Climate Change Adaptation and Implementation Plan for the Southeastern Anatolia Region

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List of Abbreviations

Abbreviation	Full Name
AFAD	Disaster and Emergency Management Authority (Afet ve Acil Durum Yönetimi Başkanlığı)
DSİ	State Hydraulic Works (Devlet Su İşleri Genel Müdürlüğü)
MoAF	Ministry of Agriculture and Forestry (Tarım ve Orman Bakanlığı)
MoEUCC	Ministry of Environment, Urbanization and Climate Change (Çevre, Şehircilik ve İklim Değişikliği Bakanlığı)
MoH	Ministry of Health (Sağlık Bakanlığı)
MoNE	Ministry of National Education (Milli Eğitim Bakanlığı)
MENR	Ministry of Energy and Natural Resources (Enerji ve Tabii Kaynaklar Bakanlığı)
TOKİ	Housing Development Administration of Turkey (Toplu Konut İdaresi Başkanlığı)
TARSİM	Agricultural Insurance Pool (Tarım Sigortaları Havuzu)
TEDAŞ	Turkish Electricity Distribution Corporation (Türkiye Elektrik Dağıtım A.Ş.)
TEİAŞ	Turkish Electricity Transmission Corporation (Türkiye Elektrik İletim A.Ş.)
MGM	Turkish State Meteorological Service (Meteoroloji Genel Müdürlüğü)
TSE	Turkish Standards Institution (Türk Standartları Enstitüsü)
GAP	Southeastern Anatolia Project (Güneydoğu Anadolu Projesi)
TÜBİTAK	Scientific and Technological Research Council of Turkey (Türkiye Bilimsel ve Teknolojik Araştırma Kurumu)
NGOs	Non-Governmental Organizations
SMEs	Small and Medium-Sized Enterprises
KOSGEB	Small and Medium Enterprises Development Organization (Küçük ve Orta Ölçekli İşletmeleri Geliştirme ve Destekleme İdaresi Başkanlığı)
UNDP	United Nations Development Programme
UNCCD	United Nations Convention to Combat Desertification
GIS	Geographic Information Systems
SMS	Short Message Service
R&D	Research and Development

Abbreviation	Full Name
SLM	Sustainable Land Management

1. Introduction

The Southeastern Anatolia Region, with its semi-arid climate, unique topography, and growing population, is increasingly vulnerable to the impacts of climate change. Rising temperatures, shifting precipitation patterns, prolonged droughts, and more frequent extreme weather events such as floods and storms are already being observed across the region. These climate-related risks not only threaten the natural environment but also pose serious challenges to the region's agriculture, water resources, urban systems, public health, and socio-economic stability.

Major cities such as Diyarbakır, Şanlıurfa, and Gaziantep are experiencing intensified urban pressures, including heatwaves, water scarcity, and infrastructure strain, exacerbated by the urban heat island effect and rapid urbanization. Meanwhile, rural communities face reduced agricultural productivity, pasture degradation, and water shortages, heightening their vulnerability and limiting their adaptive capacity.

In response, this Climate Change Adaptation and Implementation Plan aims to provide a comprehensive, actionable roadmap to strengthen the region's resilience to climate risks. It identifies sector-specific vulnerabilities and presents practical adaptation strategies and implementation actions across key domains, including water management, agriculture, energy, health, biodiversity, and urban infrastructure. The plan also emphasizes nature-based solutions, climate-sensitive planning, institutional coordination, and community engagement as essential pillars for effective adaptation.

By integrating scientific knowledge, local experience, and participatory approaches, the Southeastern Anatolia Region can transition toward a more climate-resilient and sustainable future. This plan serves not only as a regional policy framework but also as a living document that will evolve as climate data improves and adaptation needs emerge over time.

2. Meteorological and Climatic Extreme Events (Floods, Storms, Droughts)

As climate change intensifies, Southeastern Anatolia is increasingly experiencing the adverse effects of extreme weather events—particularly floods, storms, and prolonged droughts. Urban areas such as Diyarbakır, Şanlıurfa, and Gaziantep are especially vulnerable due to rapid urbanization, inadequate infrastructure, and limited preparedness. This section outlines comprehensive adaptation and mitigation measures aimed at enhancing the region's resilience to meteorological and climatic hazards. It includes region-wide strategic actions such as early warning systems and emergency preparedness, alongside specific structural and non-structural interventions designed to reduce urban flood and inundation risks. The combined implementation of these actions will help safeguard communities, infrastructure, and economic stability in the face of growing climate threats.

- **Integrated early warning systems** should be established and modernized across the region, with localized SMS, mosque loudspeaker, and radio alerts reaching even remote communities.
- **Disaster response teams** should be trained at the provincial level, and regular multi-agency simulation exercises should be conducted to ensure preparedness.
- **Climate risk insurance schemes and emergency relief funds** should be expanded and made accessible to vulnerable households and farmers.
- **Post-disaster reconstruction efforts** should incorporate resilient infrastructure standards, following "build back better" principles.
- **A regional climate adaptation knowledge center** should be founded to monitor trends, publish annual reports, and update planning strategies.
- **Public awareness campaigns** on floods, heatwaves, and droughts should be implemented through multimedia channels, schools, and local engagement.
- **Neighborhood-based alert and response systems** should be formed through volunteer networks and community-level action groups.
- **Psychosocial support units** should be mobilized to provide emergency mental health services following extreme climate events.

