budgeting and funding allocation systems to implement a whole-of-government A&R strategy. Because there is no specific mandate to incorporate climate change in economic, public finance, and macro-level planning processes, climate change is not yet mainstreamed in central government budgets, where it appears as one of 67 programs (World Bank, forthcoming). Sectoral and institutional budgets and spending limits are assigned according to central government priorities, in line with the country’s 11th NDP and medium-term programs, and institutions’ strategic plans. At 1 percent of GDP, environmental spending in Türkiye is generally lower than the OECD average of 1.8 percent (2019) and A&R-specific needs are minimally reflected in the national budget. Specifically, the budget allocation for the Sustainable Environment and Climate Change (SECC) Program under the MoEUCC represents 0.14 percent of total central government budget. Within SECC’s budget, only 1.7 percent (0.0027 percent of total central government budget) is allocated to the Climate Change Mitigation and Adaptation Program, Türkiye’s main program on adaptation (World Bank, forthcoming). Funding for adaptation, risk reduction, and resilience building is highly concentrated in environmental budgets, a siloed approach that limits mainstreaming A&R investments across sectors. While dedicated funding is needed for some specific A&R tasks—such as M&E—the biggest funding needs are for sectoral interventions, such as retrofitting infrastructure or strengthening social protection, which requires A&R incremental costs to be integrated within regular sector budgets. But although sector policies and strategies are regularly well prepared, the associated budget to realize envisaged activities is not always estimated or allocated, often leaving planning and programming disconnected from the necessary financing. As a result, specific resources earmarked for adaptation and disaster resilience building can be disregarded due to budget competition for various investments. And although the MoEUCC is leading the development of regional and sectoral CCAPs and has mandated the development of municipal CCAPs, the necessary capacities and funding mechanisms for their implementation remain unclear, as current legal frameworks do not require local governments to allocate budgets for A&R actions, and climate change is not integrated in the laws stipulating the services provided by municipalities (World Bank, forthcoming).

Private sector financing will be key for scaling up adaptation and resilience investments at required levels. Türkiye has successfully used PPP financial models for infrastructure—including airports, highways, energy, health care, water, and rail projects—and has leveraged finance from multilateral development banks for climate objectives. With increasing awareness of sustainability and climate change, the private sector has been exploring financing options such as PPPs, domestic green loans, green bonds for the international market and other tools (World Bank 2021f). Some public-private joint initiatives in the insurance sector such as TARSIM and DASK are well established, providing good models to expand and/or replicate to further support adaptation and resilience efforts (box 9.1). Private sector finance is more prevalent for mitigation actions, such as clean, renewable energy investments, while private financing for adaptation and resilience is still limited. This is due to barriers such as the lack of decision-relevant climate information, the lack of regulatory framework and green taxonomy to guide the private sector, and the lack of policy and market incentives for reflecting the physical risks of climate change and disasters.

BOX 9.1 >> DEEP DIVE 6

Private sector engagement in adaptation and resilience



Private sector investment is crucial for closing the adaptation and resilience finance gap. As economic and human losses and damages attributable to natural hazards and climate change increase, there is a growing urgency for new policy measures and investments focused on adaptation and resilience to reduce economic losses and protect people's well-being. Yet, investments in building adaptation and resilience around the world continue to fall far short of what is needed to avoid severe economic and human impacts from climate change (UNEP 2021). UNEP estimates that by 2030, the cost of adaptation will reach US\$140–300 billion a year, and by 2050, US\$280–500 billion. The NDCs of just 50 developing countries identified more than US\$50 billion a year in adaptation needs for 2020–30. In addition, an estimated US\$57–95 trillion of infrastructure is expected to be built by 2030, which needs to be made resilient to climate change. It is also increasingly clear that, although public finance for adaptation has increased, it will not suffice, and private sector investment has an essential role to play in supplementing limited

public resources to help close the adaptation finance gap.

Climate change will have significant impacts on Türkiye's economic sectors. It is expected to put increasing pressure on a several sectors and infrastructure and may challenge operational, financial, and environmental businesses performance, social interactions, regulatory compliance, contractual obligations, and legal constraints. The private sector is highly exposed to risks from natural disasters and climate change: 76 percent of Türkiye's industrial facilities (83 percent of GDP) are in first- and second-degree seismic risk zones and are particularly vulnerable to earthquakes (World Bank 2019c). A 2013 market study of Türkiye's private sector identifies the sectors and industries that are most vulnerable to physical climate risks (IFC and EBRD 2013); these include many of the 11th NDP's priority areas: electricity production, transmission, and distribution; water collection, treatment, and supply; sewerage; chemicals and chemical products; tourism; and construction.

Türkiye has built a strong track record in attracting private sector

investment in climate mitigation projects, yet participation in adaptation and resilience has remained relatively low. The country embraced a decade of fast-growing PPPs, focusing on power generation, urban transport, and social infrastructure, such as hospitals. Some public-private joint initiatives—such as TARSIM and DASK in the insurance sector—are established or emerging. But while both have shown significant progress with increasing insurance uptake, private sector engagement in adaptation and resilience has remained limited despite direct climate-related risks to private sector core business operations. In a 2013 questionnaire of Turkish micro and SMEs,^a 45 percent of respondents noted that their company had been significantly affected in the previous three years by a climate-related event (IFC and EBRD 2013). The majority of these were water-related, including extreme rainfall events (45 percent), droughts and water shortages (42 percent), and decreasing rainfall (37 percent). The questionnaire also found that these businesses were at very early stages of adapting to climate change, with only six of the 90

^a In line with the EU average, SMEs account for more than nine out of every 10 enterprises in Türkiye.



respondents having started to take action related to climate change.

There are several barriers to attracting the volume of finance needed to advance the adaptation agenda in the private sector. According to the World Bank report *Enabling Private Investment in Climate Adaptation and Resilience* (Tall et al. 2021), of the US\$30 billion spent globally on adaptation in 2017–18, only around US\$500 million—a mere 1.6 percent—came from private adaptation spending. According to Tall et al., the main reasons for the relatively low level of investment in A&R-building include a lack of country-level climate risk and vulnerability data and information services that can be used to guide investment decision making, limited clarity on the government’s capital investment gaps to achieve adaptation goals and/or where private investment is needed, and low perceived or actual returns on investment. Developing a national adaptation investment plan can also help bridge these gaps, serving as a basis for clarifying capital investment needs to achieve climate resilience and for initiating discussion with private investors.

Governments need to adopt a more strategic approach to engage the private sector in adaptation. A coordinated approach to developing, financing, and executing priority adaptation investments, with well-defined goals and national investment plans, can help accelerate and scale up private investment in adaptation and resilience in Türkiye. Tall et al. (2021) pioneer a blueprint for action for governments to identify entry points for action to catalyze private investment in adaptation, with three areas of intervention for public sector stakeholders: policy; incentives; and standards, metrics, and regulations. It also identifies five entry points to enable private investment in adaptation:

- » Supporting long-term adaptation planning, taking a

whole-of-government approach

- » Developing a national adaptation investment plan anchored in a national A&R strategy
- » Conducting a market assessment and screening the pipeline for “bankable” projects for different investors
- » Providing ongoing support for project preparation
- » Supporting individual projects to close the transaction.

Making new infrastructure—such as power, roads, or ports—climate-resilient can yield significant economic gains in Türkiye. The authorities can ensure that adaptation considerations are integrated into decision making and build awareness of the financial and non-financial benefits of scaling up adaptation efforts. Entire systems can be made more resilient by making prudent choices about where and what to build and which assets to upgrade, and by prioritizing green infrastructure where possible. This will require policy makers to develop blended public-private approaches that share the costs and benefits of investing in resilient infrastructure. Building institutional climate risk analysis, planning, and project preparation capacity across government will be important to help ensure that infrastructure planning and adaptation strategies are holistic and evidence-driven. Priority areas could include water efficiency in agriculture, agri-processing, and manufacture, and climate resilience in buildings, which are the most economically important and climatically vulnerable sectors (IFC and EBRD 2013).

Developing specific guidance for private sector participation in climate A&R infrastructure in Türkiye, along with a national adaptation investment plan to attract and scale up private sector

financing, could further increase funding for A&R while opening new avenues for economic growth. The World Bank’s Enabling Private Investment in Adaptation initiative aims to identify a shortlist of bankable adaptation investments that Türkiye could prioritize for private financing. Based on Tall et al.’s (2021) blueprint for action, a first step consists in identifying key A&R priority areas and investments based on national strategies, plans, surveys, stakeholder consultation, and other means, and then preparing a long list of potential adaptation investments in priority areas by screening the climate change adaptation declarations and plans of local authorities, publicly listed companies, and official tender announcements for public procurement. The selected long list of projects is then used to guide the identification of a shortlist of bankable projects that governments can prioritize for private financing by screening pre-identified projects for better value for money through possible PPPs and conducting early market sounding to understand private sector appetite for prioritized projects. A second step involves further understanding the necessary enabling conditions and incentives to support market development and private sector investment through relevant policy, regulatory, and institutional frameworks. This includes assessing market and PPP policies and regulations to identify key obstacles and opportunities for adaptation finance. A third step is to explore the most promising financing modalities—including PPPs, public finance, and blended finance opportunities—to develop an effective financing strategy. The ultimate goal is to produce a ground-tested blueprint for action to boost private investment in A&R that global, regional, national, and local adaptation stakeholders can use to mobilize as much private investment as possible to meet countries’ fast-growing needs in a resilient way.

●●● Priority Action 6.6 >>

Track progress over time, and review and revise the strategy

INDICATORS >>

●●● Monitoring and evaluating A&R⁽ⁱⁱ⁾

●●● Disaster-related expenditure tracking and review⁽ⁱⁱⁱ⁾

●●● Independent monitoring of A&R progress⁽ⁱⁱ⁾

Türkiye does not systematically monitor and evaluate adaptation progress and post-disaster expenditure, yet this is crucial for effective and flexible implementation. Due to the uncertainty linked to climate change processes, strategic actions on A&R-building need to be revised and adjusted at regular intervals to take stock of what has worked and reprioritize actions based on emerging needs and under the light of new scientific evidence and unfolding climate conditions, such as new risks, and socioeconomic situations, such as the COVID-19 pandemic. This requires a simple, yet clear and effective M&E system for adaptation and resilience. Although the National Strategy on Climate Change stipulates the establishment of an M&E mechanism under the CCACB, no information is available on its implementation progress and whether a dedicated mechanism exists for monitoring and evaluating the Climate Change Strategy and CCAP (2011–23) (World Bank, forthcoming). This suggests that Türkiye does not have an established M&E system for adaptation and resilience, and this is a major limitation for effective monitoring of climate action. Nor is there external and independent auditing of A&R progress. But the MoEUCC is making efforts to form a pool of adaptation experts to advise and support the recently announced National Climate Change Platform and National Climate Change Research Center, which will be responsible for climate change-related data, scientific research, policy formulation, and monitoring (World Bank, forthcoming). Although Türkiye has legislation to regulate disaster-related expenditures, and the TCA reviews disaster-related expenditures, the country does not systematically conduct post-disaster public financial management reviews.

Policy recommendations for strengthening adaptation and resilience

Türkiye's recent ratification of the Paris Agreement represents an important milestone for advancing climate change adaptation in the country. However, effective implementation of its updated National Climate Change Adaptation Strategy and Action Plan will require mainstreaming A&R across all sectors and levels of government, assigning clear roles and responsibilities for target setting, allocating sufficient budget for implementation, and regularly monitoring actions. This can be achieved by further aligning climate change adaptation and DRM priorities with national development planning and policies, and integrating them into institutional strategic plans to ensure they can be systematically considered when implementing and monitoring government programs. Based on the results of this assessment, the following recommendations can help the government of Türkiye to further prioritize, implement, and monitor progress on A&R actions.

