Present Environment and Sustainable Development
Volume 17, number 1, 2023
DOI: https://doi.org/10.47743/pesd2023171007

Türkiye's sustainable water policies and planning initiatives as part of climate change action

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Keywords: climate change; water policy; sustainability; Türkiye

Abstract: Climates are formed throughout the world's life cycle and are vital for survival. Rapid changes in these climatic balances affect the maintenance of living beings and human life negatively, both directly and indirectly. Climate change is also an important variable that affects different sectors and organizational activities. One of the critical issues affected by climate change is water. In this context, there is a need for sustainable policies that will adapt to the new challenges emerging under climate change. This study aims to scrutinize the effect of climate change on Türkiye's water structure and resources in an effort to propose policy recommendations for long-term water management. To this end, the study examines the National Water Plan of Türkiye under traditional planning and/or management approaches (inactive, reactive, and preactive) and the proactive/interactive approach presented by Ackoff. The paper reveals that the National Water Plan of Türkiye consists of more strategies and policies with a reactive approach. Accordingly, it is recommended for Türkiye to give priority to "Proactive/Interactive" and/or "Preactive" strategies in climate change and sustainability.

1. Introduction

Water is indispensable for life: it is an essential resource for agricultural production, chemical production, human health, food security, and sustainable development (WWF, 2021). Significant problems arise in many countries regarding water use, which is expected to become more and more valuable in the coming years. Many countries experience difficulties accessing clean water due to climate change (Durdu, 2010). Thus, recommendations around different perspectives on water security and water efficiency policies that will ensure/improve the effective use, safety, and quality of water are becoming part of the global agenda (Marcal et al., 2021; Compagnucci and Spigarelli, 2018; Baccar et. al., 2021; Kibaroğlu, 2022).

Countries are classified according to the average amount of usable water per capita per year. Countries with less than 1,000 m³ are considered "water poor," countries between 1.000-2.000 m³ are considered "water scarce" (stress), and countries with

more than 8.000-10.000 m³ are considered "water-rich" (WWF-Türkiye, 2011; Ministry of Environment and Urbanization of the Republic of Türkiye, 2020). Türkiye's amount of usable water per person per year is approximately 1,519 m³ (Wang et al., 2021), placing it among the countries that suffer from "water scarcity." According to the United Nations, in 2025, the rate of countries experiencing "water stress" will reach 34%, and the rate of countries experiencing "water scarcity" will get to 15%. In addition, approximately 40% of the world population (10 billion in 2050) is expected to suffer from water shortages (Çorba, 2021; TBMM, 2021).

Flood and drought problems are often experienced in parts of Türkiye. While the Black Sea coast struggles with floods, severe droughts are common in the Central Anatolia, Southeastern Anatolia, and Eastern Anatolia Regions. With increasing population, rapid development, urbanization, and the increase in water demand in Türkiye, as well as the given indicators of the effects of climate change, there is an increasing possibility that deepening water conflicts between different user groups. The scarcity of water and the low awareness of its economic value can lead to mismanagement, waste, inefficient use, and pollution of water day by day. In addition, distribution inequalities show no common point of view in the planning, management, and use of water resources. In this context, "National Water Policies" implemented by countries consider the current situation, create a framework for establishing a system of laws and institutions, and present an action plan with a unified national perspective (IPCC, 2012). The overarching aim of this paper is to reveal the impact of climate change on the quantity, quality, cycle, and ground of Türkiye's water structure and resources. To this end, the planning approaches will be used to categorize the strategies on Türkiye's water policy.

This paper attempts to address several significant questions. How does climate change influence the water structure and resources, which are on the verge of becoming water-poor, and what strategies does Türkiye use to ensure long-term water management? Current water resources and management scenarios in Türkiye raise concerns: (i) a large part of Türkiye is already suffering from water shortages. The rapid increase in water demand due to population growth, urbanization, and changing lifestyles poses severe problems for water security. (ii) water governance issues are not adequately addressed. Mismanagement of water resources leads to critical situations in many parts of the country. This study is based on the fact that Türkiye is not a water-rich country due to its growing population, developing economy, and industry. On the contrary, Türkiye is on the way to becoming "water poor" (Atcı, 2019). We emphasize that Türkiye is entering the group of countries experiencing water stress day by day due to land use practices and climate change. For this reason, studying the relationship between climate change and water resources is essential for efficiently using existing water resources (Aktaş, 2014). While some previous literature (such as Özuyar et al., 2021) touches upon Türkiye's climate change policy documents, there are overall minimal sources on the impact of climate change on water resources in the context of Türkiye. Therefore, we expect that this study will contribute to the relevant issue. These policies' past, present, and future are discussed within this context. Finally, planning approaches and Türkiye's preparations are analyzed, and future projections are presented.

2. Material and Methods

The strategies related to Türkiye's water policies will be classified using the planning approaches presented by Ackoff (1999). Then, the study will determine the planning approach or approaches that are preferred within the framework of the implemented policies. The general characteristics of the planning approaches given in Table 1 will be used to classify water policies. There are studies in which a similar method is used (Çeliktürk and Kulaç, 2016). In the methodology of the paper, the approach introduced by Ackoff was used to scrutinize the national water plan of Türkiye. Thus, using

secondary data from Türkiye's national water plan, it aims to reveal functional findings on Türkiye's water policy and management. In this regard, it is desired to categorize the relevant strategies in Türkiye's national water plan based on the specific characteristics of planning approaches. In this context, the study's methodology is based on a theoretical approach and an analysis using secondary data.