2.1. Urban Flood and Inundation Adaptation & Mitigation Actions

2.1.1. Structural Adaptation Measures

Urban Drainage System Expansion and Upgrading

- *Existing stormwater networks should be expanded with increased pipe capacity.*
- *Secondary and tertiary drainage lines should be added in newly urbanizing or flood-prone districts.*
- *Pumping stations should be installed in low-lying zones to discharge excess water during flash floods.*

Retention and Detention Basins

- *Stormwater detention basins should be constructed to temporarily store runoff and reduce peak flow.*
- *Underground retention tanks beneath parking lots and public parks can help buffer floodwater surges.*

Permeable Urban Surfaces

- *Use of permeable paving materials (e.g., porous asphalt, permeable bricks) in sidewalks, parking areas, and plazas should be increased to enhance infiltration.*
- *Mandatory green infrastructure standards should be included in new urban development plans.*

Green Infrastructure for Stormwater Management

- *Bioswales, rain gardens, vegetated swales, and tree trenches should be installed in city landscapes to absorb and filter runoff.*
- *Riverbanks should be stabilized using vegetation buffers rather than concrete walls to slow runoff.*

Urban River Channel Restoration and Maintenance

- *Riverbeds and urban canals should be restored to their natural floodplain functions.*
- *Encroachments and illegal construction along rivers should be removed, and sediment buildup should be regularly cleared.*

Elevation of Critical Infrastructure

- *Roads, bridges, hospitals, and electrical substations in flood-prone areas should be elevated above the projected flood level.*
- *Backup power systems and drainage for underground metro stations and tunnels should be reinforced.*

Construction of Flood Barriers and Diversion Channels

- *Levees, embankments, and diversion canals should be built to redirect floodwaters away from populated areas.*
- *Smart gates and flap valves should be installed at stormwater outlets to prevent backflow from rising rivers.*

Stormwater Harvesting Systems

- *Buildings (especially public facilities) should be equipped with rooftop rainwater harvesting systems to capture water during extreme rainfall, reducing overload on drainage.*

2.1.2. Non-Structural Adaptation Measures

Urban Flood Risk Zoning and Land Use Planning

- *Flood hazard maps should be developed and integrated into zoning regulations.*
- *Construction in floodplains should be restricted or prohibited through updated master plans.*

Early Warning and Urban Alert Systems

- *Real-time rainfall and river level monitoring stations should be connected to municipal alert systems.*
- *City-wide alerts should be disseminated via SMS, mobile apps, and sirens in flood-prone neighborhoods.*

Flood Emergency Preparedness and Evacuation Planning

- *Neighborhood-based evacuation plans should be developed with designated routes and shelter points.*
- *Regular public drills and simulations should be carried out in collaboration with civil defense units.*

Flood Insurance Expansion

- *Urban households and businesses in high-risk zones should be encouraged to enroll in subsidized flood insurance.*
- *Local authorities should assist in registering low-income families for microinsurance products.*

Community Awareness and Education Programs

- *Municipalities should conduct education campaigns on flood preparedness, drainage maintenance, and self-protection measures.*
- *Materials should be culturally appropriate and multilingual (e.g., Turkish, Kurdish, Arabic).*

Monitoring and Maintenance Protocols for Urban Drainage

- *Municipalities should establish maintenance schedules for drain cleaning, manhole inspection, and blockage removal before rainy seasons.*
- *Incentives should be offered for private property owners to maintain and clear drainage on their premises.*

Integration of Flood Data into Urban Planning Tools

- *Urban planners should incorporate hydrological modeling into infrastructure siting, road design, and building permits.*
- *A centralized GIS-based flood risk portal should be developed for local use.*

Governance and Institutional Coordination

- *Local governments, AFAD, DSİ, and meteorological authorities should establish inter-agency flood management task forces.*
- *Roles and responsibilities during extreme weather events should be defined clearly across municipal departments.*
- *Roles and responsibilities during extreme weather events should be defined clearly across municipal departments.*

Figure 1. Some Examples for Adaptation and Mitigation Actions for Urban Flood and Inundation Risk Management

Table 1. Meteorological and Climatic Extreme Events Adaptation and Mitigation Measures – Southeastern Anatolia

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Integrated Early Warning Systems	Timely warning to reduce disaster impact	SMS, mosque loudspeakers, local radio alerts	AFAD, MGM, Municipalities, GSM operators, Religious Affairs
Provincial Disaster Response Teams	Increase emergency readiness	Train local teams; conduct regular simulations	AFAD, Red Crescent, Municipalities, Health Directorate
Climate Risk Insurance Schemes	Financial resilience for vulnerable groups	Expand insurance access for farmers and low-income households	TARSİM, Ministry of Agriculture, Insurance Agencies, NGOs
Resilient Post-Disaster Reconstruction	Reduce future vulnerability	Apply “build back better” principles in rebuilding	Ministry of Environment, AFAD, Municipalities
Regional Climate Adaptation Knowledge Center	Data-driven planning and strategy update	Monitor trends; publish reports; support planning	Universities, TÜBİTAK, Ministry of Environment
Public Awareness Campaigns	Increase climate literacy and preparedness	School programs, media outreach, community workshops	Municipalities, MoNE, NGOs, Local Media
Neighborhood-Based Response Systems	Community-level preparedness	Form volunteer groups; create local response plans	Mukhtars, Municipalities, NGOs, Youth Organizations
Psychosocial Emergency Support	Address mental health impacts of disasters	Deploy crisis response psychologists and counselors	Ministry of Health, Red Crescent, NGOs
Urban Drainage Expansion and Upgrading	Reduce surface flooding	Upgrade pipes; install secondary drainage; build pump stations	DSİ, Municipalities, Infrastructure Departments
Retention and Detention Basins	Manage stormwater surges	Build basins; install underground tanks	DSİ, Municipalities, Urban Development Agencies
Permeable Urban Surfaces	Enhance water infiltration, reduce runoff	Use permeable materials in urban design	Municipalities, Ministry of Environment, Contractors
Green Infrastructure	Natural water absorption and filtration	Install bioswales, rain gardens, vegetated buffers	Municipalities, NGOs, Landscape Architects
River Channel Restoration	Restore floodplain functions	Clear encroachments; maintain riverbeds	DSİ, Municipalities, Environment Directorates