- ✓ **Create a strong institutional and legal framework for A&R, with broad stakeholder engagement.** Passing a comprehensive climate change law (currently in progress) and strengthening A&R governance by assigning clear roles and responsibilities to central and line ministries, local governments, and service providers are central to this. Further building the capacity and authority of the executive, judiciary, and legislative branches to review, audit, and enforce A&R actions is also vital. This could include establishing a climate change committee under the TGNA and including climate change in TCA's thematic audits. Consolidating broad and systematic stakeholder engagement mechanisms such as through the CCACB and Climate Change Council—and giving them a regulatory basis—can help also ensure that climate policies and decisions capture stakeholders' adaptation and resilience needs and are communicated appropriately across society.
- ✓ **Design an A&R strategy with prioritized actions.** Türkiye already has a National Climate Change Strategy and an Adaptation Strategy and Action Plan, but they expire in 2023. Updating these strategies offers an opportunity to review their implementation, identify needs and priorities, and set short- and long-term goals and targets to inform these and other national climate-related processes, including the NDC update and the forthcoming preparation of the LTS.
- ✓ **Set concrete sector-level targets to guide implementation by line ministries and local governments.** This includes mainstreaming the A&R provisions of Türkiye's NDP at the sectoral level and ensuring that line ministries lead the planning, funding, and implementation of comprehensive sectoral A&R strategies and plans, in close collaboration with local governments. Türkiye can benefit from establishing clear and legally binding functional responsibilities for A&R planning and action across all levels of government. It could task central ministries and agencies with designing national A&R strategic processes and approving, supporting, and overseeing sectoral A&R strategies and action plans. Integrating A&R into the national policies and legislation that govern municipal activities and expenditures can further accelerate risk management and climate adaptation action at the local level.
- ✓ **Screen all public policies and expenditures for climate and disaster risks and align them with adaptation targets.** To ensure that A&R becomes systematically embedded in regular sectoral strategic planning and budgeting, the government can establish legal or regulatory requirements for mainstreaming climate change policy objectives into public financial management instruments and investment cycles. Public and private enterprises alike would benefit from a more comprehensive consideration of climate and disaster risks into their planning and budgeting processes. A green taxonomy could become an important screening mechanism for the private sector, while SOEs would benefit from establishing a more active screening of climate and disaster risk integration into their long-term strategies, plans, budgets, and expenditures.
- ✓ **Allocate appropriate funding to the National Adaptation Strategy and Action Plan.** This requires increasing environmental protection spending to OECD levels and allocating sufficient resources to cover A&R needs at national, subnational, and sectoral levels, including budgets for the implementing regional and municipal CCAPs. Mainstreaming A&R in sectoral budgets can further contribute to shifting the focus of and responsibility for tackling climate change from the environment sector to the whole of government. Developing a plan to attract and scale up private sector financing for A&R solutions with investment potential could provide the additional resources required for adaptation spending. The private sector could also benefit from regulatory instruments and market incentives to address the physical risks of climate change and disasters.

- ✓ **Systematically track progress over time, and review and revise the National Adaptation Strategy.** Designing and implementing an overall M&E plan for adaptation targets with regular progress reviews will be crucial for tracking the effectiveness and efficiency of actions taken to reduce risks and build resilience, and for adjusting the National Adaptation Strategy accordingly during its next 10-year cycle. Accelerating the establishment of the independent adaptation experts pool that will advise the NCCP and the National Climate Change Research Center can also help better monitor and steer A&R action in the country. Türkiye can also benefit from conducting and institutionalizing systematic post-disaster public financial management reviews.

TABLE 9.1 >>

Recommendations for the prioritization, implementation, and monitoring progress of adaptation and resilience

Priority Action	Policy recommendation	Priority	Lead role	Links to other priority actions	Fiscal implications
6.1	✓ Strengthen the legal framework for A&R implementation and governance, with clear roles and responsibilities for central and line ministries and across different actors through a framework climate change law	Short-term	» MoEUCC » AFAD » SBO » TGNA » TCA		
6.2	✓ Update the National Climate Change Strategy and the National Adaptation Strategy and Action Plan to include short, medium, and long-term A&R actions and targets linked to the NDP and sectoral strategic plans	Short-term	» MoEUCC » AFAD » SBO		
6.3	✓ Promote the development, funding, and implementation of comprehensive sectoral A&R strategies and plans led by sectoral line ministries in close collaboration with local governments	Short to medium term	» Line ministries » Local govts. » MoEUCC » AFAD » MOTF	3.4, 3.5, 3.6, 3.7, 3.8, 6.2, 6.5	\$
6.4	✓ Incorporate systematic climate and disaster risk screening in public investment management and in private investment through a green taxonomy	Medium-term	» SBO » MOTF » MoEUCC » AFAD	6.2, 6.3, 6.5	
6.5	✓ Secure appropriate public and private funding for national, subnational, and sectoral A&R actions and increase environmental spending to foster resilience	Medium to long term	» SBO » MOTF » Line ministries » Local govts		\$
6.6	✓ Design and implement an overall M&E plan for the updated A&R strategy and conduct regular and independent progress reviews	Medium-term	» MoEUCC » AFAD » TurkStat		\$

Notes: AFAD = Disaster and Emergency Management Presidency; MoEUCC = Ministry of Environment, Urbanization and Climate Change; MOTF = Ministry of Treasury and Finance; SBO = Strategy and Budget Office; TCA = Turkish Court of Accounts; TGNA = Turkish Grand National Assembly; TurkStat = Turkish Statistical Institute.

Türkiye A&R assessment stocktake

The aftermath of the COVID-19 pandemic presents a major opportunity for Türkiye's economic growth to resume in a green, resilient, and inclusive development pathway while learning from the pandemic experience to further refine the policy, institutional, and regulatory frameworks needed to strengthen preparedness against climate and disaster risks and build back better after future external shocks.

Following *The Adaptation Principles* (Hallegatte et al. 2020), this

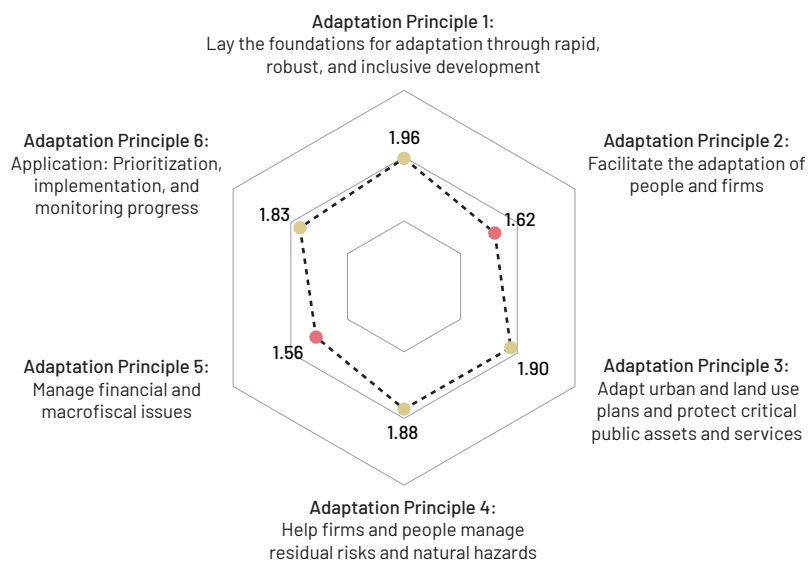
report provides an assessment of current policy strengths, gaps, and opportunities for strengthening national capacities to prepare, cope with, and recover from external shocks across levels of government, sectors, and stakeholders, including the private sector. While the report offers detailed analyses and recommendations on each of the adaptation principles, this stocktake summarizes key findings and highlights priorities that can inform ongoing national strategic climate change and development processes in the aftermath of the COVID-19 pandemic.

Although Türkiye has made good progress in several areas to support adaptation and resilience to climate and disaster risks, this assessment finds that its overall enabling environment is still *emerging*. Based on the 155 indicators used to assess 31 priority actions and six adaptation principles, the results show that at the aggregate level, none of the principles is well *established*. Four principles are *emerging*, and two are *nascent*. The least advanced principles are those related to the conditions required to facilitate the adaptation of people and firms (Adaptation Principle 2) and manage financial and macrofiscal issues (Adaptation Principle 5). At priority action level, 20 are *emerging*, 10 are *nascent*, and only one—related to the key elements of an A&R strategy—is well *established*. [Figure 10.1](#) summarizes the assessment by adaptation principle, while a scorecard showing results at priority action level is in [Appendix B](#). These findings indicate that progress is still needed across most priority actions and adaptation principles in Türkiye to effectively reduce vulnerability and build resilience to climate change, natural disasters, and other external shocks.

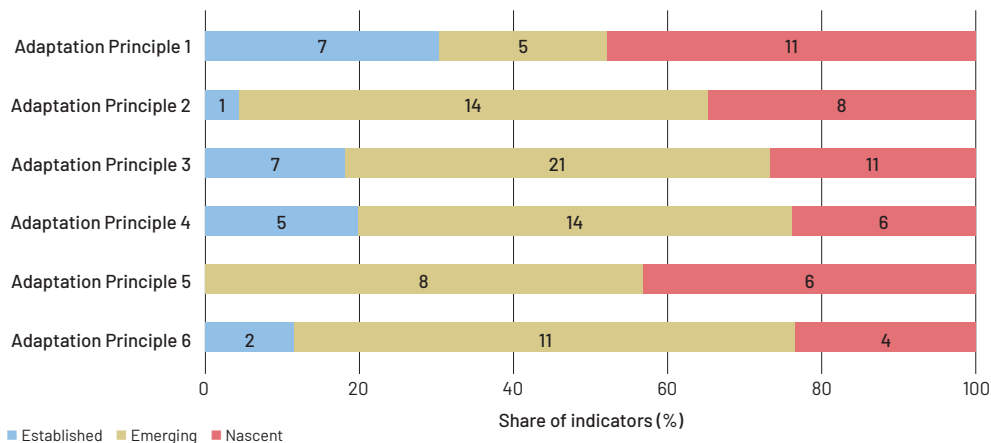
FIGURE 10.1 >>

Summary of A&R assessment for Türkiye

a. A&R scores per Adaptation Principle



b. A&R scores per indicator used in the assessment



Note: The number in each bar shows the number of indicators per category.

The assessment highlights the following key near- to medium-term policy priorities for strengthening A&R preparedness in Türkiye.