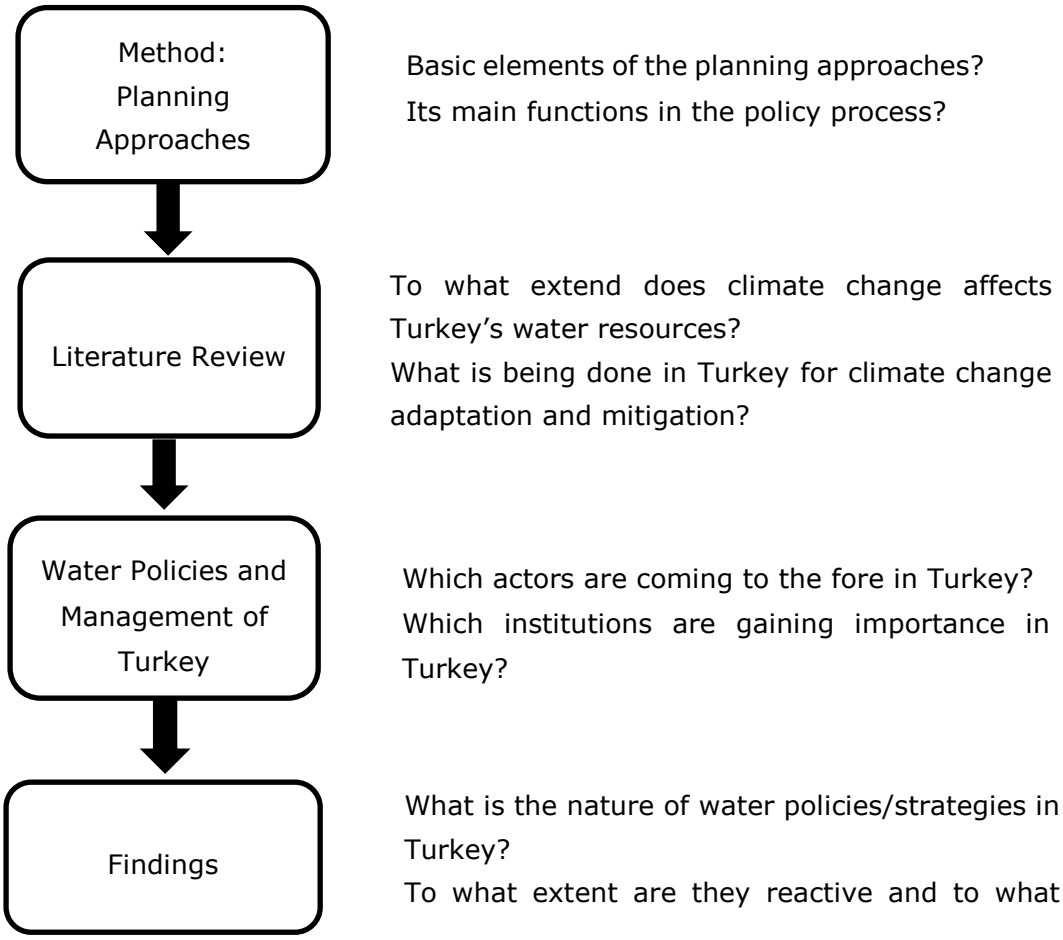

Figure 1. Flowchart of the Research

2.1. Planning Approaches in the Organizations

In the private or public sector, it is essential to determine future goals for organizations and develop strategies in this direction. Short-term and long-term steps can be taken in decision-making and implementation processes in which socio-economic and cultural structure, political conjuncture, and various actors are prominent factors. Planning has become even more critical with the transformation experienced in the public sector due to the massive impact of New Public Management. The changes in the demands and expectations of citizens, digitalization, and globalization have brought efficiency and effectiveness to the forefront of public policies. While policymakers make longer-term plans in regular periods, especially during the formulation of policies, they also implement short-term solution proposals in some circumstances. It is also necessary to give functional direction to planning and strategic management processes to establish sustainable development. International organizations of which countries are members or candidates significantly impact the planning of national policies and the coordination of implementation processes. In addition, global crises, pandemics, and disasters show the necessity of short and long-term planning. Although most countries' planning stages and strategies are similar, country-specific conditions should not be ignored.

Ackoff's statements (1974; 1999) regarding planning approaches and processes are milestones that listed the planning approaches of organizations as Inactive, Reactive, Preactive, and Proactive (Interactive). Accordingly, some basic features of each planning approach are presented. It can be seen that a conservative management approach is more common than an Inactive planning approach. According to inactivists, organizations should be highly closed to external environmental influences. With using the passive planning approach, minor gradual steps are taken against crises and problems by preserving the structure and systems of organizations.

Similarly, in the incremental approach, a public policy decision-making model, minor steps and changes are preferred over major ones (Anderson, 1979; Birkland, 2005; Lindblom, 1959). The Inactive approach emphasizes that future planning is not very significant in solving problems and that eliminating problem symptoms is more functional (Ackoff, 1974). In the reactive approach, existing issues are considered, and simple solutions are offered. In problem-solving processes, past experiences are used, and common sense is created. The reactive approach avoids confusion and uncertainty (Ackoff, 1974).

Often used by organizations, the reactive plan approach states that it may not be possible to control threats to the future, and organizations need to take some measures to reduce risks. In this way, the adverse effects that may occur in the future can be reduced. In the preactive approach, organizations often use science and technology while planning (Ackoff, 1999). According to predictivity, inter-organizational co-operation is not a roadmap because of the intense competition between organizations. Change is an opportunity for organizations, and effective planning is required. Although proactivists think the future will be better than the present and the past, they still believe that preparing well for the future is necessary. In the preactive approach, developing and improving are among the most important goals. In this regard, according to the preactive method, solving problems before they get and become more complex is essential. However, the preactive approach does not focus on revolutionary change (Ackoff, 1974).