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Elevation of Critical Infrastructure	Protect essential services	Elevate roads, bridges; install backup systems	Municipalities, MoH, Energy Firms, TCDD
Flood Barriers and Diversion Channels	Redirect floodwaters safely	Build levees, diversion canals, smart floodgates	DSİ, Municipalities, Construction Firms
Stormwater Harvesting	Reduce runoff pressure on drainage systems	Install rooftop systems in public buildings	Municipalities, Public Building Administrations
Flood Risk Zoning	Restrict construction in high-risk areas	Develop flood maps; update zoning laws	Municipalities, Urban Planning Departments
Real-Time Monitoring and Alert Systems	Enable immediate action	Install sensors; integrate alerts with mobile apps	AFAD, MGM, IT Departments of Municipalities
Flood Evacuation Planning	Ensure safe relocation of residents	Design routes, shelters; conduct drills	AFAD, Civil Defense, Local Governments
Flood Insurance Promotion	Financial protection for urban populations	Provide subsidies; register low-income households	Ministry of Treasury and Finance, Insurance Firms
Community Education on Floods	Foster self-protection behaviors	Workshops, pamphlets in multiple languages	Municipalities, MoNE, Local NGOs
Drainage Maintenance Protocols	Maintain system efficiency	Schedule cleanings; incentivize private upkeep	Municipalities, Site Management Associations
Integration of Flood Data in Planning	Avoid risk-prone development	Use GIS, hydrological models in planning	Urban Planners, Universities, DSİ
Institutional Coordination	Streamline response efforts	Define roles; form inter-agency task forces	Municipalities, AFAD, DSİ, MGM

3. Water Scarcity and Drought Managemen

3.1. Introduction

Southeastern Anatolia faces increasing pressure on its water resources due to rising temperatures, declining precipitation, and growing demand from agriculture and urbanization. The region's vulnerability to prolonged droughts and water scarcity threatens food security, ecosystem health, and the sustainability of rural livelihoods. This section outlines a strategic framework to manage and adapt to these challenges through efficient water use, improved infrastructure, proactive drought planning, and watershed protection. The proposed actions aim to build long-term water resilience by integrating both technological and nature-based solutions, while promoting sustainable governance and equitable access to water resources.

- **Agricultural irrigation systems** should be upgraded to water-saving drip and sprinkler technologies, supported by farmer incentives.
- **Rainwater harvesting and micro-storage infrastructure** should be installed in rural and urban areas using GIS-based site selection.
- **Leak detection and water reuse programs** should be implemented in municipal water networks to reduce loss and enhance efficiency.
- **Drought management plans** should be developed with clear thresholds, emergency water allocation, and rationing protocols.
- **Watershed afforestation and conservation projects** should be launched in critical catchment zones using native, drought-tolerant species.
- **Groundwater levels** should be routinely monitored, and extraction should be regulated to ensure long-term sustainability.
- **Water pricing mechanisms** should be reviewed and adjusted to incentivize conservation and discourage excessive use.
- **Seasonal drought outlook reports** should be produced regularly to inform policymakers, water managers, and farmers.