- ✓ **Continue efforts to reduce poverty and share prosperity, while ensuring that the most vulnerable populations have the financial, technical, and institutional resources they need to adapt.** Priority actions include measures to ensure macroeconomic stability, expand social protection coverage, adequacy, and efficiency, increase the scope and efficiency of investments in human capital, reduce gender disparities in labor force participation, and increase access to financial services, health care, and telecommunications for poor and vulnerable populations. Enhancing governance to the level of other OECD countries is also a priority to ensure the sustainability of A&R actions.
- ✓ **Strengthen the provision of and access to climate risk information that people and firms need to adapt.** Türkiye can build on the good progress it has made to date and continue generating climate, risk, and socioeconomic data and information for effective adaptation and risk reduction processes at various geographic and temporal scales. Public access to existing data and information can be improved, and more granular information generated, including downscaled climate change scenarios and local-scale hazard maps. Sectoral climate and natural hazard risk assessments are also urgently needed to support adaptation decisions by the people and firms who depend on these sectors. Establishing residual risk targets would help clarify the level of protection public infrastructure offers against natural hazards and enable people and businesses to make informed risk reduction decisions and investments. Opportunities to further support adaptation while promoting economic diversification and competitiveness under climate change include: encouraging the development of CCAPs for businesses to help them identify the risks and opportunities climate change poses to their operations; elaborating comprehensive assessments for sunset and sunrise sectors; and creating incentives for business innovation, R&D, and commercialization of A&R solutions.
- ✓ **Protect public investments, assets, and services from climate impacts through integrated and comprehensive strategic approaches.** This includes developing a government-wide infrastructure masterplan that encompasses, among others: completing a full inventory and mapping of public assets and an assessment of their vulnerability to major hazards; identifying critical infrastructure and a system to monitor public asset performance and maintenance; strengthening the enforcement of infrastructure and building regulations for private actors to invest in resilient construction; and improving the integration of risk considerations in urban and land use planning by training planners in DRM and promoting the use of local hazard maps and downscaled climate change scenarios, when available.
- ✓ **Build on the progress made during—and lessons learned from—the COVID-19 pandemic to strengthen the education and health care systems' capacity to cope with major emergencies.** This includes expanding the capacity of health care workforce to ensure the system meets recommended WHO levels. To reduce educational disruptions, Türkiye can expand and strengthen its digital learning system, bolster teachers' ICT skills, and set up mechanisms to reduce the digital divide that affects vulnerable populations.
- ✓ **Develop overarching strategies for the adaptation of climate-sensitive natural resource sectors, particularly agriculture and water.** A comprehensive adaptation strategy for agriculture that mainstreams CSA approaches can support rural planning processes and adaptation in all agriculture subsectors. Such a strategy can: enable the rapid expansion of end-to-end climate services for farmers and other actors to receive the information they need for

short- and medium-term decision making; promote the use of agricultural insurance and other risk reduction solutions that are already available; and spur innovation through R&D efforts in finding new adaptation solutions tailored to local and subsectoral needs. Strengthening collaboration with the agencies in charge of WRM would ensure the CSA strategy leads to more efficient water resource use. The agencies in charge of WRM across levels of government must also strengthen their coordination and collaboration mechanisms to ensure that existing WRM plans, which are crucial for adaptation, are effectively implemented. Climate-smart water management—with integrated water resource investment planning, policy and regulatory instruments that encourage demand-side management, investments in multipurpose water storage, and continued modernization of irrigation and drainage services—should be mainstreamed. This can be further facilitated by the developing an overarching WRM strategy that integrates existing sector plans and incorporates long-term climate change considerations.

- ✓ **Further strengthen adaptation and resilience by tapping into the potential of NbS and mainstreaming them across sectors as cost-effective mechanisms for protecting people and assets and a source for economic growth.** Türkiye can achieve this by striving to conserve its biodiversity and ecosystem services and protect them from further degradation pressures. Designing and implementing a blue economy strategy could help protect the vast number of people and assets located in coastal areas. Integrating natural resource accounts into development planning and decision making would also contribute to Türkiye's green and resilient growth objectives and provide a systematic way to monitor the stock and flows of natural capital.
- ✓ **Ensure people and firms can prepare, cope with, and recover from unavoidable climate shocks and disasters.** Recommendations include reinforcing Türkiye's emergency management services by conducting detailed EP&R needs assessments and strengthening the skills of emergency personnel; giving households and firms better access to risk management instruments by promoting greater insurance coverage against climate-related perils; extending the social protection registry and interconnecting it with DRM systems to build an adaptive social protection system; and incentivizing the private sector to develop BCPs. Ensuring enhanced resilience standards are part of recovery plans can further help the country build back better and more sustainably.
- ✓ **Protect the economy from the macroeconomic impacts of climate change and natural disasters.** Türkiye can achieve this by, among other things, assessing financial risks and contingent liabilities associated with natural hazards and climate change to inform financial institutions and facilitate a better understanding of risk; and reviewing available financial instruments for DRM in Türkiye to ensure they can cover both assessed and unforeseen contingent liabilities and thus reduce the risk of hazard impacts suddenly affecting fiscal balances. The government can also diversify the tax base away from vulnerable sectors to hedge macrofiscal risks, review public debt vulnerabilities relative to climate change and disasters, and implement regulations for private financial institutions to identify, test, manage, and report climate and natural hazard risks in their portfolios.
- ✓ **Integrate A&R considerations in public and private investment management** by developing regulatory requirements and guidance to ensure public financial management instruments, the investment cycle, the annual investment program, and overall infrastructure governance systematically integrate and contribute to achieving climate change policy objectives and are screened for climate and disaster risks. Establishing green budgeting approaches could help ensure resources are earmarked for A&R investments while a green taxonomy could help separate green from (un)sustainable assets and economic activities, catalyzing further investments. A national adaptation investment plan can also clarify capital investment needs and attract private funding for achieving climate resilience.



Mainstream adaptation and resilience in institutional planning and budgeting processes across sectors and government levels and monitor progress to adjust course over time. The update of Türkiye's National Adaptation Strategy offers an opportunity to revise the policy, institutional, and regulatory framework needed to prepare for the impacts of hazards that are known, and those that will become more frequent with climate change. The strategy should be accompanied by a comprehensive climate change law defining clear roles, responsibilities, and targets for central government ministries, sectors, and local governments to effectively integrate A&R issues in their planning and implementation processes. An updated national A&R strategy would need clear targets for prioritized actions, an effective M&E system to track progress, and adequate funding levels for general coordination, while specific actions should be embedded in national and sectoral budgets.

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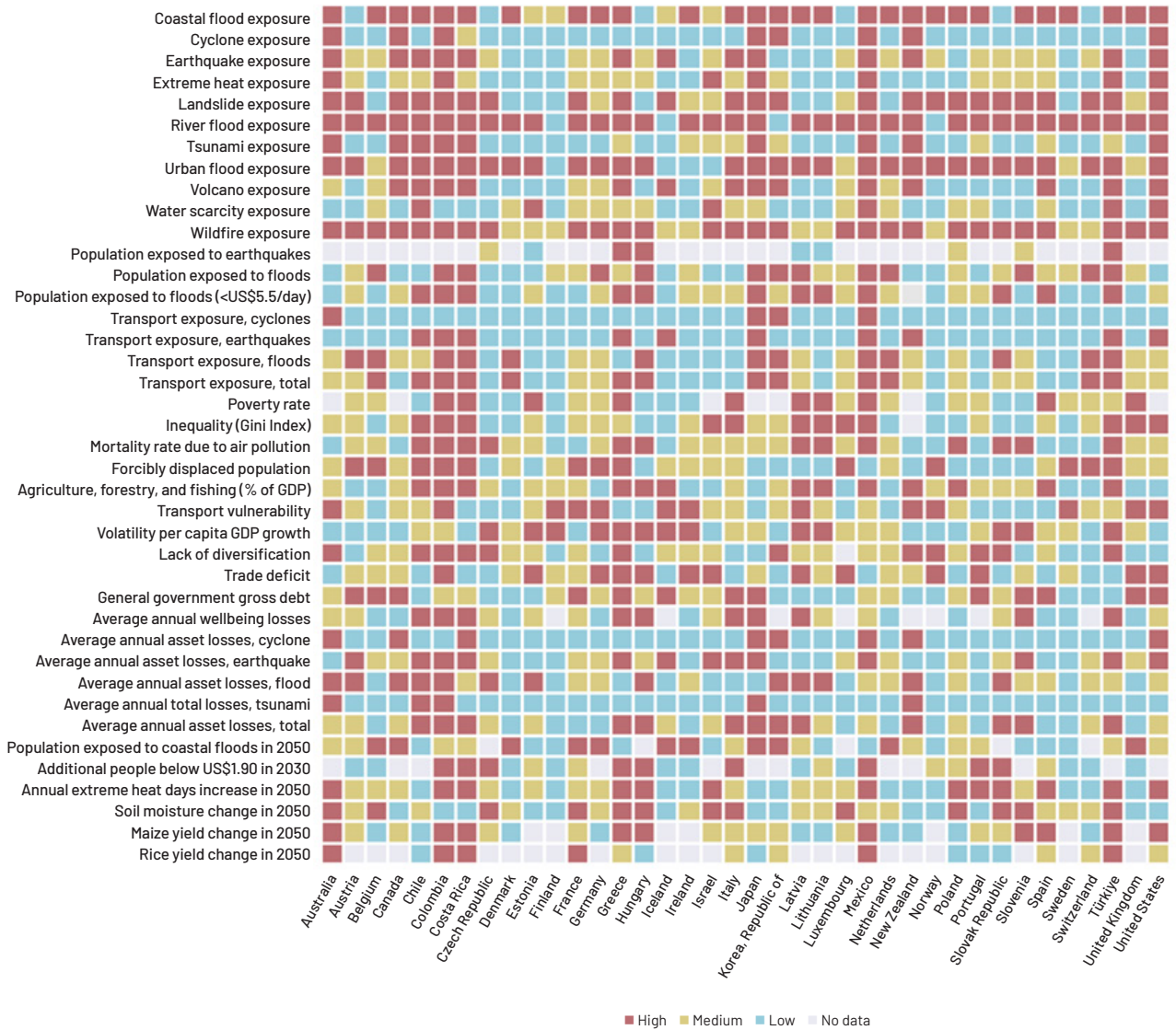
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Appendix A: Heatmap of the drivers of climate and disaster risks in Türkiye



Appendix B: Türkiye A&R scorecard

The ratings were developed as follows. First, each indicator is assigned a score of 1 (nascent), 2 (emerging), and 3 (established). Second, for each priority action, an average score is derived across ratings of the underlying indicators. Third, for each adaptation principle, an average rating is derived across the ratings of the underlying priority actions. Fourth, each priority action or pillar is categorized as *nascent*, *emerging*, or *established* based on the derived average rating. An average rating of 1–1.67 is *nascent* (red ●), 1.67–2.33 is *emerging* (yellow ●●), and 2.33–3 is *established* (blue ●●●).

TABLE B.1 >>

Türkiye A&R scorecard

ADAPTATION PRINCIPLE 1: Lay the foundations for rapid, robust, and inclusive development		●●●	1.96
1.1	Increase economic productivity and growth, while keeping buffers for shocks	●●●	2.20
1.2	Ensure that economic growth is inclusive	●●●	1.72
ADAPTATION PRINCIPLE 2: Facilitate the adaptation of people and firms		●●●	1.62
2.1	Assess climate and disaster risks, and make this information available	●●●	2.00
2.2	Clarify responsibilities and align incentives with A&R objectives	●●●	1.75
2.3	Facilitate access to technical solutions for resilience through R&D and trade policies	●●●	1.50
2.4	Ensure financing is available to all, and provide support to the poorest and most vulnerable people	●●●	1.50
2.5	Facilitate structural change in the economic system	●●●	1.33
ADAPTATION PRINCIPLE 3: Adapt urban and land use plans and protect critical public assets and services		●●●	1.90
3.1	Identify critical public assets and services	●●●	1.75
3.2	Design and implement a government-wide strategy to increase the resilience of infrastructure systems and public assets	●●●	1.57
3.3	Revise urban and land use plans to make them risk-informed	●●●	2.00
3.4	Increase the resilience of the agriculture sector and ensure food security	●●●	2.00
3.5	Increase the resilience of water infrastructure and water resources management	●●●	1.80
3.6	Increase the resilience of the health system	●●●	2.17
3.7	Increase the resilience of the education system	●●●	2.00
3.8	Increase the resilience of forests and other natural ecosystems	●●●	1.86
ADAPTATION PRINCIPLE 4: Help firms and people manage residual risks and natural disasters		●●●	1.88
4.1	Save lives (and money) with hydromet, early warning, and emergency management systems	●●●	2.11
4.2	Provide all firms and households with risk management instruments	●●●	1.50
4.3	Develop the insurance sector, building on public-private partnerships	●●●	1.67
4.4	Build a social protection system and make it responsive to shocks	●●●	2.25
4.5	Help firms develop BCPs and financial preparedness	●●●	1.75
4.6	Be prepared to build back better after disasters, with contingency plans and financing	●●●	2.00
ADAPTATION PRINCIPLE 5: Manage financial and macrofiscal issues		●●●	1.56
5.1	Include contingent liabilities from natural disasters and environmental shocks in the planning and budgeting process	●●●	1.67
5.2	Develop a financial strategy to manage contingent liabilities, combining multiple instruments	●●●	2.00
5.3	Anticipate and plan for long-term macroeconomic impacts	●●●	1.33
5.4	Communicate and mitigate the climate and disaster risk exposure of the financial sector	●●●	1.25
ADAPTATION PRINCIPLE 6: Application: Prioritization, implementation, and monitoring progress		●●●	1.83
6.1	Create strong institutional and legal framework, with appropriate stakeholder involvement	●●●	2.00
6.2	Design an A&R strategy with prioritized actions	●●●	2.50
6.3	Set concrete sector-level targets to guide implementation by line ministries and local governments	●●●	1.83
6.4	Screen all public policies and expenditures for climate and disaster risks and align them with adaptation targets	●●●	1.00
6.5	Allocate appropriate funding to the adaptation strategy	●●●	1.25
6.6	Track progress over time, and review and revise the strategy	●●●	1.33
Average rating across all adaptation principles		●●●	1.79