One of the most crucial planning approaches, the proactive (interactive) planning approach aims to shape the future with an idealistic perspective. Radical changes are planned, including changes to the structure of organizations and the use of resources. The proactive approach aims to do even more for the future than what is predicted. Technological and social changes are taken into consideration when making plans. In the proactive approach, past experiences cannot be a helpful reference point for projects (Ackoff, 1974).

Similarly, Dror (1964) states that policies based on experience are insufficient when guiding future actions. Bateman and Crant (1999) note that change opportunities are always seen as a chance in the proactive planning approach, and preventive measures are taken by predicting future problems. Table 1 lists some key features of each of the planning approaches.

Table 1. The Features of Planning Approaches*

Reactive	**Inactive**
1. Focusing on current problems and developing fast solutions. 2. Experience, intuition, and common sense are essential in problem-solving. 3. Simple solutions are offered when problems turn into threats.	1. Closed to external environment and effects. 2. Problem indicators are hidden rather than resolved. 3. The current structure and system are preserved. 4. However, minor steps are taken during a severe attack or crisis.
Preactive	**Proactive/Interactive**

1. Science and technology are utilized. 2. Short-term and minor plans are made for the future. 3. Change is regarded as an opportunity. 4. Planning is based on future predictions. 5. Competition is crucial, and there is no need for co-operation with others.	1. Attempts to design the future from an idealistic point of view. 2. The multi-dimensional management model is the basis. 3. Long-term plans are made based on scientific and technological advancements. 4. Tends to change the functioning of organizational structure and the usage of resources. 5. Coordinates and cooperates with systems inside and outside their regions.

*The authors prepared this table by benefitting from Ackoff (1974; 1999); Kulaç et al. (2015); Çeliktürk and Kulaç (2016).

3. Literature Review

3.1. The impact of climate change on Türkiye's water resources

Climate change affects many areas of our life. One of the issues affected by climate change is ground and surface water resources. As a whole, climate change is reported to cause fluctuations in groundwater levels as well as changes to soil pore water pressure, groundwater flow regime, and water quality and quantity (Aktaş, 2014). A bibliometric study between 1996 and 2019 (Ackoff, 1999; Bateman and Crant, 1999; Sawassi and Khadra, 2021) shows that studies on water adaptation, water systems, and water management are increasing due to climate change. Climate change fundamentally affects the water cycle by increasing the evaporation rate and the difference in precipitation quantity and seasonal distribution. It was stated that there are important issues regarding water, such as average annual flow in the coastal zone, changes in the hydrological effects of changes in water quality, changes in groundwater, drought effects of floods, and the effects of water temperature and changes in water demand (Ministry of Agriculture and Forestry, 2020).

Since 1992, Türkiye has taken part in efforts at the international level on climate change. However, the accession to the Kyoto Protocol in 2009 started a new era regarding climate change policies. Since becoming a party to the Kyoto Protocol, Türkiye has reflected on the issue of climate change in its development plans and prepared particular policy documents related to the point (Turkish National Strategy for Climate Change, 2010-2020; National Climate Change Action Plan, 2011-2023) and new sub-organizations have been set up to ensure effective coordination of the process. In fact, following the ratification of the Paris Climate Agreement in the national assembly in September 2021, Türkiye changed the name of the relevant ministry to the Ministry of Environment, Urbanization, and Climate Change (Turhan et al., 2016). Türkiye is developing its institutional, financial, and technical capacity to implement climate change policies. However, it should be emphasized that there is still a long way to go in order to implement the proposed policies (Özuyar et al., 2021; Çeliktürk and Kulaç, 2016) fully.

The precipitation regime of Türkiye, which is in the semi-arid region of the world in terms of water resources, varies regionally and seasonally. Moreover, the increase in summer temperatures, decrease in winter precipitation, surface water losses, more frequent droughts, deterioration of the soil, erosion of the coasts, and the threat of floods due to climate change affect the water resources of the country (Lütfi Şen, 2013) (p.1-2). Figure 1 shows the predictions for temperature changes in Türkiye at the provincial level at the middle and end of the current century (Lütfi Şen, 2013).

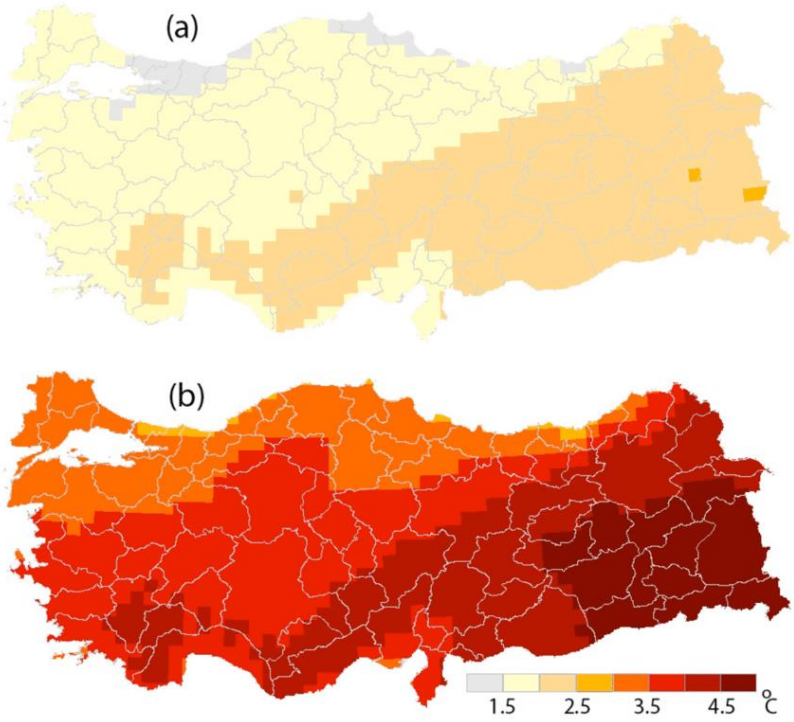

Figure 1. Future temperature change in Türkiye over 1961-1990: (a) 2041-2070 period, (b) 2071-2099 period (Lütfi Şen, 2013).