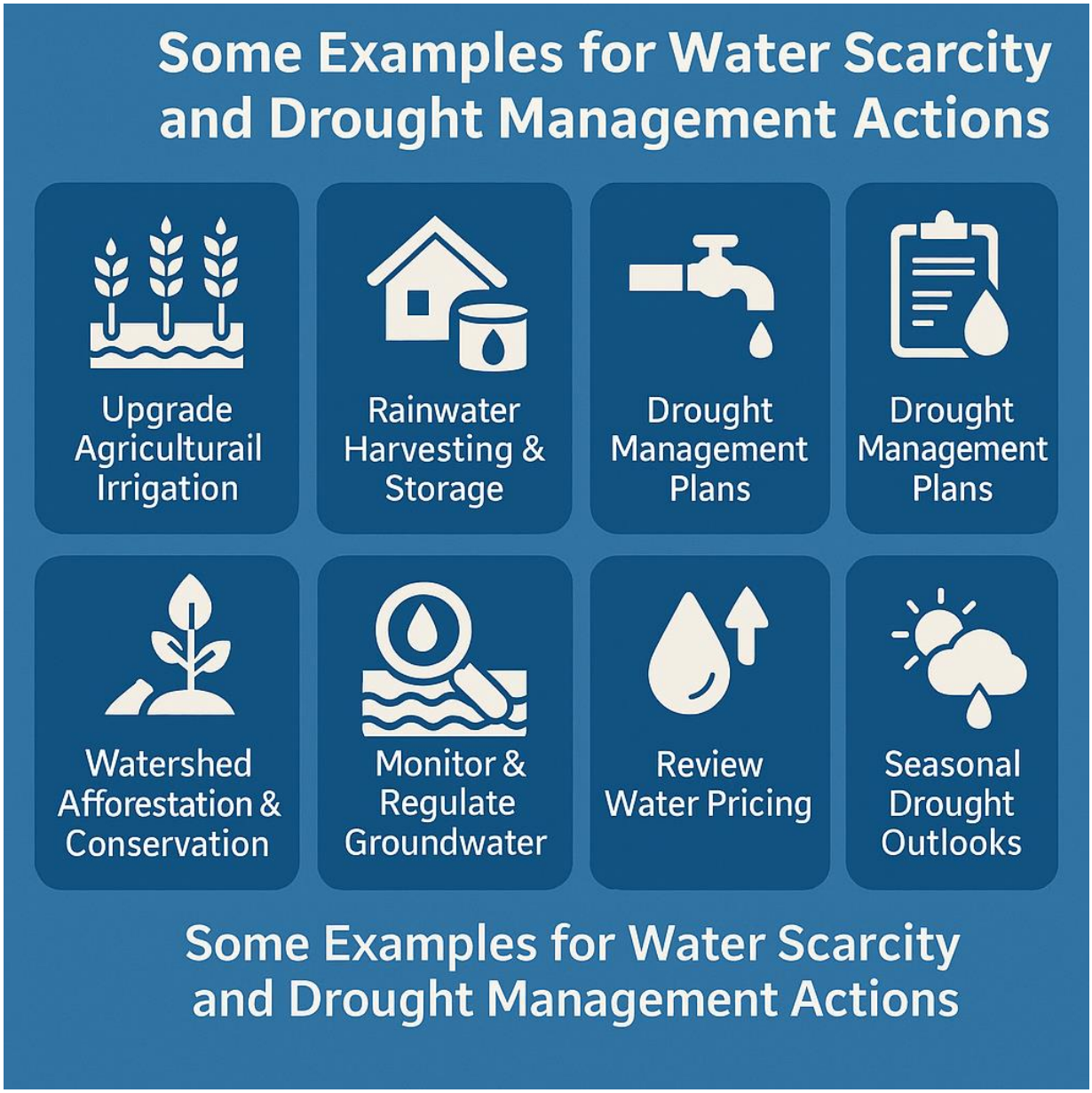

Figure 2. Some Examples for Water Scarcity and Drought Management Adaptation Actions in Southeastern Anatolia

Table 2. Adaptation Actions and Implementation Measures for water scaricity and drought management– Southeastern Anatolia

Adaptation Actions	**Purpose**	**Implementation Actions**	**Institutions/Organizations for Cooperation**
Modernization of Agricultural Irrigation Systems	Reduce water consumption in agriculture	Promote and subsidize drip and sprinkler systems	Ministry of Agriculture and Forestry (MoAF), DSI, Agricultural Chambers, GAP Administration

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Rainwater Harvesting and Micro-Storage	Capture alternative water sources and buffer droughts	Use GIS tools to identify locations; install tanks and small reservoirs	Municipalities, MoAF, Universities, NGOs
Leak Detection and Water Reuse in Urban Networks	Improve urban water efficiency	Conduct network audits; install smart meters; promote greywater reuse	Municipal Water Utilities (e.g., DESKİ, GASKİ), MoEUCC, Private Sector
Development of Drought Management Plans	Prepare for water shortages systematically	Define drought thresholds, emergency allocation rules, and rationing plans	AFAD, MoAF, DSI, Water Authorities
Watershed Afforestation and Conservation	Enhance water retention and ecosystem resilience	Plant native, drought-tolerant trees; prevent erosion in headwaters	General Directorate of Forestry, Municipalities, NGOs
Groundwater Monitoring and Regulation	Prevent over-extraction and aquifer depletion	Install monitoring wells; enforce extraction permits and limits	DSI, MoAF, Local Water Boards, Universities
Water Pricing Mechanism Review	Encourage efficient and fair water use	Adjust tariffs; apply increasing block rates for high users	Ministry of Treasury and Finance, Municipalities, Water Utilities
Seasonal Drought Outlook Reports	Provide early warning and inform decision-making	Develop regional models; distribute forecasts to users	MGM, Universities, DSI, Agricultural Extension Services

4. Agriculture and Food Security

4.1. Introduction

Agriculture remains a cornerstone of the Southeastern Anatolia Region's economy and rural livelihoods, yet it is increasingly threatened by the impacts of climate change. Rising temperatures, unpredictable rainfall, and more frequent droughts are reducing crop yields, stressing livestock systems, and undermining food security. This section presents targeted adaptation strategies to build a more resilient and sustainable agricultural sector. It emphasizes the adoption of drought-tolerant crops, climate-smart farming practices, improved irrigation

governance, and expanded insurance coverage. Additionally, it supports diversification of rural incomes, the integration of digital technologies, and inclusive programs that empower women and young farmers in the transition to climate-resilient agriculture.

- **Drought-tolerant crop varieties** should be developed, demonstrated, and adopted through farmer field schools and extension programs.
- **Climate-smart agricultural techniques** such as conservation tillage, mulching, and rotational cropping should be encouraged to maintain soil moisture and fertility.
- **Irrigation governance and agricultural insurance coverage** should be expanded to improve equity and resilience to weather shocks.
- **Livestock and rangeland systems** should be adapted through rotational grazing plans, shade infrastructure, and sustainable water points.
- **Income diversification opportunities** (e.g., agroforestry, beekeeping, eco-tourism) should be promoted through grants, training, and cooperative models.
- **Digital tools and precision agriculture technologies** should be introduced to optimize planting, irrigation, and harvesting decisions.
- **Agrobiodiversity and traditional seed systems** should be preserved and supported through community seed banks and research programs.
- **Special support programs for women and young farmers** should be designed to encourage participation in climate-resilient agriculture.