Appendix C: Traffic light system

The tables in this appendix contain detailed descriptions of the indicators, sources and rating criteria used in this assessment. The indicators presented here form a non-exhaustive list to assess progress toward adaptation and resilience under a whole-of-economy approach in Türkiye. Bottom, middle and top tercile ratings are relative to other OECD countries. The final column in table B indicates data quality (DQ) type, where I = quantitative benchmarking assessment supported by global data or statistics (such as World Development Indicators, OECD Data, and so on); II = qualitative assessment based on national statistics, review of policy documents and reports, websites, literature from different sources including government, World Bank, and OECD analytics, among others; and III = qualitative assessment based on technical/country expert judgement. Source information is under *References*.

TABLE C.1 >>

Drivers of risk indicators

Indicator	Low	Medium	High	Notes	Source
Socioeconomic vulnerability					
People					
Poverty rate	Bottom tercile	Middle tercile	Top tercile	Share of population that is poor, latest year available, measured at national poverty line	World Development Indicators
Inequality (Gini Index)	Bottom tercile	Middle tercile	Top tercile	Gini Index measures the extent to which income distribution (or consumption expenditure) among individuals or households deviates from a perfectly equal distribution. 0 represents perfect equality, 100 implies perfect inequality	World Development Indicators
Mortality rate attributed to ambient air pollution	Bottom tercile	Middle tercile	Top tercile	Number of deaths attributable to the joint effects of household and ambient air pollution in a year per 100,000 population. Rates are age-standardized	UN Open Data Hub: SDG 3.9.1
Forcibly displaced people	Bottom tercile	Middle tercile	Top tercile	Forcibly displaced people as % of total population	UNHCR 2018
Economic sectors					
Agriculture, forestry, and fishing (% of GDP)	Bottom tercile	Middle tercile	Top tercile	Value added or net output of sectors after adding up all outputs and subtracting intermediate inputs	World Development Indicators
Transport network vulnerability	Bottom tercile	Middle tercile	Top tercile	Average consumer losses due to longer routes or isolation of routes (% of user utility) when 10% of the network becomes unavailable (e.g. due to disruptions)	Koks et al. forthcoming
Macroeconomy					
Volatility of per capita GDP growth	Bottom tercile	Middle tercile	Top tercile	Standard deviation of real GDP per capita growth 2009–18	IMF WEO Database
Lack of diversification	Bottom tercile	Middle tercile	Top tercile	Based on the Economic Complexity Index, a ranking of countries based on the diversity and complexity of their export basket and a proxy for economic diversification. High-complexity countries are home to a range of sophisticated, specialized capabilities and can produce a highly diversified set of complex products	The Growth Lab 2019
Current account deficit	Bottom tercile	Middle tercile	Top tercile	Imports minus exports, average of 2015–19	IMF WEO Database
Debt	Bottom tercile	Middle tercile	Top tercile	Debt as share of GDP, average of 2015–19	IMF WEO Database

TABLE C.2 >>

Adaptation and resilience indicators

Indicator	Low	Medium	High	Notes	Source
Current probability of natural shocks					
Flood, river (return period/flood depth)	1,000 years / 0.5m	50 years / 0.5m	10 years / 0.5m	For probabilistic data, the probability of occurrence is classified as high if the hazard exceeds at any location in the ADM-2 (second order administrative division) unit the damaging intensity threshold presented under high; the same applies for medium and low for their respective thresholds. This implies that aggregation at the national level, as has been done for purposes of this report, can in the most extreme cases result in classifying the entire country as high when just one ADM-2 unit in a country classified as high. For more level of detail (ADM-1 or ADM-2), see ThinkHazard! https://thinkhazard.org/en/ . While in ThinkHazard!, distinction is made between low and very low, for purposes of this report, both are aggregated under low.	ThinkHazard!
Flood, urban (return period/ flood depth)	1,000 years / 0.5m	50 years / 0.5m	10 years / 0.5m		ThinkHazard!
Flood, coastal (return period/ flood depth)	100 years / 0.5m	50 years / 0.5m	10 years / 2m		ThinkHazard!
Landslide (annual frequency)	<3.2km2/year	3.2-7.5km2 / year	>7.5km2/year		ThinkHazard!
Earthquake (return period/ Peak Ground Acceleration)	1,000-2,500 years / 0.1g	475-500 years / 0.1g	100-250 years / 0.2g		ThinkHazard!
Tsunami (return period/ coastal maximum amplitude)	2,500 years / 0.5m	500 years / 1m	100 years / 2m		ThinkHazard!
Wildfire (return period/ Canadian Wildfire Index)	30 years / >15	10 years / >20	2 years / >30		ThinkHazard!
Volcano (volcanic explosivity index/ last known eruption date)	<3 / more ancient times or unknown	3-5 / <10,000 years ago	>5 / <2,000 years ago		ThinkHazard!
Extreme heat (daily maximum temperature)	100 years / <28°C	20 years / 28-32°C	5 years / >32°C		ThinkHazard!
Water scarcity (return period/ m³capita/year)	1,000 years / ≤1,700m³	50 years / ≤1,000m³	5 years / ≤500m³	ThinkHazard!	
Exposure to natural hazards					
People					
Population exposed to floods	Bottom tercile	Middle tercile	Top tercile	Population exposed to a 1-in-100 year flood, as a percentage of total population in 2015	Rentschler and Salhab 2020
Population exposed to earthquakes	Bottom tercile	Middle tercile	Top tercile	Population exposed to a 1-in-250 year earthquake, as a percentage of total population in 2015	GFDRR 2016
Poor population exposed to floods	Bottom tercile	Middle tercile	Top tercile	Poor population (<5.5/day) exposed to 1-in-100-year flood, 0.15m inundation (% of total poor population in 2019)	Rentschler and Salhab 2020
Assets					
Transport network exposed to cyclones	Bottom tercile	Middle tercile	Top tercile	Share of transport network exposed to cyclones	Hallegatte et al. 2019
Transport network exposed to floods	Bottom tercile	Middle tercile	Top tercile	Share of transport network exposed to floods	Hallegatte et al. 2019
Transport network exposed to earthquakes	Bottom tercile	Middle tercile	Top tercile	Share of transport network exposed to earthquakes	Hallegatte et al. 2019
Risk					
Annual average well-being losses (AAWL)	Bottom tercile	Middle tercile	Top tercile	Total AAWL from floods, cyclones, earthquakes, and tsunamis in US\$PPP (% of GDP)	Hallegatte et al. 2017
Annual average asset losses (AAAL), earthquake	Bottom tercile	Middle tercile	Top tercile	Total AAAL from earthquakes (% of GDP)	UNISDR 2015a
AAAL, cyclone	Bottom tercile	Middle tercile	Top tercile	Total AAAL from cyclones (% of GDP)	UNISDR 2015a
AAAL, tsunami	Bottom tercile	Middle tercile	Top tercile	Total AAAL from tsunamis (% of GDP)	UNISDR 2015a
AAAL, flood	Bottom tercile	Middle tercile	Top tercile	Total AAAL from floods (% of GDP)	UNISDR 2015a
AAAL, total	Bottom tercile	Middle tercile	Top tercile	Total AAAL from floods, cyclones, earthquakes, and tsunamis (% of GDP)	UNISDR 2015a
Climate change impacts in 2050					
Future population exposed to sea level rise and frequent coastal floods	Bottom tercile	Middle tercile	Top tercile	Population exposed to annual coastal floods due to sea level rise, as a share of actual population, is reported as a percentage and reflective of the population in 2050, determined by the minimum exposure scenario (RCP4.5)	Kulp and Strauss 2019
Additional people exposed to coastal floods	Bottom tercile	Middle tercile	Top tercile	Additional population exposed to annual coastal floods due to sea level rise, as a share of actual population, reported as a percentage and reflective of the 2050 population, determined by the maximum exposure scenario (RCP8.5)	Kulp and Strauss 2019
Extreme heat days (>35°C)	Bottom tercile	Middle tercile	Top tercile	Annual increase in number of extreme heat days (>35°C) for the 90th percentiles of all models (RCP 4.5) between 2040-59	CCKP
Soil moisture change	Bottom tercile	Middle tercile	Top tercile	Relative changes in soil moist (%) at different global warming levels compared to the reference period 1986-2006, based on the RCP4.5 scenario	Climate Analytics
Wheat yield change	Bottom tercile	Middle tercile	Top tercile	Relative changes in wheat yield (%) at different global warming levels compared to the reference period 1986-2006, based on the RCP4.5 scenario	Climate Analytics