Similarly, Figure 2 shows the forecast for precipitation change in Türkiye at the regional level at the middle and end of the present century (Lütfi Şen, 2013).

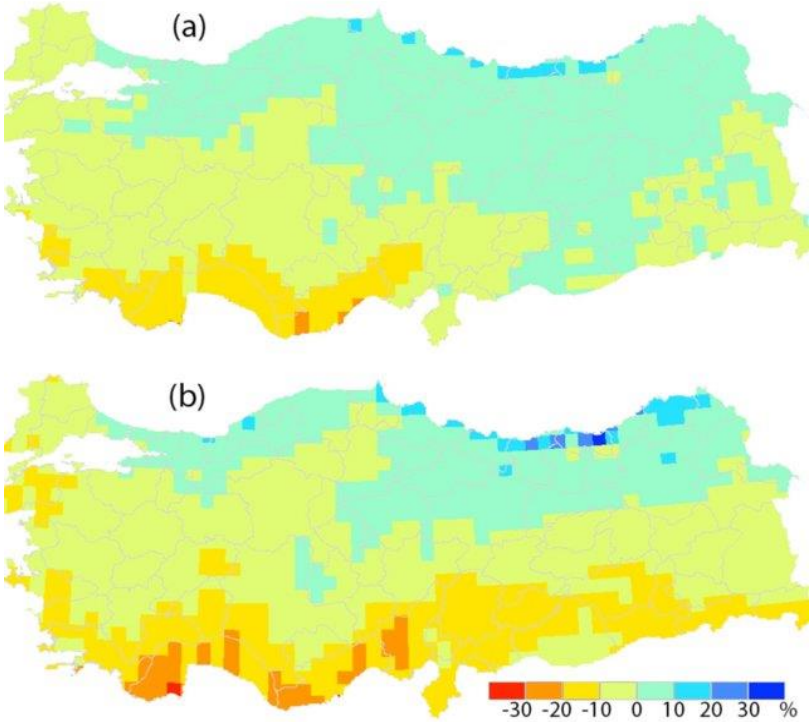

Figure 2. Future precipitation change in Türkiye over 1961-1990: (a) 2041-2070 period, (b) 2071-2099 period (Lütfi Şen, 2013).

30% of the soil in Türkiye is categorized as "semi-arid" and "dry-semi-humid". It should be noted that Türkiye also has humid regions: Central Anatolia and Southeastern Anatolia, east and west of Eastern Anatolia, and parts of the Eastern Mediterranean, Western and Eastern Black Sea, and Eastern Marmara. The arid and humid sub-humid climate class includes the Marmara, Aegean, and Mediterranean regions and the central and northeastern parts of the Eastern Anatolia Region (Türkeş, 2021). According to the data published by the Turkish Statistical Institute, 18.2 Tm^3 m^3 of water was drawn for drinking/usage (8.4 Tm^3) and cooling (9.8 Tm^3) purposes in 2020 in Türkiye. It is stated that 56% of the water withdrawn is obtained from the sea and 44% from freshwater sources (22.5% groundwater, 21.5% surface water) (in municipal settlements). 40.9% is obtained from dams, 29.3% from wells, 15.6% from springs, 10.1% from rivers, and 4% from lakes, ponds, or seas (TURKSTAT, 2020).

A study carried out in the Büyük Menderes River basin in western Türkiye examined climate change's effect on water resources between the years 1963 and 2007 was reviewed. The examination determined that the temperature increased by 1 degree within the specified period. In the long-term analysis, we determine that there is a decrease in the amount of precipitation on an annual basis, which is not statistically significant. It is considered that the decrease in the amount of precipitation detected is strongly related to the changes in temperature and precipitation (Sawassi and Khadra, 2021). In the context of Ankara province, the evaluation based on the data from 1961-1990 shows that the rainfall will decrease depending on the increasing temperatures. It is emphasized that the water need will not be met in this situation, and the existing Sakarya Basin will need alternative water sources (Aygün Albayrak, 2017). On the other hand, another study examining the impact of climate change over different scenarios within the scope of the Euphrates-Tigris Basin in Türkiye estimates that the snow water amount will decrease by 30-39% in both basins, and average snow cover will decrease by 37-43 days by 2099 (Peker and Sorman, 2021).

The project carried out by the Ministry of Agriculture and Forestry General Directorate of Water Management examines the effects of climate change on water resources (surface and ground) originating from 25 water basins in Türkiye (Figure 3) (Delipınar and Karpuzcu, 2017). The calculations made over 10-year periods through different models (HadGEM2-ES, MPI-ESM-MR, and CNRM-CM5.1) and scenarios (RCP4.5 and RCP 8.5) predict an increase in seasonal and annual temperatures between the years 2015-2100. Model calculations taking into account temperature change in 25 water basins over 30-year periods indicate that the temperature increase is expected to start from the southern latitudes of Türkiye and expand towards the north. Moreover, an anticipated increase of 4-6 degrees is anticipated by 2100, especially in the southern and eastern Anatolian regions (p.6-8). It is determined that there are differences in terms of increase and decrease between different models and scenarios in the 2015-2100 period. However, precipitation is predicted to decrease throughout the country in the last 30 years of the specified period. Importantly, Eastern Mediterranean, Western Mediterranean, and Ceyhan River Basins will experience the most significant changes. While a decrease of 3% and 8%, respectively, is expected in the Euphrates-Tigris Rivers' precipitation, the lowest precipitation values will be recorded in the Konya Closed Basin, and the rainfall will be between 10 mm and 30 mm according to the calculation made over thirty years. Furthermore, short-October or medium-term fluctuations in the groundwater level pose a critical problem, especially in semi-arid regions such as Central Anatolia (Aktaş, 2014).