Figure 3. Some Examples for Adaptation Actions in Agriculture and Food Security in Southeastern Anatolia

Table 3. Adaptation Actions and Implementation Measures for agriculture and food management– Southeastern Anatolia

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Development and Adoption of Drought-Tolerant Crops	Increase resilience to water stress and maintain yields	Conduct R&D; implement farmer field schools and demonstration sites	MoAF, Universities, TAGEM, Agricultural Chambers
Promotion of Climate-Smart Agriculture Practices	Improve soil health, conserve moisture, and reduce emissions	Train farmers in conservation tillage, mulching, and rotational cropping	MoAF, GAP Administration, NGOs, Extension Services
Improved Irrigation Governance and Insurance	Ensure equitable water access and protection from losses	Expand participatory water user associations; increase insurance access	DSI, TARSİM, MoAF, Cooperatives
Adaptation of Livestock and Rangeland Systems	Reduce heat stress and protect pasturelands	Develop grazing rotation plans; install shade structures and water points	MoAF, Veterinary Services, Pastoral Associations
Rural Income Diversification	Reduce dependence on climate-sensitive activities	Support agroforestry, apiculture, and eco-tourism via grants and cooperatives	Development Agencies, MoAF, NGOs, Local Governments
Integration of Digital Agriculture Tools	Optimize inputs and boost climate resilience	Introduce apps, remote sensing, and precision farming tools	TÜBİTAK, Tech Startups, MoAF, Agricultural Tech Providers
Preservation of Agrobiodiversity and Traditional Seeds	Protect genetic resources and ensure seed access	Support seed banks, traditional farming knowledge, and local varieties	Universities, MoAF, Seed Associations, Farmers' Unions
Programs for Women and Young Farmers	Ensure inclusive transition to resilient agriculture	Offer training, credit access, and mentorship for youth and women	MoAF, Women's Cooperatives, Youth Platforms, NGOs

5. Sustainable Energy

5.1. Introduction

As climate change accelerates, the need for a resilient and low-carbon energy system in Southeastern Anatolia has become increasingly urgent. Rising temperatures, expanding energy demand—particularly for cooling—and climate-induced disruptions to infrastructure call for a rapid transition to cleaner, more efficient, and adaptive energy solutions. This section outlines a comprehensive approach to sustainable energy development, focusing on the expansion of renewable sources such as solar and wind, integration of hybrid systems, and the promotion of energy efficiency across buildings and industry. It also highlights the importance of climate-sensitive urban planning, decentralized energy production, and support mechanisms for local communities and small businesses, all aimed at reducing emissions while enhancing regional energy security and climate resilience.

- **Solar and wind energy investments** should be rapidly expanded through public-private partnerships and incentives.
- **Hybrid hydro-solar systems** should be implemented at major dam sites to optimize renewable energy output and water use.
- **Energy efficiency programs** in buildings and industry should be launched, including home retrofits and industrial equipment upgrades.
- **Energy infrastructure** should be climate-proofed by reinforcing transformers, burying vulnerable power lines, and upgrading substations.
- **Community-based solar cooperatives** should be piloted to democratize energy production and reduce household costs.
- **Urban planning** should integrate passive building design and thermal insulation standards to reduce cooling needs.
- **Climate-sensitive urban design** should be adopted to reduce energy use, such as shaded pathways and reflective materials.
- **Energy consumption audits** in industrial zones should be conducted, and conversion support programs should be provided for SMEs.

Figure 4. Some Examples for Adaptation Actions in Sustainable Energy in Southeastern Anatolia

Table 4. Adaptation and Implementation actions for Sustainable Energy –Southeastern Anatolia

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Expansion of Solar and Wind Energy Investments	Reduce dependency on fossil fuels and enhance energy security	Provide investment incentives; establish public-private partnerships for large-scale installations	Ministry of Energy and Natural Resources (MENR), EPDK, Private Sector, Development Agencies
Implementation of Hybrid Hydro-Solar Systems	Maximize renewable output and efficient water-energy use	Integrate floating or adjacent solar systems at dams	DSI, MENR, Municipalities, Energy Companies
Launching Energy Efficiency Programs	Reduce emissions and energy costs in residential and	Retrofit buildings; replace inefficient industrial equipment	MoEUCC, Industrial Zones, Chambers of Commerce, Municipalities

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
	industrial sectors		
Climate-Proofing Energy Infrastructure	Prevent energy disruptions during extreme weather events	Reinforce transformers; bury lines; upgrade substations	TEDAŞ, TEİAŞ, Municipalities, AFAD
Piloting Community-Based Solar Cooperatives	Democratize energy production and reduce local energy costs	Support local cooperatives with grants and training	Cooperatives Union, Municipalities, NGOs, GAP Administration
Integrating Passive Design and Insulation in Urban Planning	Lower energy demand for cooling and improve comfort	Update zoning codes; promote green buildings and thermal standards	MoEUCC, Municipalities, Urban Planners
Adopting Climate-Sensitive Urban Design	Reduce urban heat and cooling loads	Install reflective surfaces, tree-lined walkways, and ventilation corridors	MoEUCC, Universities, Architects' Chambers
Conducting Energy Audits and SME Transition Programs	Improve industrial energy performance	Offer audits, technical assistance, and conversion grants	KOSGEB, Organized Industrial Zones, MENR, TÜBİTAK

6. Public Health and Safety

6.1. Introduction

Climate change presents growing risks to public health in Southeastern Anatolia, including rising incidence of heat-related illnesses, waterborne diseases, and mental health impacts following extreme weather events. Vulnerable populations—such as children, the elderly, and low-income communities—are particularly at risk. This section outlines a proactive and inclusive approach to protecting public health by enhancing early warning systems, strengthening disease surveillance, and climate-proofing health infrastructure. It also emphasizes the importance of public education, workforce training, and the integration of climate and health awareness into school curricula, aiming to build long-term community resilience and adaptive capacity in the face of evolving climate challenges.

- **Heat-health early warning systems** should be established, and municipalities should designate cooling centers and activate heat action protocols during extreme events.
- **Drinking water safety plans** should be developed for all major utilities, with emergency provisions for water testing, purification, and distribution.
- **Disease surveillance systems** should be strengthened and integrated with climate data to anticipate outbreaks and enable rapid response.
- **Healthcare infrastructure** should be upgraded to ensure continuity of services during disasters, including backup energy systems and flood protection.
- **Public health education campaigns** should be implemented to raise awareness about heatstroke, water hygiene, and disease prevention in multiple languages.
- **Mobile health response teams** should be established to provide medical and mental health services during and after climate-related disasters.
- **Healthcare staff** should be trained in climate-sensitive risk factors, including heat-related illnesses and vector-borne diseases.
- **School curricula** should incorporate basic climate-health education to foster awareness from a young age.