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Adaptation Principle 1: Lay the foundations for adaptation through rapid, robust, and inclusive development						
Priority Action 1.1. Increase economic productivity and growth, while keeping buffers for shocks						
Economic growth	5-year GDP growth rate per capita (2015–19 average, excluding 2020 due to COVID-19)	Bottom tercile	Middle tercile	Top tercile	World Development Indicators	I
Adjusted net savings	Changes in a country's wealth (net national savings plus education expenditure minus energy depletion, mineral depletion, net forest depletion, and carbon dioxide and particulate emissions damage)	Bottom tercile	Middle tercile	Top tercile	World Development Indicators	I
Macroeconomic stability	Composite index of inflation, fiscal deficit-to-GDP, external debt-to-GDP, and current account deficit-to-GDP, using 2015–19 averages. After normalizing each variable between 0–1 using all the world's countries as reference group, all variables are added up. The higher the index, the lower the macroeconomic stability	Bottom tercile	Middle tercile	Top tercile	IMF WEO Database	I
Investment or gross capital formation	Ratio of total investment to GDP, both in current local currency. Total value of gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables for a unit or sector	Bottom tercile	Middle tercile	Top tercile	IMF WEO Database	I
Economic productivity: Total Factor Productivity (TFP) Index	Based on the GGD Faculty of Economics and Business' Penn World Table (v.10.0), TFP at constant national prices (normalized to 1 in 2017 for all countries) is computed using the growth rate of real GDP from national accounts data with the growth rates of capital stock and labor force, to obtain productivity growth rates for each country	Bottom tercile	Middle tercile	Top tercile	GGDC	I
Priority Action 1.2. Ensure that economic growth is inclusive						
Poverty rate	Share of people whose income falls below the national poverty line	Top tercile	Middle tercile	Bottom tercile	World Development Indicators	I
Poverty headcount change	Change in poverty headcount in the last 10 years (2010–19, excluding 2020 due to COVID)	Bottom tercile	Middle tercile	Top tercile	World Development Indicators	I
Shared prosperity	Annualized real per capita consumption growth rate difference between poorest 40% and total population (2015–19 average)	Negative difference	No difference, equal growth	Positive difference	Turkstat 2019	I
Unemployment rate	Number of unemployed persons as a percentage of total number of persons in the labour force, based on national estimates	Top tercile	Middle tercile	Bottom tercile	World Development Indicators	I
Overall governance (World Governance Index)	Measures voice and accountability; political stability and absence of violence; government effectiveness; regulatory quality; rule of law; and control of corruption	Bottom tercile	Middle tercile	Top tercile	Worldwide Governance Indicators	I
Human Capital Index	Calculates the contributions of health and education-to-worker productivity, with scores ranging from 0–1 measuring the productivity as a future worker of a child born today relative to the benchmark of full health and complete education	Bottom tercile	Middle tercile	Top tercile	World Development Indicators	I
Women's empowerment (Global Gender Gap Index)	Benchmarks the evolution of gender-based gaps in economic participation and opportunity, educational attainment, health and survival, and political empowerment. The smaller the index, the larger the gap	Bottom tercile	Middle tercile	Top tercile	WEF 2021	I
Access to basic water	Share of population with access to basic drinking water services	<75%	75–90%	>90%	World Development Indicators	I
Access to safe sanitation	Share of population using safely managed sanitation services and a hand-washing facility with soap and water	<75%	75–90%	>90%	World Development Indicators	I
Access to electricity	Share of population with access to electricity	<75%	75–90%	>90%	World Development Indicators	I
Access to universal health coverage	Coverage index based on tracer interventions including reproductive, maternal, newborn and child health, infectious diseases, noncommunicable diseases, and service capacity and access	<75%	75–90%	>90%	World Development Indicators	I
Access to ICT	UN Telecommunications Infrastructure Index. Number of active mobile-broadband subscriptions, internet users, mobile subscribers, and fixed broadband subscriptions per 100 inhabitants	<75%	75–90%	>90%	UN 2020	I
Access to primary and secondary education	Average of primary and secondary school enrollment (net %)	<75%	75–90%	>90%	World Development Indicators	I
Access to financial services	Account ownership at a financial institution or with a mobile-money-service provider (% of population ages 25+)	Bottom tercile	Middle tercile	Top tercile	World Development Indicators	I
Access to public services for refugees	Availability of policies and programs to support the targeted provision of public services (access to clean water, health, and education services) for refugees	No or limited policies and programs	Some policies and programs exist, but coverage and adequacy can be improved	Policies and programs are in place and have adequate coverage	UNHCR n.d.	II
Social protection coverage	Coverage of social protection and labor programs (% of population)	Bottom tercile	Middle tercile	Top tercile	World Bank ASPIRE	I
Social spending	Social expenditure (cash benefits, direct in-kind goods and services, tax breaks with social purposes) on households (% of GDP)	Bottom tercile	Middle tercile	Top tercile	OECD Data	I
Socioeconomic resilience	Capacity to mitigate the impact of disaster-related asset losses on welfare. Calculated as ratio of asset losses to well-being losses: the lower the rate, the higher the well-being losses in relation to asset losses. Poor people typically experience much higher well-being losses compared to their asset losses	Top tercile	Middle tercile	Bottom tercile	Hallegatte et al. 2017	I

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Adaptation Principle 2: Facilitate the adaptation of people and firms						
Priority Action 2.1. Assess climate and disaster risks, and make this information available						
Hydromet data availability and completeness	Weather and hydrological observation stations produce hydromet observations for different rainfall regimes and timeseries that are long enough to produce probabilistic hazard maps (e.g. availability of a baseline). This information is available to the public for free.	Hydromet data are not available	Data are available for some locations, limited rainfall regimes, and on request/for a fee	Data are available for multiple locations, different rainfall regimes, and publicly available on a web platform	MoEUCC 2018b	II
High-resolution DTM data coverage and availability	High-resolution and accurate DTM and/or point cloud data are complete (measured by share of country covered) and available to the public for free	High-resolution DTM data are not available	High-resolution data cover <60% of the country and are available for a fee	High-resolution data cover >60% of the country and are publicly available on a web platform	Expert judgement	III
National-scale hazard map availability and completeness	Availability and completeness of national-scale hazard maps for all relevant hazards and the whole country in an open GIS format (e.g. metadata are available and complete)	National-scale hazard maps for relevant hazards are not available	Some national-scale hazard maps are available within government, and on request/ for a fee to the public	National-scale maps are publicly available on a web platform for all relevant hazards	AFAD 2020	II
Local-scale hazard maps availability and completeness	Availability and completeness of local-scale (1:10,000 or larger) hazard maps (for all relevant hazards) in an open GIS format (e.g. metadata are available and complete) and their coverage	There are no local-scale hazard maps	Maps are available for some hazards or locations and to the public on request/ for a fee	Maps are publicly available on a web platform for all relevant hazards and priority locations	Consultations	III
Local-scale climate change scenarios	Climate change scenarios are available at relevant scales for subnational and local decision making	Local-scale climate change scenarios are not available	Local-scale climate change scenarios are in development or outdated	Local-scale climate change scenarios are available	MoEUCC 2018b	II
Data platform providing easy access to climate and disaster information	A data platform provides easy access to hazard and climate change scenario data as well as past and current, small- and large-scale events, alongside global platforms such as ThinkHazard!, DesInventar or EM-DAT.	A data platform is not available	A data platform is in development or not kept up to date	A complete data platform is publicly available and up to date	AFAD 2020	II
Community awareness of hazard and vulnerability levels	The government has conducted campaigns and projects to raise awareness among community members about climate and disaster hazards, risks, and vulnerability	No community awareness campaigns are carried out	Some community awareness campaigns are carried out, with limited coverage	Significant community awareness campaigns have extensive coverage	MoEUCC 2018b	II
Climate and disaster risk assessment for main economic sectors	Climate and disaster risk assessment for the main economic sectors are complete and publicly available	Risks have not been assessed	Risks are being assessed	Risks have been assessed, potential opportunities identified and information is publicly available	MoEUCC 2018b Frankfurt School of Finance & Management 2018 World Bank 2019c	II
Priority Action 2.2. Clarify responsibilities and align incentives with A&R objectives						
Institutional responsibilities for disaster and climate risk management	Responsibilities and liabilities for disaster risk management and climate change have been assigned to relevant institutions	Not assigned	Assigned but not effectively implemented	Assigned and effectively implemented	Expert judgement	III
Residual risk target level	Defines acceptable levels of risk and can guide investment decisions to keep residual risk below the target level. These targets can be made public, e.g. through maps of residual flood risks that account for existing protection infrastructure	Residual risk target levels have not been established	Target levels are established, but do not account for all relevant current and future hazards	Target levels are established and account for all relevant current and future hazards	Hallegatte et al. 2020	II
Private sector CCAPs	Plans are developed for major private actors and industries or associations. By preparing CCAPs, the private sector can act against potential physical changes and manage climate change risks	No CCAPs are in place	Some isolated or pilot CCAPs are in place	CCAPs are systematically developed by major private sector actors	Expert judgement	III
Companies integrate A&R in sustainability risk reporting	The private sector considers adaptation and related risks in sustainability risk reporting (e.g. Global Reporting Initiative) and climate change adaptation is becoming an integrated part of environmental and social risk reporting	No sustainability risk reporting framework is in place	A framework is in place but not widely applied/ does not consider climate and disaster risk	A framework that considers climate and disaster risk is in place and commonly applied	World Bank 2021f	II
Priority Action 2.3. Facilitate access to technical solutions for resilience through R&D and trade policies						
Public R&D spending	Environmentally related government R&D budget (% of total government R&D) as a proxy for climate change adaptation and resilience R&D spending	Bottom tercile	Middle tercile	Top tercile	OECD Data	I

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Private sector R&D spending	Share of firms that spend on R&D as a proxy for innovation that can enable solutions for climate change adaptation and resilience	Bottom tercile	Middle tercile	Top tercile	World Bank 2019a	I
Innovativeness of the private sector	Share of firms that introduced a new product of service as a proxy for innovation that can enable solutions for climate change adaptation and resilience	Bottom tercile	Middle tercile	Top tercile	World Bank 2019a	I
Resilience tariff	Average tariff applied to imports of resilience-related technologies	High	Medium to low (in general)	0 tariffs for resilience-related technology imports	World Bank 2019a World Bank 2021d	II
Priority Action 2.4. Ensure financing is available to all, and provide support to the poorest and most vulnerable people						
Most vulnerable populations and communities identified	Most vulnerable populations and communities have been identified through exposure and vulnerability assessments, poverty maps, socioeconomic census, or other means	Populations and communities have not been identified	There are efforts to identify the most vulnerable populations and communities	Vulnerable populations and communities have been identified	AFAD 2020	II
Access to financial services for the bottom 40%	Account ownership at a financial institution or with a mobile-money-service provider, bottom 40% (% of population ages 15+)	Bottom tercile	Middle tercile	Top tercile	World Development Indicators	I
Social protection coverage for the poorest quintile	Coverage of social safety net programs for the poorest quintile (% of population)	Bottom tercile	Middle tercile	Top tercile	World Development Indicators	I
Job opportunities for refugees	Availability of policies and programs to provide sustainable and decent job opportunities to help refugees integrate into host communities	No/few policies and programs provide decent job opportunities for refugees	Some policies and programs provide job opportunities but coverage and adequacy can be improved	Policies and programs are in place and have adequate coverage	World Bank 2015	II
Priority Action 2.5. Facilitate structural change in the economic system						
Diversification of the economy (Economic Complexity Index)	Ranks countries based on the diversity and complexity of their export basket, as a proxy for economic diversification. High-complexity countries have a range of sophisticated, specialized capabilities and are can produce a highly diversified set of complex products	Bottom tercile	Middle tercile	Top tercile	The Growth Lab 2021	I
Strategy to manage the decline of sunset sectors	Sunset sectors and activities are identified and a strategy to manage the impacts is in place (job retraining, social protection, etc.)	Sunset sectors not identified; no strategy is in place	Sunset sectors identified but there is no strategy to manage their decline	Sunset sectors identified and a strategy is in place and published	World Bank 2019b IFC and EBRD 2013 MoD 2019	II
Strategy to support the development of sunrise sectors	Economic sectors and activities that may benefit from the physical (e.g., increase in agricultural yields or suitable areas) and transition (e.g., due to economic structure change) impacts of climate change are identified; and a strategy to support and maximize the benefits is in place	Sunrise sectors not identified	Sunrise sectors identified but there is no strategy to support them	Sunrise sectors identified and a strategy to support them is in place and published	OECD 2016 World Bank 2019a	II
Adaptation Principle 3: Adapt urban and land use plans and protect critical public assets and services						
Priority Action 3.1. Identify critical public assets and services						
Critical assets and infrastructure identified	A geolocated inventory of public assets and infrastructure, including health and education buildings is in place and up to date	There is no inventory of critical assets and infrastructure	Inventories exist, but they are incomplete or out of date	Inventory exists and is complete and up to date	Expert judgement	III
Vulnerability of critical assets and infrastructure assessed	The vulnerability of critical assets and infrastructure has been assessed through exposure and vulnerability analyses	Vulnerability of critical assets and infrastructure has not been assessed	Vulnerability of critical assets and infrastructure is partially assessed	Vulnerability of critical assets and infrastructure is assessed and up to date	Expert judgement	III
Logistics Performance Index	Perceptions of logistics based on efficiency of customs clearance, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time. The index ranges from 1 to 5, with a higher score representing better performance.	Bottom tercile	Middle tercile	Top tercile	World Development Indicators	I
Energy Architecture Performance Index	Composite index of energy system performance, including energy system efficiency, delivery, access, and environmental performance	Bottom tercile	Middle tercile	Top tercile	WEF 2017	I
Priority Action 3.2. Design and implement a government-wide strategy to increase the resilience of infrastructure systems and public assets						
Resilient infrastructure investment needs	Increase in annual investments needed to make infrastructure more resilient by 2030 (% of baseline investment costs without resilience considerations)	Top tercile	Middle tercile	Bottom tercile	Hallegatte et al. 2019	I
Long-term resilient infrastructure plan	A strategy to manage critical infrastructure and services is approved and published	No strategy or plan in place	A strategy or plan is being developed or it exists but is outdated or does not consider resilience	A strategy or plan is in place, complete with resilience considerations and up to date	Expert judgement	III