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DOI: https://doi.org/10.47743/pesd2023171007

Table 2. The impact of climate change on Türkiye's River Basins (Tokuşlu, 2022)

River Basins	Average basin temperature 1971-2000	Average temperature change 2071-2100 Increase	Average annual precipitation 1971-2000	Average annual precipitation change 2071-2100	Gross water potential of the basin [Annual]	Change in gross water potential of the basin 2041-2070	Water deficit 2071-2100	Technically and economically usable amount of the reserve 1971-2000	Change in hydrogeological reserve of the basin 1971-2100
Meriç-Ergene Basin	13,4 °C	1,5-4,7 °C	598,3 mm	13% dec.	1.838 million ³	Up to 60% dec.	1.485 million m³	125 km³	3% dec.
Marmara Basin	13,9 °C	1,5-4,6 °C	679,2 mm	13% inc.	8,566 million ³	Up to 50% dec.	-	29 km³	10% dec.
Susurluk Basin	12,5 °C	1,6-4,7 °C	640 mm	10 %dec.	6,157 million ³	Up to %50 dec.	-	18 km³	11% dec.
North Ege Basin	15,9 °C	1,5-4,6 °C	615 mm	15 %dec.	2,379 million ³	Up to 60% dec.	75 million m³	10 km³	21% dec.
Gediz Basin	14,6 °C	1,7-4,9 °C	589,7 mm	20% dec.	2,505 million³	Up to 75% dec.	1.445 million m³	21 km³	20% dec.
Küçük Menderes Basin	16,7 °C	1,6-4,7 °C	695,6 mm	20% dec.	1.369 million³	Up to 70% dec.	315 million m³	32 km³	5% dec.
Büyük Menderes Basin	14,4 °C	1,8-5 °C	592,4 mm	25% dec.	4.028 million³	Up to 65% dec.	2.480 million m³	138 km³	7% dec.
Batı Akdeniz Basin	16,2 °C	1,8-4,9 °C	731 mm	28% dec.	9.403 million³	Up to 50% dec.	-	43 km³	22% dec.
Antalya Basin	14,2 °C	1,8-5 °C	690 mm	25% dec.	12.153 million³	Up to 60% dec.	-	168 km³	12% dec.
Burdur Basin	12,3 °C	1,9-5,1 °C	508,7 mm	25% dec.	606 million³	Up to 85% dec.	495 million m³	26 km³	26% dec.
Akarçay Basin	11,3 °C	1,8-5 °C	460,4 mm	17% dec.	678 million³	Up to 70% dec.	545 million m³	57 km³	20% dec.

Sakarya Basin	11,3 °C	1,7-4,9 °C	477,8 mm	8% dec.	8.592 million³	Up to 75% dec.	1.175 million m³	200 km³	10% dec.
Batı Karadeniz Basin	11,6 °C	1,6-4,7 °C	741,6 mm	8% inc.	10.346 million³	Up to 50% dec.	-	55 km³	18% dec.
Yeşilırmak Basin	11 °C	1,8-5 °C	510,2 mm	6% inc.	6.432 million³	Up to 50% dec.	-	48 km³	17% dec.
Kızılırmak Basin	10,3 °C	1,8-5,1 °C	448,7 mm	6% dec.	8.011 million³	Up to 60% dec.	2.160 million m³	266 km³	13% dec.
Konya Kapalı Basin	11,1 °C	1,9-5,2 °C	397,6 mm	16% dec.	6.532 million³	Up to 70% dec.	4.490 million m³	306 km³	6% dec.
Doğu Akdeniz Basin	16 °C	2-5,1 °C	629,1 mm	26% dec.	11.167 million³	Up to 60% dec.	4.695 million m³	6 km³	13% dec.
Seyhan Basin	12,3 °C	2-5.3 °C	545,3 mm	15% dec.	8.711 million³	Up to 30% dec.	2.325 million m³	70 km³	8% dec.
Asi Basin	18 °C	1,8-5 °C	804,6 mm	21% dec.	1.572 million³	Up to 55% dec.	270 million m³	9 km³	54% dec.
Ceyhan Basin	13,7 °C	2-5,3 °C	619,3 mm	20% dec.	8.165 million³	Up to 70% dec.	2.650 million m³	41 km³	15% dec.
Fırat-Dicle Basin	12 °C	2,3-5,8 °C	584,5 mm	12% dec.	57.167 million³	Up to 60% dec.	23.175 million m³	473 km³	5% dec.
Doğu Karadeniz Basin	12,2 °C	1,7-4,9 °C	961,4 mm	15% inc.	15.336 million³	Up to 60% dec.	-	0,008 km³	0%
Çoruh Basin	8,5 °C	2-5,4 °C	616,8 mm	10% inc.	6,600 million³	Up to 20% dec.	-	0,7 km³	7% dec.
Aras Basin	6,1 °C	2,3-5,7 °C	460,5 mm	5% dec.	4.886 million³	Up to 5% dec.	-	14 km³	13% dec.
Van Lake Basin	8 °C	2,2-6 °C	527,6 mm	7% inc.	2.569 million³	Up to 40% dec.	-	7 km³	17% dec.