Figure 5. Some Examples for Adaptation Actions in Public Health and Safety in Southeastern Anatolia

Table 5. Adaptation and implementation actions for Public Health and Safety –Southeastern Anatolia

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Establishment of Heat-Health Early Warning Systems	Reduce heat-related morbidity and mortality	Set up alert systems; designate cooling centers; implement heatwave action plans	Ministry of Health, Municipalities, AFAD, Turkish State Meteorological Service
Development of Drinking Water Safety Plans	Ensure clean water access during climate disruptions	Prepare water safety plans; stock emergency purification equipment and mobile distribution units	Municipal Water Utilities, MoEUCC, Public Health Directorates
Strengthening of Disease Surveillance Systems	Detect and respond to climate-sensitive disease outbreaks	Integrate climate and health data; build lab capacity and response protocols	Ministry of Health, Universities, Local Health Units, TÜİK

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Climate-Proofing of Healthcare Infrastructure	Maintain health service delivery during climate disasters	Elevate facilities in flood-prone areas; install backup generators and cooling systems	Ministry of Health, TOKİ, Municipalities, DSİ
Public Health Education Campaigns	Increase awareness of climate-health risks and preventive behavior	Multilingual campaigns on heatstroke, water hygiene, and infectious disease prevention	Ministry of Health, NGOs, Local Media, Religious Leaders
Establishment of Mobile Health Response Teams	Reach vulnerable and remote populations during disasters	Equip mobile units for emergency medical and mental health care	Provincial Health Directorates, Red Crescent, AFAD
Training of Healthcare Workers on Climate Risks	Build healthcare system capacity for climate-induced health threats	Provide continuing education on heat, vector-borne, and water-related illnesses	Medical Chambers, Ministry of Health, Universities
Integration of Climate-Health Education into Schools	Raise future generations' awareness and preparedness	Add modules to science and life-skills curricula on climate-health links	Ministry of National Education, Teachers' Unions, NGOs

7. Urban Infrastructure and Resilient Cities

7.1. Introduction

The rapid urbanization of Southeastern Anatolia's major cities—such as Diyarbakır, Şanlıurfa, and Gaziantep—has heightened the vulnerability of urban populations to the impacts of climate change. Increasingly frequent flash floods, water stress, and extreme heat events are placing significant strain on aging infrastructure and public services. This section outlines a set of comprehensive actions to strengthen the climate resilience of urban systems. These include enhancing drainage capacity, promoting green infrastructure, revising urban planning regulations, and improving emergency preparedness.

A key priority within this framework is addressing the **urban heat island effect**, which exacerbates heat-related health risks and energy demand in densely built areas. The plan

proposes integrated solutions such as urban greening, reflective materials, passive building design, and community engagement to reduce localized heat stress and improve urban livability. Together, these measures aim to build safer, cooler, and more adaptive cities in the face of ongoing climate challenges.

7.2. Adaptation Actions

- **Urban drainage systems** should be expanded and retrofitted to handle increased rainfall and mitigate flash flooding.
- **Green infrastructure** (e.g., urban parks, bioswales, permeable pavements) should be developed to manage stormwater and reduce heat islands.
- **Alternative water supply systems** (e.g., groundwater, desalination, treated wastewater reuse) should be explored and implemented to secure urban water needs.
- **Building codes and zoning regulations** should be revised to incorporate climate risks and resilience criteria such as elevation, insulation, and rainwater harvesting.
- **Evacuation and emergency response plans** should be updated and regularly practiced, particularly in high-risk urban districts.
- **Heat-resilient urban planning** should be promoted by using reflective materials, expanding tree canopy cover, and orienting streets/buildings to maximize shade and airflow.
- **Smart city technologies** (e.g., real-time flood sensors, energy use dashboards) should be adopted to improve responsiveness to climate impacts.
- **Community engagement in urban resilience** should be prioritized through participatory planning workshops and localized climate action programs.

Figure 6. Some Examples for Adaptation Actions in Urban Infrastructure and Resilient Cities in Southeastern Anatolia

7.3. Reducing Urban Heat Island Effect in Major Cities

- Urban green spaces should be expanded significantly by planting drought-resistant trees, particularly in heat-vulnerable neighborhoods.
- Green roofs and vertical gardens should be promoted for public buildings, schools, and commercial centers.
- Light-colored and reflective roofing and paving materials should be mandated for new buildings and public infrastructure.
- Asphalt surfaces should be replaced or coated with heat-reflective materials where feasible.
- Building orientation and design should incorporate passive cooling strategies such as cross-ventilation and shading.
- Urban planning should prioritize pocket parks and mini green zones within dense neighborhoods.
- Cooling corridors (green-lined streets and open spaces) should be designed to facilitate airflow and mitigate localized heating.
- Public awareness campaigns should be launched to encourage citizen participation in tree care and building insulation improvements.