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Resilient infrastructure agency	An fully operational agency with a clear operational mandate coordinates resilience of critical assets and infrastructure	Agency is not in place and responsibilities have not been mandated	Agency is under development or responsibilities are clearly mandated	Agency is in place and operational	Expert judgement	III
Infrastructure maintenance budget	An adequate maintenance budget for critical infrastructure is in place	The maintenance budget is inadequate	The maintenance budget is partially adequate	The maintenance budget is adequate	MoD 2019	II
Asset management system	An operational asset management system exists and includes an inventory of critical infrastructure, its condition, exposure to hazards, and maintenance history and evidence-based maintenance plans	No asset management system is in place	A system is in place but does not contain all elements or is out of date	A full system is in place, regularly updated and used to carry out preventive maintenance	MoD 2019	II
Construction standards for infrastructure	Construction standards for infrastructure are established, accounting for local hazards and criticality, and an enforcement mechanism is in place	Construction standards do not account for local hazards and criticality and are not enforced	Locally relevant construction standards are in place, but are not effectively enforced	Locally relevant construction standards are in place and an efficient enforcement mechanism ensures most infrastructure is up to standard	Expert judgement	III
Construction standards and codes for buildings	Construction standards and building codes are updated, accounting for local hazards and criticality, and an enforcement mechanism is in place	Building standards and codes are not updated, do not consider local hazards or criticality, and there is no effective enforcement	Locally relevant construction standards and building codes are in place, but an effectively enforced	Locally relevant construction standards are in place and an efficient enforcement mechanism ensures most buildings are up to standard	Ilki and Celep 2012	II
Priority Action 3.3. Revise urban and land use plans to make them risk-informed						
Institutional and regulatory framework for urban and land use planning	Clear national urban and land use planning legislation requires the preparation and regular updating of plans using multi-hazard risk information, participatory approaches, and linkages across administrative boundaries and socioeconomic development plans, and assigns responsibilities to relevant agencies	Legislation is not in place	A framework is in place but key A&R elements are missing	A framework is in place and incorporates key elements of A&R	MoEU 2010 MoAF 2016	II
Identifying areas that are at risk	Areas that are impossible or too costly to protect against climate change impacts are identified and communicated to the public	Areas are not identified	Areas are partly identified	Areas are identified and communicated to the public	World Bank, forthcoming	II
Number of qualified planners per capita	There are enough qualified planners with technical capacity to incorporate disaster risk into planning. The benchmark for an adequate number of qualified planners is 1 per 30,000 people	There are insufficient (untrained) planners	There are enough planners, but they do not all have the necessary training	The number of trained planners is adequate	Expert judgement	III
Quality of urban plans	Urban plans are in place, up to date, and aligned with national objectives, consider disaster risk, are accompanied by implementation plans, and communities and stakeholders are involved in planning	Plans are not in place	Some cities have plans or plans are in place but lack key A&R elements	All/major cities have an urban plan and incorporate key A&R elements	Expert judgement	III
Financing for implementing urban plans	Budget is available for implementing urban plans, including to include DRM measures	Financing for implementation is insufficient	Financing for implementation is sufficient, but there is no DRM budget	Financing is available and includes DRM budget	Expert judgement	III
Priority Action 3.4. Increase the resilience of the agriculture sector and ensure food security						
Food vulnerability	Composite indicator capturing a food system's vulnerability to climate change, in terms of production, demand, nutrition, population, etc., including projected change of cereal yields, projected population growth, food import dependency, rural population, agriculture capacity, and child malnutrition. The lower the score, the higher the food security.	Top tercile	Middle tercile	Lower tercile	ND-GAIN	I
CSA strategy	A CSA strategy or plan has been developed that addresses the most prominent hazards and risks and assigns responsibility for identified adaptation actions	Climate risks and impacts for the sector have not been assessed and there is no CSA strategy and/or action plan in place	Climate risks and impacts have been assessed but a comprehensive CSA strategy and/or action plan is either not in place or outdated	Climate risks and impacts have been assessed and a comprehensive CSA strategy and/or action plan is in place, up to date, and with clear responsibilities	MoEU 2011 Bagherzadeh and Shigemitsu 2021	II

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Agriculture EWS	An EWS is in place that produces and disseminates trend and forecast information on crop and livestock price information to producers, weather and climate forecasts, and pests/disease information	An EWS is not in place	AN EWS is in place but out of date or not widely and/or effectively applied	An EWS is in place and applied widely and effectively	MoEUCC 2018b	II
Agriculture insurance	An agricultural insurance system is in place and includes climate hazards that cover a large share of all producers	There is no system in place	A system is in place but omits main climate hazards and/or has low coverage	A system is in place, includes main climate hazards and has high coverage	MoEUCC 2018b TARSIM 2019, 2020 Bagherzadeh and Shigemitsu 2021	II
Ex-post assessment of drought impacts	An up-to-date repository of damages and losses from droughts exists and is available to the private sector	A repository is not in place	A repository is in place but not available to the private sector	A repository is in place, up to date and available to the private sector	Bagherzadeh and Shigemitsu 2021	II
Public agricultural research expenditure	Agricultural R&D policy commits to climate change research and a mechanism that promotes collaborative research among multiple stakeholders is in place and in use	There is no commitment to climate change research	Commitment to climate change research is not prominent; effective collaborative mechanisms are not in place	There is strong commitment to climate change research; effective collaborative mechanisms are in place	MoAF 2016a	II
Agricultural land irrigated	Share of arable land equipped for irrigation (%) (3-year average)	Bottom tercile	Middle tercile	Upper tercile	FAOSTAT	I
Priority Action 3.5. Increase the resilience of water infrastructure and WRM						
WRM strategy incorporating climate change considerations	Climate change adaptation considerations are integrated into existing and new WRM strategies, plans and legislation	Adaptation considerations are not integrated	Adaptation considerations are partially integrated	Adaptation considerations are fully integrated	MoEU 2011 MoEUCC 2018b	II
Dedicated WRM agencies	A dedicated WRM agency or agencies are in place with functional coordination mechanism on WRM across the main subsectors—water supply and sanitation (WSS), WRM, and irrigation	An agency is not in place	An agency is in place but has limited functional coordination mechanisms	An agency is in place with effective functional coordination mechanisms across water subsectors	MoEUCC 2018b World Bank 2020b	II
National water information system	NWIS includes regularly updated WSS infrastructure inventory and is used in decision making on WRM across the water subsectors (e.g. water supply and sanitation, irrigation)	NWIS is not in place	NWIS is in place but out of date or not used effectively in decision making	NWIS is in place and used in decision making	World Bank 2020b	II
Water productivity	Calculated as GDP in constant prices, divided by annual total water withdrawal (constant 2015 US\$ GDP/m ³ of total freshwater withdrawal) and is a measure of water security for high-value economic sectors	Bottom tercile	Middle tercile	Upper tercile	World Development Indicators	I
Untreated water discharge	Share of residential and industrial wastewater that is discharged untreated to natural water bodies	>25%	25–10%	<10%	MoEUCC 2018a World Bank 2020b	II
Priority Action 3.6. Increase the resilience of the health system						
IHR average score	Average of the scores recorded for the 13 capacities assessed under the WHO IHR in the SPAR. These encompass the capacities needed to detect, assess, notify, report, and respond to public health risk and acute events of domestic and international concern	Bottom tercile	Middle tercile	Top tercile	WHO IHR	I
Health care expenditure	Health care expenditure as a percentage of GDP	Bottom tercile	Middle tercile	Top tercile	WHO GHED	I
Health sector emergency response plan	A national health sector emergency response plan is in place and up to date	No plan is in place	A plan is under development or in place but out of date	A plan is in place and up to date	MoH 2021	II
Health risk communication	Established and functioning health risk communication mechanisms exist, including a National Risk Communications Plan for Health Emergencies. Based the WHO's IHR capacity #10. The thresholds for the indicator ratings are the same as those applied by the WHO IHR	IHR score <21	IHR score = 21–61	IHR score >61	WHO IHR	I
Surge demand health capacity	Number of health workers is adequate to meet surge demand in emergency situations. The WHO recommends 4.45 doctors, nurses, and midwives per 1,000 population for operational routine services, plus a 30% surge capacity and 1 field epidemiologist per 200,000 people	Bottom tercile	Middle tercile	Top tercile	OECD Data	I
Medical countermeasures stockpiles	Availability of medical countermeasures stockpiles (i.e. vaccines, therapeutics, and diagnostics) for national use during public health emergencies	Stockpile is not available	Stockpile is available but there are no clear procurement rules	Stockpile is available and includes clear procurement rules	WHO e-spar	II