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Figure 3. Turkish river basin boundaries and provincial borders (Gisgeography, 2023)

It is also stated that snowfall will decrease over the years (Aktaş, 2014) (p. 10-13). Within this project's scope, Türkiye's water potential (ground and surface) is approximately 108.5 Tm^3 (p.16) compared to the previous calculation of 112 Tm^3. Thus, within this project's scope, the effects of climate change on 25 water basins in Türkiye are discussed through different climate models and scenarios, and various calculations are presented.

3.3. Water policies and water management in Türkiye

Public institutions and non-governmental organizations in Türkiye, from the past to the present, have issued many action plans, regulations, and laws associated with water policy and management. The first Law on water management in Türkiye was enacted in 1926. However, the first institutional steps on water policy and governance were taken in the 1990s, and changes to the current legislation were implemented in the 2000s. The main objective is to protect and improve the quantity and quality of water resources in Türkiye in terms of an ecosystem (TUSIAD, 2008), as well as to control and sustainably manage watershed-based water with a participatory approach (Avcı, 2021).

The most significant development at the international level regarding sustainability that considers climate change and water policies is the Sustainable Development Goals (United Nations, 2022), consisting of 17 main goals and 169 targets set at the UN Sustainable Development Summit in 2015. Türkiye has also accepted the stated goals, with numerous institutional structures established and new policy implementations planned. In July 2022, Türkiye introduced the National Sustainable Development Coordination Board, enabling different parties to cooperate and coordinate to increase the effectiveness of the goals.

The first scholarly studies on water policies and management were carried out by the research commission established by the Turkish Grand National Assembly at the end of the 20th century to research "Water Policy, Water Management, and Water Resources in Türkiye" and by public and non-governmental organizations (Kibaroglu, 2015). The "International Water Forums" was organized by the Turkish Water Institute. With the General Directorate of Water Management in 2011, studies on the water have taken on

a corporate identity (Avcı, 2021). Research on "integrated water management on a basin basis" was initiated by the General Directorate, and the Water Policy, Management, and Water Draft Law were introduced within the scope of harmonization with the European Union. With the establishment of the General Directorate of Water Management, basin management committees in 25 basins and provincial water management coordination boards in 81 provinces were established for basin-centered water management within the scope of restructuring efforts in water management (Kınacı, 2017).

Furthermore, comprehensive assessments on water management were included in the development plans, such as the Water Resources Management and Security Specialization Report prepared for the 11th Development Plan (Republic of Türkiye Ministry of Development, 2018). In addition, the National Water Plan for 2019-2023 was prepared by the Ministry of Agriculture and Forestry. Finally, the Global Climate Change Research Commission was established by the Grand National Assembly of Türkiye to determine the measures to minimize the effects of global climate change, combat drought, and use water resources efficiently (Hürriyet, 2021)."

Apart from the objectives mentioned earlier, the following goals regarding water resource management were also included in the Climate Change Adaptation Strategy and Action Plan published by Türkiye (Türkiye Republic of Ministry of Environment, 2012):

- Integrating "adaptation to the effects of climate change" into water resources management policies
- Strengthening the capacity, inter-institutional co-operation, and coordination on adaptation to the decision regarding climate in the management of water resources
- Development and dissemination of research and development as well as scientific studies to ensure successful adaptation to the effects of climate change in water resource management
- Holistic management of water resources in watersheds to adapt to climate change
- Planning renewable energy source strategies by considering the effects of climate change and the sustainability of ecosystem services that increase resistance to climate change.

Many stakeholder institutions and organizations implement water policies within the framework of water governance in Türkiye. Notable institutions and organizations include DSI (General Directorate of State Hydraulic Works), the State Planning Organization of Türkiye, the Ministry of Environment, Urban Development and Climate Change universities, the General Directorate of Meteorology, the Ministry of Energy and Natural Resources, irrigation associations, the Ministry of Agriculture and Forestry, the Ministry of Health, ILBANK, the Ministry of Interior Affairs, SUEN (Turkish Water Institute), provincial and municipality water and sewage administrations and municipalities (Yıldız, 2019) (p. 8). Similarly, there are many leading organizations related to water, such as the International Water Resources Association (IWRA), Global Water Partnership, the United Nations, the European Union, the World Water Council (WWC), the International Network of Basin Organizations (INBO) of the International Commission of Irrigation and Drainage (ICID), the Organization for Economic Co-operation and Development (OECD), the International Association of Large Dams (ICOLD) and Economic Co-operation, the D-8 organization (Ochqun, 2015; Turkish Water Institute, 2014).

3.4. Water management legislation and organization in Türkiye

The general framework for water resources is established in Article 163 of the Constitution. Despite the increasing importance of water in recent years, there are no legal protections regarding water in Türkiye. While two Draft Water Laws were drafted in 2011 and 2016 regarding water management, they were not implemented. Thus, there is no independent water law in Türkiye. Since the end of the 1990s, proposals have been put forward in this direction by different actors in public administration and NGOs, but legislation has never been implemented. The latest step regarding the water law is

a commission established in February 2021. The commission is based on the Draft Water Law submitted to the Parliament by the General Directorate of Water Management of the Ministry of Forestry and Water Affairs. There are five laws on water management in Türkiye: "Environmental Law" (2020), "DSI Law" (1960), "Ground Water Law" (1953), "Law on Water" (2021), "Law on Drinking and Utilizing Waters of Villages" (1960), "Coastal Law" (2020), and "Fisheries Law" (2020). The rules regarding water pollution are specified in the Water Pollution Control Regulation (WPCR) (United Nations, 2022). Within the framework of this regulation, specific standards regarding water use were developed, rules regarding diverting water wastes to receiving environments through sewers were determined, and measures were put forward regarding water use for irrigation purposes (Turkish Fisheries Law, 2020; Delipınar and Karpuzcu, 2017).