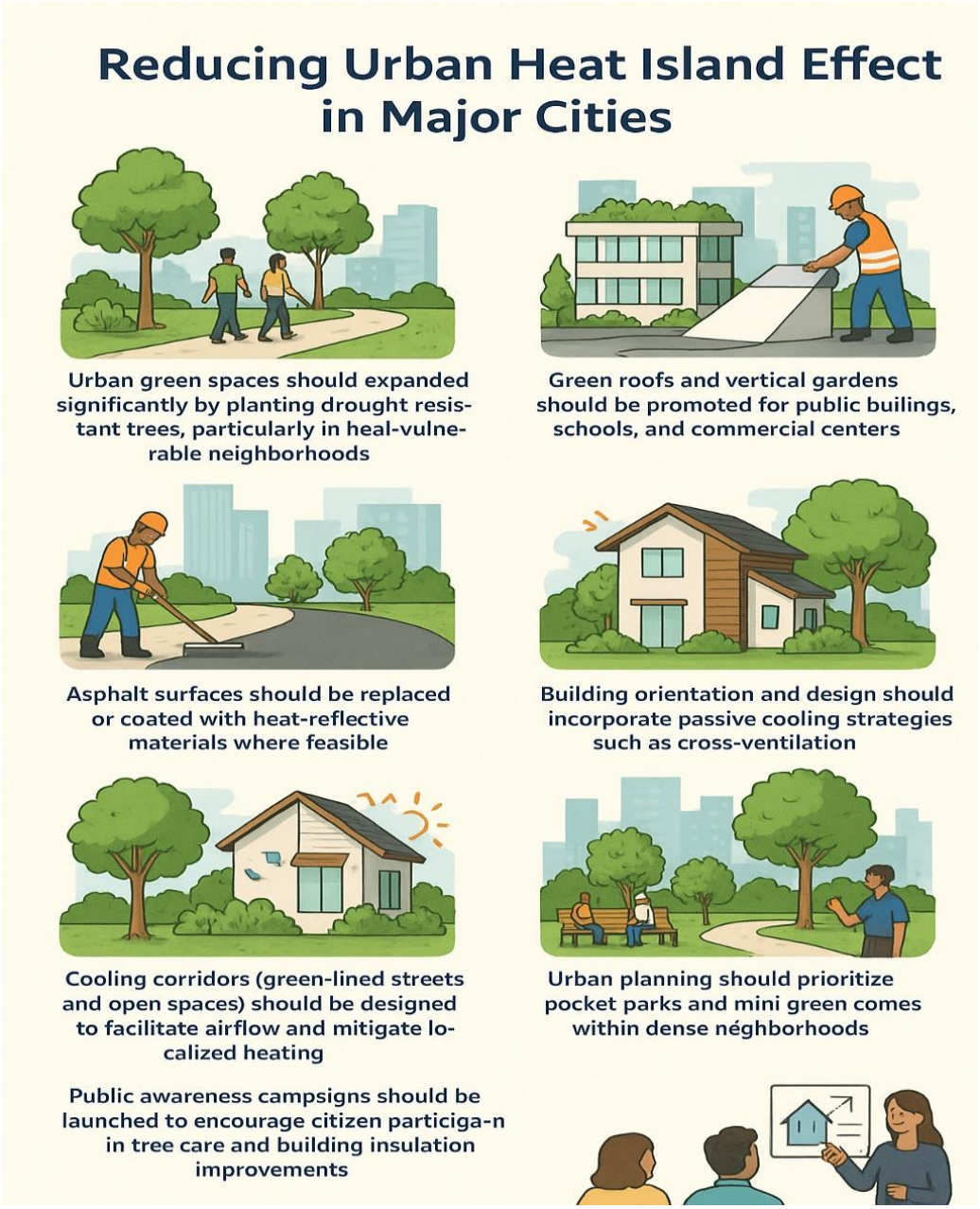

Figure 7. Some Examples for Adaptation Actions to Reduce the Urban Heat Island Effect in Major Cities

Table 6. Adaptation and implementation actions for Urban Infrastructure and Resilient Cities-Southeastern Anatolia

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Expansion and retrofitting of urban drainage systems	Prevent urban flooding during extreme rainfall	Upgrade storm drains; integrate floodplain zoning	Municipalities, İller Bankası, DSİ, MoEUCC
Development of green infrastructure	Manage stormwater and reduce urban heat	Establish parks, bioswales, green pavements	Municipalities, NGOs, Landscape Architects Chambers
Alternative urban water supply systems	Ensure water security in times of shortage	Utilize treated wastewater, explore groundwater and desalination	Municipal Water Utilities, TSE, Universities
Revision of building codes and zoning laws	Integrate resilience into construction and planning	Mandate rainwater harvesting, insulation, elevated structures	Ministry of Environment, Urbanization and Climate Change (MoEUCC), Municipal Councils
Modernization of emergency plans	Enhance preparedness and response capacity	Update evacuation routes; run community drills	AFAD, Municipalities, Fire Departments, Red Crescent
Promotion of heat-resilient urban planning	Reduce urban temperatures and health risks	Apply reflective materials; orient buildings for airflow	MoEUCC, Architects Chambers, Urban Planners
Adoption of smart city technologies	Improve real-time climate responsiveness	Install sensors, dashboards, climate monitoring tools	Smart City Units, Universities, Tech Companies
Community engagement programs	Increase public participation and local solutions	Conduct resilience workshops; co-create climate actions	NGOs, Local Leaders, Neighborhood Associations

Table 7. Adaptation and Implementation Actions for Reducing the Urban Heat Island Effect – Specific Actions

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Expansion of urban green spaces	Cool dense neighborhoods, improve air quality	Plant drought-tolerant trees, especially in vulnerable areas	Municipalities, Forestry Directorate, Local NGOs
Promotion of green roofs and vertical gardens	Insulate buildings and increase vegetation	Provide grants and incentives for green infrastructure on buildings	MoEUCC, TOKİ, Chambers of Architects and Engineers