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Priority Action 3.7. Increase the resilience of the education system						
Disaster-proof schools	Share of schools that are disaster-proof	<40% of schools are disaster-proof	40–80% of schools are disaster-proof	>80% of schools are disaster-proof	UNISDR 2015b	I
Operational standards for use of schools as shelters	Operational standards for the alternative use of schools as shelters during emergency situations are in place	Standards are not in place	Standards are under development or in place but out of date	Standards are in place and up to date	AFAD 2022	II
Safe and continued learning environment	Education sector plans and guidelines include DRM measures, education continuity plans are in place, and these documents are up to date	Education sector plans and guidelines do not include DRM measures	Education sector plans and guidelines include DRM measures but continuity plans are not in place or outdated	Education sector plans and guidelines include DRM measures and continuity plans are in place and up to date	Expert judgement	III
Resources to enable remote learning	Share of households that have access to a computer at home	Bottom tercile	Middle tercile	Top tercile	OECD Data	I
A&R included in the education curriculum	An age-specific climate change adaptation and DRM curriculum is in place and teachers are trained with technical and pedagogical skills to raise thorough disaster awareness and deliver distance education	Curriculum is not in place and teachers have not been trained	Curriculum is not in place but some efforts are underway	Curriculum is in place and widely applied; teachers are trained	Consultations	III
Priority Action 3.8. Increase the resilience of forests and other natural ecosystems						
Use of NBS for A&R	A strategy or specific regulations regarding the use of NbS to increase climate and disaster resilience has been approved and published	There is no strategy/ regulation in place	Strategy/ regulation is partially developed, outdated, or not adequately budgeted for and implemented	Strategy/ regulation is in place and adequately budgeted for and implemented	MoEU 2011	II
Forests and climate change strategy	Strategy is developed and implemented to incorporate climate change in forest management and planning, based on a sectoral vulnerability assessment, and includes developing options that facilitate adaptation of natural ecosystems to climate change impacts with clearly assigned responsibilities to relevant agencies	There is no strategy in place	Strategy is partially developed, outdated, or inadequately budgeted for/ implemented	Strategy is in place and adequately budgeted for and implemented	MoEU 2011	II
Blue economy strategy	Strategy and/or action plan is in place and up to date to enable the sustainable, resilient, and inclusive management of marine and coastal resources, considering the effects of climate change on coastal areas based on vulnerability studies	There is no strategy/ action plan in place	Strategy/plan is partially developed, outdated, or not adequately budgeted for/ implemented	Strategy is in place and adequately budgeted for and implemented	MoEU 2011	II
Natural capital accounting	SEEA framework is implemented to keep track of the quantity and quality of natural capital in the country	SEEA is not adopted	Efforts are being made but SEEA is not fully integrated into national accounts	SEEA framework is being implemented and integrated into national accounts	Statistical Commission 2018	II
Land degradation	Proportion of land that is degraded over total land area (%)	Top tercile	Middle tercile	Bottom tercile	Sachs et al. 2021	I
Biodiversity Habitat Index	Composite indicator assessing countries' actions toward retaining natural ecosystems and protecting the full range of biodiversity within their borders, including terrestrial biome protection (weighted for national and global rarity of biomes), MPAs, Protected Areas Representativeness Index, Species Habitat Index, Species Protection Index, and Biodiversity Habitat Index. A score closer to 100 indicates better performance across all indicators.	Bottom tercile	Middle tercile	Top tercile	Yale University Environmental Performance Index	I
Ecosystem Services Index	Composite indicator recognizing the important services ecosystems provide to human and environmental well-being, including carbon sequestration and storage, biodiversity habitat, nutrient cycling, and coastal protection, with three indicators to evaluate the loss of tree cover, grassland, and wetland. A score closer to 100 indicates better performance across all indicators.	Bottom tercile	Middle tercile	Top tercile	Yale University Environmental Performance Index	I
Adaptation Principle 4: Help firms and people manage residual risks and natural disasters						
Priority Action 4.1. Save lives (and money) with hydromet, early warning, and emergency management systems						
Daily weather forecasts	Daily weather forecasts produced by the hydromet agency and easy-to-communicate alert system in place	Agency does not produce weather forecasts	Agency produces weather forecasts but not daily/ in easy-to-communicate formats	Agency produces daily weather forecasts in easy-to-communicate formats	MoEUC 2018b AFAD 2019 MoD 2019	II
Impact-based forecasting	IBF provides the information needed to act before disasters to minimize the socioeconomic costs of weather and climate hazards. The indicator assesses the level of development and application of IBF	IBF is not used	The country has started using IBF approaches	IBF is well established and functioning	Expert judgement	III

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
EWS for natural hazards	An effective EWS for climate extremes and relevant natural hazards is in place, including effective communication channels between institutions and with the target population	EWS for the main natural hazards are not in place	EWS exist for some hazards; communication systems exist but are not effective	EWS exist for all major hazards and effective communication systems are in place	MoEUCC 2018b AFAD 2019 MoD 2019	II
Early warning communication and dissemination	Early warning message recipients are efficiently notified and take notice of the warning on time	The lack of mass communication channels for disseminating information limits reach	A multichannel dissemination approach increases capability to reach the entire population	A multichannel dissemination approach reaches the entire population and can geotarget warnings	MoEUCC 2018b AFAD 2019 MoD 2019	II
EP&R management system	EP&R legislation, regulation, strategies, and plans exist, and there are clear government and private sector accountabilities to ensure public safety service delivery and resilience	There is no EP&R management system	Some legislation, regulation, strategies, and plans exist but need improvement/ are not implemented effectively	Appropriate national legislation, regulation, strategies, and plans exist and are implemented effectively	AFAD 2019	II
EP&R training	A formal EP&R training program exists for all involved in emergency response, which establishes the required skillset and experience and is subject to evaluation and review to ensure ongoing improvement of the training program	There is no EP&R training program	There is no formal EP&R training program; ad hoc trainings are provided	A formal EP&R training program with all key elements is in place	AFAD 2019	II
Emergency service and shelter capacity	Measured by number of emergency medical service units, trained health emergency professionals, number of drills performed, and the availability of modern, well-kept, and sufficient emergency response equipment and shelters	There is insufficient capacity	There is some capacity, but it can be improved	There is sufficient capacity	AFAD 2020	II
Effective crisis response coordination mechanism	A coordination mechanism is in place between the various preparedness actors in key government agencies, including the ministries of interior, social protection, health, agriculture and finance	There is no mechanism in place	Mechanism is in place but is not effective	Mechanism is in place and effectively used	AFAD 2019	II
Community emergency response plans	Existence of up-to-date community emergency response plans with broad coverage	There are no community disaster response plans	Few communities have plans in place and these are not systematically revised	The most at-risk communities have plans in place and these are revised systematically	Expert judgement	III
Priority Action 4.2. Provide all firms and households with risk management instruments						
National strategy for managing residual climate and disaster risks	A comprehensive national strategy for managing residual climate and natural disaster risks is prepared, approved, operationalized, and regularly updated	Not in place or not publicly available	In place but outdated or not effectively implemented	In place and effectively implemented	Expert judgement	III
Financial instruments uptake to cope with shocks	Degree to which people are covered by financial instruments (insurance, social protection, access to emergency borrowing, remittances, sufficient savings) to cope with shocks	Financial instruments are generally lacking	Instruments are in place but uptake is low	Instruments are in place with sufficient uptake	World Development Indicators AFAD 2020 OECD Data	II
Priority Action 4.3. Develop the insurance sector, building on public-private partnerships						
Non-life insurance penetration	Average non-life insurance premium to GDP between the years 2008–17. Non-life insurance includes policies for people, property, and from disasters	Bottom tercile	Middle tercile	Upper tercile	IMF Climate Change Indicators Dashboard	I
Private sector disaster risk insurance	Degree to which insurance schemes are in place that increase the resilience of the private sector (e.g. farmers' insurance against climate change impacts, fire, or earthquake risk insurance)	Insurance schemes are not in place	Insurance schemes are in place but uptake is low	Insurance schemes are in place with sufficient uptake	Expert judgement	III
Building stock insurance	Dwelling/building stock insurance is in place, covering losses to buildings from natural disasters	Insurance is not in place	Insurance is in place, but with low coverage	Insurance is in place with enough coverage	OECD 2015	II
Priority Action 4.4. Build a social protection system and make it responsive to shocks						
Social registry coverage and targeting	Social registry coverage is extensive (including potential beneficiaries in case of scale-up) and targets high-risk households	Registry covers a small share of the population/ does not target high-risk households	Registry covers a significant share of the population and targets high-risk households	Registry covers (close to) the entire population, including high-risk households	Expert judgement	III

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Interoperable social protection (SP) and DRM information systems	SP and DRM information systems are interoperable (including those used for postdisaster household assessment data collection), risk-informed, and used to inform DRM actions (e.g. risk maps use social protection data on vulnerability)	There is no data sharing between social protection and DRM	There is some data sharing, but very limited interoperability	Information systems are interoperable and risk-informed and DRM actions are informed by social protection data	Expert judgement	III
Multiple SP delivery mechanisms	Multiple and accessible benefit delivery mechanisms (such as manual cash transfer systems (over the counter, electronic, or via mobile phone payments) help facilitate adaptation to the post-shock environment and choice of beneficiary	There is a single method delivery mechanism, with no post-shock adaptability	There is some flexibility in post-shock benefit delivery	Multiple and accessible mechanisms help facilitate post-shock adaptation and choice of beneficiary	Expert judgement	III
Adaptive social protection (ASP)	Existing SP programs (cash transfers, public works, etc.) integrate climate and disaster risk and include aspects to increase resilience, such as contingent plans to scale up social protection systems allowing for adaptive social protection adjustments in response to shocks	SP programs are not adaptive	SP programs are adaptive but no contingent plans are in place	SP programs are adaptive and contingent plans allow for scale up	Smith and Bowen 2022	II
Priority Action 4.5. Help firms develop BCPs and financial preparedness						
Firms with BCPs	Firms have assessed risks from natural hazards and climate change and developed BCPs to hedge against risks and increase preparedness	No/few firms in vulnerable sectors have BCPs	Some firms in the vulnerable sectors have BCPs	Most firms in the vulnerable sectors have BCPs	Business for Goals 2020	II
Access to finance for firms	Share of firms identifying access to finance as a constraint to their business. Used as a proxy for access to finance for adaptation due to the lack of more specific data	Bottom tercile	Middle tercile	Top tercile	World Bank 2021f	II
Generator ownership	Share of firms that own a generator	Bottom tercile	Middle tercile	Upper tercile	World Bank 2019a	I
Revenue lost due to outages	Average losses due to electrical outages (% of annual sales) among firms	Upper tercile	Middle tercile	Bottom tercile	World Bank 2019a	I
Priority Action 4.6. Be prepared to build back better after disasters, with contingency plans and financing						
Resilient recovery and reconstruction principles and guidelines	Resilient recovery and reconstruction principles and guidelines are in place, including enhanced standards for resilience	There are no principles or guidelines in place	Principles/guidelines are in place, without enhanced standards for resilience	Principles/guidelines are in place with enhanced standards for resilience	Expert judgement	III
Emergency procurement planning and procedures	Updated annual or multi-annual procurement plans with disaster response provision are included in the annual budget, disaster emergency procurement procedures, and accompanying documents and templates—standard operating procedures, handbooks, user guides, or other manuals—with instructions for procurement in postdisaster situations	There are no plans in place	Plans are in place but lack detailed procedures/are not effectively applied	Emergency procurement plans and procedures are in place and effectively applied	Expert judgement	III
Reconstruction time	Average time to rebuild 75% of assets destroyed in the aftermath of a 200-year earthquake event	>5 years	1–5 years	<1 year	World Bank 2021c	II
Adaptation Principle 5: Manage financial and macrofiscal issues						
Priority Action 5.1. Include contingent liabilities from natural disasters and environmental shocks in the planning and budgeting process						
Climate and disaster risks are assessed and considered in fiscal policies	Fiscal risks from climate change and natural disasters are assessed and reflected in fiscal risk statements and fiscal policies	Risks are not assessed/ included in fiscal risk statements	Risks are assessed but are not considered in fiscal policies and risk statements	Risks are assessed and reflected in fiscal policies and risk statements	World Bank 2021d	II
Contingent liabilities are quantified and included in budget documents	Explicit and implicit contingent liabilities (including risk to public assets and emergency and SP spending needs) are assessed and included in budget documents	Liabilities are not assessed and not included in the budget	Liabilities are assessed but not systematically included in the budget	Liabilities are assessed and systematically included in the budget	World Bank 2021d	II
Institutional arrangements for public financial management during emergencies	The central finance agency has clearly assigned powers/authority during states of emergency to enhance the management of public finances as needed to expedite disaster response, including clearly defined coordination mechanisms with the national disaster management agency	Agency has no or limited authority and coordination	Agency has authority but duties, activities, and coordination with national agency are unclear	Agency has clear granted authority and defined coordination mechanisms with national agency	Government of Türkiye 2009, 2011	II
Priority Action 5.2. Develop a financial strategy to manage contingent liabilities, combining multiple instruments						
National climate and DRF strategy	DRF needs are assessed and a national climate and DRF strategy is in place to manage contingent liabilities, including alternative risk instruments to allow immediate increase of financial response capacity against natural hazards and better protect fiscal balances	There is no strategy in place	Strategy is not in place but some financial instruments are operational	Strategy is in place, including layered financial instruments	Expert judgement	III