Surface and water are managed through various regulations. Some of these are listed below (Ögenler and Okuyaz, 2017):

- Regulation on Waters Intended for Human Consumption (2005)
- Regulation on the Quality of Surface Waters from which Drinking Water is Obtained or Planned to be Obtained (2012)
- Water Pollution Control Regulation (2004)
- Fisheries Regulation (1995)
- Regulation on the Protection of Groundwater Against Contamination and Degradation (2012)
- Surface Water Quality Regulation (2012)
- Regulation on Monitoring of Surface Waters and Groundwater (2014)

One of the most fundamental organizations focusing on the water in Türkiye is the DSI. DSI's founding purpose in 1954 was to meet Türkiye's water resource and human needs as well as to protect water from harm. The duties of DSI are to explore ground waters, drill water wells, and build dams and waterways to establish water facilities. These duties suggest that DSI is the most authoritative public institution on water management and use in Türkiye (Turkish Law on Services Conducted by the General Directorate of State Hydraulic Works, 1953).

With the "Ground Waters Law" that came into force in 1960, it is the only authorized state regarding groundwater. While the articles on groundwater are unrelated to the amount and conditions of the water extracted, they contain provisions on the issues to be pulled in general (TUSIAD, 2008). With this law, some responsibilities and authority, such as the determination and announcement of groundwater operation sites, the drilling, exploration, and use of wells in the declared groundwater, and obtaining and registering documents, has been given to DSI (Arpacı, 2020; Turkish Law on Ground Water, 1960).

Along with the DSI, the General Directorate of Water Management is another vital organization related to water. The Directorate studies to determine policies related to protecting, improving, and using water resources. Various coordination boards within the Ministry of Agriculture and Forestry focus on water. These boards are as follows: Water Management Coordination Board, Basin Management Central Board, Basin Management Delegation, and Provincial Water Management Coordination Board. In addition, municipalities have a fundamental role at the level of local authorities, especially in the water management of cities. Thus, one can see that the lack of a national water plan and water law for all institutions and organizations to follow is a critical problem in creating and implementing water policies.

4. Findings

The highlights from Türkiye's Policies and Strategies in the National Water Plan were analyzed according to the various planning approaches. The strategies and policies analysis yielded five categories: Policies and Strategies Regarding Policy Actors, Protection and Improvement of Water Resources in Quantity, Quality, and Ecosystems,

Water Efficiency, and Water Policy. These policies and strategies were then classified according to different planning approaches.

Table 3. Policies and Strategies Regarding Policy Actors (Türkiye Republic of Ministry of Agriculture and Forest, 2022)

Policy / Strategy	Type of Planning Approach
Relevant laws should be revised.	Reactive
Water management efficiency should be increased by including institutions such as agencies, institutes, basin coordinators, foundations, and NGOs.	Proactive
Units/courses on water resource protection and floods should be added to the national curriculum by the Ministry of National Education.	Preactive
Potable-use water basin protection plans should be prepared for surface water resources.	Reactive
Area-specific standards should be introduced to the Basin Management Plans in Special Environmental Protection Areas.	Reactive
Local governments should be given authority under the supervision of a strengthened central government in water management.	Reactive
Social awareness of water management issues should be increased.	Reactive
Infrastructure, financing, and administrative capacity needs should be determined, and necessary arrangements should be made to revise the national water legislation by putting forward the requirements of the E.U. environmental sector acquis.	Reactive
A robust administrative structure should be established, and a framework of legal regulation should be created to support this structure.	Preactive
Based on the agreement between the Ministry of Agriculture and Forestry and the Ministry of Environment and Urbanization on the draft Water Law, the draft law should be implemented, and conflicts of authority should be handled appropriately.	Reactive
Basin Management Committees should become the only authorized structure at the basin scale in all planning and applications related to water resources and should have legal personality.	Preactive

Official, civil, and international actors greatly influence public policy formulation and implementation processes and stages. When the actors on water policy are considered, it is observed that the policies and strategies followed generally show a reactive planning approach. On the other hand, some policies and strategies reflect a preactive and proactive/interactive approach.

Table 4. Protection and Improvement of Water Resources in Quantity, Quality, and Ecosystems (Türkiye Republic of Ministry of Agriculture and Forest, 2022)

Policy / Strategy	Type of Planning Approach
Effective control of plant protection product use should be established.	Reactive
Legislative studies, including criteria and standards regarding using water reuse, should be carried out.	Reactive

Preventing pollution at its source with clean production technologies that save water in the industry should be preferred and encouraged.	Proactive
Efficient operation of urban and industrial wastewater treatment plants should be ensured, online monitoring systems should be expanded, and inspection activities should be activated.	Proactive
Basin monitoring programs should be revised periodically.	Reactive
Biological indices are specific to Türkiye should be disseminated to all basins.	Preactive
A necessary mechanism should be established to ensure harmony between River Basin Management Plans, Integrated Coastal Management Plans, Environmental Plans, and Tourism Development Plans.	Reactive
Real-time monitoring stations and early warning systems to detect pollution should become widespread.	Proactive
Certain pollutants should be updated every six years.	Proactive

As seen above, policies regarding the Protection and Improvement of Water Resources in Quantity, Quality, and Ecosystems show a general trend toward proactive and reactive approaches. Utilizing technology and making long-term plans establishes a promising framework.