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Use of reflective roofing and paving materials	Lower surface temperatures and reduce cooling demand	Mandate light-colored surfaces in new developments	Building Inspectors, MoEUCC, Construction Sector
Replacement or coating of asphalt surfaces	Reflect solar radiation to mitigate heat	Apply cool coatings or alternative materials	Municipal Technical Services, Asphalt Producers Association
Passive building design strategies	Reduce indoor heat without mechanical cooling	Encourage cross-ventilation, shading, natural airflow	Building Code Commissions, Universities
Development of pocket parks and mini green zones	Provide local cooling and community space	Reclaim small plots for greenery in urban cores	Local Authorities, Green NGOs
Creation of cooling corridors	Facilitate airflow and reduce heat buildup	Design tree-lined streets, open green networks	Urban Planning Offices, MoEUCC, Academic Experts
Public awareness and citizen involvement	Foster a culture of urban climate action	Launch campaigns on tree maintenance, insulation	Media, Schools, Environmental NGOs

8. Biodiversity and Ecosystem Resilience

8.1. Introduction

Biodiversity and healthy ecosystems are critical to the Southeastern Anatolia Region's environmental stability, water regulation, food security, and cultural heritage. However, climate change is accelerating habitat degradation, desertification, and species vulnerability, placing these vital natural systems at significant risk. This section presents strategic actions aimed at conserving and strengthening ecosystem resilience in the face of a changing climate. It emphasizes the expansion of protected areas, restoration of wetlands and river systems, sustainable land management, and community-based conservation efforts. By integrating ecosystem-based approaches into broader adaptation strategies, the region can safeguard its biodiversity while supporting local livelihoods and promoting sustainable development.

- **Protected area networks** should be expanded and connected through ecological corridors to support species migration under changing climates.

- **Desertification control programs** should be launched using reforestation, windbreaks, and sustainable land management techniques in erosion-prone areas.
- **Wetlands and river systems** should be safeguarded by enforcing environmental flow requirements and restoring degraded aquatic habitats.
- **Species monitoring and conservation programs** should be implemented, with the potential use of assisted migration and captive breeding where necessary.
- **Community-based conservation initiatives** should be supported, providing incentives for local stewardship of forests, rangelands, and wildlife.
- **Environmental education** should be scaled up to build awareness of ecosystem services and foster behavior change for conservation.
- **Nature-based tourism and sustainable harvesting enterprises** should be promoted to provide livelihoods while preserving biodiversity.
- **Climate adaptation plans for ecosystems** should be integrated into regional and national biodiversity strategies, using updated ecological data and projections.

Figure 8. Some Examples for Adaptation Actions in Biodiversity and Ecosystem Resilience in Southeastern Anatolia

Table 8. Adaptation and implementation actions for Sustainable Biodiversity and Ecosystem Resilience–Southeastern Anatolia

Adaptation Actions	Purpose	Implementation Actions	Institutions/Organizations for Cooperation
Expansion and connection of protected area networks	Support species adaptation and migration	Identify climate corridors, expand and link protected zones	Ministry of Agriculture and Forestry (MoAF), Nature Conservation Center, TÜBİTAK, NGOs
Launch of desertification control programs	Prevent soil loss and ecosystem collapse	Reforestation, windbreaks, erosion control, SLM practices	MoAF, General Directorate of Combating Desertification, UNCCD Focal Points
Restoration and protection of wetlands and river systems	Ensure water availability and aquatic biodiversity	Enforce environmental flows, restore degraded habitats	DSİ, Wetlands Commission, Universities, MoEUCC
Implementation of species monitoring and conservation	Prevent extinction and strengthen species recovery	Use of citizen science, assisted migration, captive breeding	MoAF Wildlife Division, Zoological Societies, Universities
Support for community-based conservation	Empower locals and ensure stewardship	Incentive programs for forest, rangeland, and wildlife management	Local Authorities, Village Cooperatives, UNDP, NGOs
Scale-up of environmental education programs	Raise awareness and change behavior	Integrate ecosystem education in schools, public campaigns	MoNE, Universities, NGOs, Local TV & Radio Channels
Promotion of nature-based tourism and sustainable harvesting	Link conservation to livelihoods	Develop eco-tourism, regulate plant/animal product harvesting	Regional Development Agencies, Tourism Ministry, Chambers of Commerce
Integration of ecosystem adaptation into biodiversity strategies	Ensure holistic and data-driven adaptation planning	Update national strategies using climate projections	MoAF, MoEUCC, Academia, International Biodiversity Conventions

9. Conclusion

Climate change demands urgent and coordinated action in Southeastern Anatolia. This adaptation plan has outlined priority measures across water management, agriculture, energy, public health, urban planning, biodiversity, and disaster preparedness – all tailored to the region's specific vulnerabilities and strengths. Key to success will be the **implementation**: mobilizing the responsible institutions and stakeholders identified for each action, securing funding, and ensuring strong governance. The Southeastern Anatolia Region will leverage existing structures like the GAP Administration and provincial authorities to integrate these actions into development planning.

By taking these proactive steps, the region can reduce the risks of climate change – protecting water supplies, sustaining agriculture, keeping communities safe and healthy, and preserving the natural environment. Many adaptation actions bring multiple benefits, including economic opportunities (such as jobs in renewable energy or landscape restoration) and contributions to climate change mitigation (through energy efficiency and reforestation). Public engagement and awareness will be nurtured throughout, because an informed and involved community is the foundation of resilience. Southeastern Anatolia has a history of resilience and innovation (evident from its ambitious irrigation projects and cultural heritage); this plan builds on that spirit to confront the new challenge of climate change.

In summary, by implementing this comprehensive adaptation and action plan, Southeastern Anatolia will strengthen its adaptive capacity and secure a more sustainable and resilient future for all its provinces and people. Regular monitoring and updates to the plan will ensure it remains effective as climate conditions evolve. The road ahead is challenging, but with collaboration between local and central government, scientists, communities, and businesses, the region can serve as a model for climate adaptation in arid and semi-arid areas. Together, these efforts will safeguard livelihoods, spur sustainable development, and protect the rich heritage of Southeastern Anatolia in the face of a changing climate.

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