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Use of climate and DRF instruments	The country uses several climate and DRF instruments, including budgetary instruments (reserve fund specially designated for disaster-related expenditures, general contingency budgets), contingent financing instruments (contingency credit lines, Catastrophe Deferred Drawdown Options (Cat-DDOs) and market-based instruments (catastrophe bonds/swaps, parametric insurance, or sector-specific instruments that complement ASP)	Climate and DRF instruments are not used	Some climate and DRF instruments are used	All relevant instruments are adopted and part of a national DRF strategy	Expert judgement	III
Emergency budget allocation	Clear emergency budget guidelines exist, including for recurrent low-severity events such as localized floods, storms, or landslides	Emergency budget reallocation is not applied	Emergency budget reallocation is applied ad hoc without clear guidelines or mechanisms	Emergency budget reallocation is systematically applied and guided by clear guidelines and mechanism	Government of Türkiye 2021	II
Process to manage ex-post financial assistance inflow	Process in place to effectively and efficiently manage inflow of international aid in case of major disasters, including using existing financial instruments to coordinate delivery	There is no process to manage inflow of international aid	Process is in place but can be improved to enhance efficiency and flexibility of internal delivery	Process is in place, and internal delivery mechanism is flexible and efficient	World Bank 2021d	II
Priority Action 5.3. Anticipate and plan for long-term macroeconomic impacts						
Proportion of tax revenues from high-vulnerability sectors	Share of tax revenue contributions originating from sectors that are highly vulnerable to climate and disaster risks	Vulnerable sectors' tax contribution is high, posing a significant risk for government revenue	Vulnerable sectors' tax contribution is somewhat high, posing a moderate risk for government revenue	Vulnerable sectors' tax contribution is low, posing a minimum risk for government revenue	World Bank 2021d	II
Long-term plan to diversify tax revenues	A long-term plan to diversify tax revenues away from climate and disaster-vulnerable sectors is developed and in place	There is no long-term plan to diversify tax revenues	A plan exists but does not explicitly consider the most vulnerable sectors	A plan is in place	MoTF 2021	II
Debt sustainability or financial sector assessment program considers climate and disaster impacts	Climate and disaster impacts are included in debt sustainability assessment or financial sector assessment program	Debt sustainability or financial sector assessments do not that consider climate and disaster impacts	Assessments somewhat consider climate and disaster impacts or are starting to do so	Assessments considers climate and disaster impacts as an established practice	World Bank 2021d	II
Priority Action 5.4. Communicate and mitigate the disaster and climate risk exposure of the financial sector						
Integration of climate and disaster risks into business processes by banks, insurers, and large investors	Climate and disaster risks are identified and integrated in business processes and portfolios (e.g. lending, investments) and are measured and reported	Banks, insurers, and large investors do not consider climate and disaster risks	Banks, insurers, and large investors have identified and begun to consider climate and disaster risks	Climate and disaster risks and management are fully integrated in business processes and portfolios	World Bank 2021f TSKB 2021	II
Specific disaster and climate risk requirements in bank, insurer, and large investor regulations	Regulations for banks, insurers, and large investors include specific disaster and climate risk requirements	There are no specific disaster and climate risk requirements in regulations	Some specific risk requirements are in place or under development	Regulations for banks, insurers, and large investors have specific risk requirements	World Bank 2021f	II
Quantified estimates of exposure to natural hazards required for banks, insurers, and large investors	Quantified estimate of exposure to natural hazards are required for banks, insurers, and large investors	Banks, insurers, and large investors have no quantified estimates of their exposure to natural hazards	Some banks, insurers, and large investors conduct quantified estimates of their exposure to natural hazards but not systematically	Banks, insurers, and large investors systematically conduct quantified estimates of their exposure to natural hazards	World Bank 2021f TSKB 2021	II
Climate and disaster risk stress tests for banks, insurers, and large investors	Banks, insurers, and large investors undertake stress testing for climate and disaster risks under at least two climate scenarios	Banks, insurers, and large investors do not undertake stress tests	Some banks, insurers, and large investors conduct stress tests but not systematically	Banks, insurers, and large investors systematically undertake stress tests	World Bank 2021f	II

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Adaptation Principle 6. Application: Prioritization, implementation, and monitoring progress						
Priority Action 6.1. Create a strong institutional and legal framework, with appropriate stakeholder involvement						
Climate change law	A climate change law and related regulations are in place	There is no climate change law in place	A climate change law is under development or review by parliament	A climate change law is in place and up to date	World Bank, forthcoming	II
A&R governance framework	The executive, judiciary, and legislative bodies have the authority and capacity to review executive A&R action/inaction, enforce executive and legislative action on A&R and review and implement government A&R policies	A&R governance effectiveness by the executive, judiciary, and legislative is low	A&R governance effectiveness by the executive, judiciary, and legislative is moderate	A&R governance effectiveness by the executive, judiciary, and legislative is high	World Bank, forthcoming	II
Government coordination mechanism for A&R policies and actions	A whole-of-government coordination mechanism for A&R policies and actions is in place including a committee or body responsible for climate change adaptation and resilience and a horizontal (including all relevant ministries) and vertical (including local governments, public institutions, the private sector, and other relevant organizations) participation structure	There is no mechanism in place	Mechanism is in place but lacks integration of all relevant parties	Mechanism is in place and functioning effectively	MoEUC 2018b World Bank, forthcoming	II
Effective stakeholder involvement	There is effective stakeholder engagement for A&R that allows for integrating all stakeholders' needs in policy development and planning	There is no engagement or participation	There is limited participation	There is inclusive and effective participation	MoEUC 2018b World Bank, forthcoming	II
Priority Action 6.2. Design an A&R strategy with prioritized actions						
National Climate Change Adaptation Strategy	A national climate change adaptation strategy and/or action plan is in place and implemented	There is no strategy or plan in place	A strategy or plan is in place but not effectively implemented	A strategy or plan is in place and effectively implemented	MoEUC 2018b	II
National communications (NCs) and biennial reports (BRs)	NCs and BRs are regularly submitted to the UNFCCC with good-quality information on vulnerability and adaptation assessments and strategies	NCs and BRs are not regularly submitted	NCs and BRs are regularly submitted, but A&R information is limited	NCs and BRs are regularly submitted with good-quality A&R information	MoEUC 2018b MoEUC 2019	II
LTS	An LTS for climate change is in place and includes A&R considerations and objectives	LTS is not in place	LTS with A&R objectives is under development	LTS with A&R objectives is in place	Expert judgement	III
NDC	An NDC is in place under the UNFCCC, is regularly updated, and incorporates A&R considerations	There is no NDC in place	NDC is in place but not updated/ does not consider A&R	NDC is regularly updated and considers A&R	UNFCCC n.d. Climate Action Tracker 2021	II
Priority Action 6.3. Set concrete sector-level targets to guide implementation by line ministries and local governments						
NDP incorporates A&R targets	The strategic framework of the economy/finance/planning ministries incorporates and is aligned with A&R targets set in the national CCAP	NDP does not incorporate A&R targets	NDP incorporates some A&R targets, but they are not aligned with the National Climate Change Adaptation Strategy	NDP incorporates A&R targets in line with the National Climate Change Adaptation Strategy	MoD 2019	II
Tasking central ministries to tackle climate change issues	Central economy, finance, and planning ministries are tasked with and effectively implement clear functions and responsibilities on climate change issues	Climate change tasks and functions are not assigned to central ministries	Tasks and functions have been assigned but are not effectively implemented	Tasks and functions are assigned and effectively implemented	World Bank, forthcoming	II
Sectoral A&R priority setting and implementation	Sectoral A&R priorities are set by line ministries and accompanied by an established implementation plan	Sectoral A&R priorities are not in place	Some line ministries set sectoral A&R priorities / these are not effectively implemented	Line ministries set and effectively implement sectoral A&R priorities	OECD 2019b	II
Clear A&R functions assigned between national and local authorities	A clear organizational structure and functional assignment is in place for designing and/or implementing A&R policies and actions between national and local authorities and administrations	A clear structure is not in place	Structure is under development or in place but not effective	Structure is in place and effective	World Bank, forthcoming	II
Regional A&R priority setting and implementation	Regional A&R priorities have been identified in collaboration with local authorities and stakeholders and regional CCAPs are developed and implemented	Regional CCAPs have not been developed	Regional CCAPs have been/are being developed but not effectively implemented	Regional CCAPs are in place and effectively implemented	World Bank, forthcoming	II

Indicator	Definition	Nascent	Emerging	Established	Source	DQ
Local climate change action	Local CCAPs are developed with objectives and priorities identified and implemented for A&R	Local CCAPs have not been developed	Some local CCAPs have been/are being developed but A&R objectives and priorities are underdeveloped or not implemented	Local CCAPs have been/are being developed, and A&R objectives and priorities are developed and implemented	UNDP 2021	II
Priority Action 6.4. Screen all public policies and expenditures for climate and disaster risks and align them with adaptation targets						
Disaster and climate-informed public investment management	The government considers disaster risk and climate change in public investment planning and management	Disaster risk and climate change are not considered	Disaster risk and climate change are considered, but not systematically	Disaster risk and climate change are systematically considered	World Bank, forthcoming	II
Green taxonomy considering A&R	A green taxonomy is in place and considers A&R	Green taxonomy is not in place	Green taxonomy is under development or in place but does not consider A&R	Green taxonomy in place and considers A&R	World Bank 2021f	II
SOEs identify and consider climate- and disaster-related risks	SOEs have identified DRM and climate change risks and develop adaptation and resilience strategies/plans or include them in their LTS and decision making	SOEs have not identified and do not consider risks in their decision making	Some SOEs have included risks in their LTS and decision making	Most SOEs have included risks in their LTS and decision making	MoD 2019 World Bank, forthcoming	II
Priority Action 6.5. Allocate appropriate funding to the adaptation strategy						
National budget allocates funding for A&R actions	The national budget is used as a policy instrument for setting DRM and climate adaptation priorities over the short and medium terms and allocates resources to cover A&R financing needs	A&R financing needs are not/minimally reflected	A&R financing needs are partially reflected	A&R financing needs are adequately reflected	World Bank, forthcoming	II
Subnational governments budget for A&R actions	Requirements are in place for subnational governments to allocate budget for A&R actions	Subnational governments are not required to budget for A&R actions	There is a requirement to budget for A&R actions, but it is not effectively implemented	The requirement for subnational governments to budget for A&R is effectively implemented	World Bank, forthcoming	II
Environmental protection spending	Environmental protection spending (% of GDP); includes all activities and actions that have as their main purpose the prevention, reduction, and elimination of pollution as well as any other degradation of the environment, is used as a proxy for A&R spending	Bottom tercile	Middle tercile	Upper tercile	OECD Data	I
Private sector A&R financing	Mechanisms such as PPPs are in place to increase the availability of financial instruments for A&R for the private sector	Mechanisms are not in place	Some mechanisms are in place but need further development to expand private sector participation in A&R financing	Mechanisms are in place and starting to be widely used	World Bank 2021f	II
Priority Action 6.6. Track progress over time, and review and revise the strategy						
A&R M&E	An M&E plan for A&R planning and implementation is in place	There is no plan in place	A plan is in place but not implemented	A plan is in place and implemented	World Bank, forthcoming	II
Independent monitoring of A&R progress	Availability of an independent body or third party assigned to review A&R progress	There is no independent monitoring	Independent monitoring is in place but not effectively implemented	There is effective independent monitoring of A&R progress	World Bank, forthcoming	II
Disaster-related expenditure tracking and review	Mechanisms to track disaster-related expenditures, such as Postdisaster Public Financial Management Reviews (PD-PFM), are in place, implying that the legislature systematically scrutinizes postdisaster expenditures, issues recommendations, and follows up on their implementation, and independent bodies perform frequent reviews	PD-PFM or other mechanisms are not conducted	PD-PFM or other mechanisms are conducted but not systematically and are not effectively followed up	PD-PFM or other mechanisms are conducted systematically and are effectively followed up	Expert judgement	III