Table 5. Water Efficiency (Türkiye Republic of Ministry of Agriculture and Forest, 2022)

Policy / Strategy	Type of Planning Approach
Recovery should be encouraged in the use of industrial and irrigation water.	Reactive
Activities that raise public awareness about water conservation should be amplified.	Preactive
The use of gray water and rainwater harvesting technologies should be encouraged.	Preactive
Mechanisms should be developed to support the implementation of methods to increase water efficiency technically and economically.	Preactive
The regulation on the Quality of Irrigation Water and the Reuse of Used Water should be put into force.	Reactive
The use of treated domestic wastewater in irrigation parks, gardens, and green areas should be expanded further.	Preactive
The relevant institutions should conduct necessary studies to achieve the irrigation efficiency target.	Proactive
Loss-leakage management should be made more effective in the drinking water networks of municipalities, and financial support mechanisms should be established for this purpose.	Proactive
Municipalities should conduct researches and make the necessary investments to reduce drinking and potable water losses.	Preactive

Table 5 shows that a particularly proactive planning approach comes to the fore regarding water efficiency. Moreover, there is evidence of large-scale steps and various additional steps.

Table 6. Water Policy (Türkiye Republic of Ministry of Agriculture and Forest, 2022)

Policy / Strategy	Type of Planning Approach
Existing policies for the efficient use of water should be developed and implemented.	Reactive
The participation of non-governmental organizations in the policy development process should be ensured.	Proactive
Water should be treated as a strategic and priority issue.	Preactive
A holistic ecosystem approach should be considered when developing policies.	Proactive
Coordination and harmony with the Basin Management Plans should be ensured in water-related planning.	Preactive
Regulatory impact and cost-benefit analyses should be conducted during the legislative preparation process.	Preactive
Efforts should be made to raise awareness about water's effective, efficient, and economical use.	Reactive
Water policy should be established alongside environmental, agricultural, industrial, energy, and tourism policies.	Proactive
A legally and administratively robust water management system should be established by reconsidering the distribution of authority and responsibility between institutions in water management.	Reactive
A participatory approach should be followed, and a holistic view should be created with the participation of all stakeholders in determining and planning water policies.	Proactive
Each sector's budget should be strengthened by creating policies to expand R&D activities.	Preactive
In all kinds of planning and investments in areas such as urbanization, agriculture, industry, mining, and tourism; compliance with the determined measures in the basin management plans should be ensured.	Preactive

Policies and strategies related to water policy are of great importance. The analysis of National Water Plan strategies thus shows examples of preactive and proactive approaches. Policies and strategies that include collaborative, long-term solutions and a holistic approach might be more likely to be more permanent and successful

5. Discussion

Caused by global warming, climate change leads to drought and desertification problems in many world regions. Indeed, present studies predict that water will become more and more valuable with time. The projections show climate change will decrease water resources, increase forest fires and drought, and related ecological disruptions. Climate change is primarily a water problem. Its effects are presented through an increase in floods and floods, rises in sea levels, melting of glaciers, forest fires, and drought more and more throughout the world. However, saving water can help battle climate change. Sustainable water management is crucial for building resilience in societies and ecosystems and reducing carbon emissions. All states also have vital tasks to ensure this.

Three factors affecting the water policies of countries are highlighted in this study: ideas, institutions, and interests (Kim and Lee, 2018). In this context, Türkiye is implementing basin-based water management by establishing its institutional structure in parallel with the UN's agenda. Despite the increasing need for water due to the rapid population growth in Türkiye, problems arise in parallel with the scarcity of resources and developing industrial and agricultural activities. For these reasons, the issues experienced, such as excessive water use, decrease in groundwater, and pollution,

necessitate long-term and basin-based planning. In this context, the General Directorate of Water Management was established in Türkiye, "Basin Management Committees" were established in 25 basins, and "Provincial Water Management Coordination Boards" were founded in 81 provinces for basin-based water management. To fight the climate crisis more effectively, Türkiye has changed its institutional structures, and the ministry's name related to environmental policies was established as the Ministry of Environment, Urbanization, and Climate Change. In addition, the Department of Climate Change was established within the ministry. Head of climate change, ozone depletion, and global climate change and related measures for green development plans, policies, and strategies concerning the determination of national and international efforts is conducted.

As observed in the study, Türkiye has made promising efforts regarding water policies, with various documents related to Türkiye's water policy being implemented. The proposed national water plan determines essential strategies and targets regarding the water policies of Türkiye in the coming years. The present study analyzed policies and strategies related to policy actors, conservation, and improvement of water resources in quantity, quality, ecosystems, water efficiency, and policy in the national water plan. Strategies and policies were classified based on traditional planning approaches and proactive/interactive approach features. The analysis of selected policies and strategies found that 40% had reactive, 35% had Proactive, and 25% had proactive/interactive approach characteristics. In other words, 60% of the selected strategies and targets in the national water plan prepared for Türkiye's water policy are preactive and proactive/interactive approaches. It is functionally valuable for organizations to follow multiple approaches, depending on the situation, rather than a single planning or management approach. While public policies are formulated, minor and additional steps can be introduced in some cases, and longer-term and significant changes can be planned in others.

For this reason, Türkiye's national policies regarding water must include more than one approach, and roughly half of them are formed with a preactive and proactive/interactive approach. Taking the proactive/interactive approach into consideration while creating Türkiye's water policies and making plans in this way, as introduced by Ackoff, may bring positive outcomes. Furthermore, as one of the most prominent features of the proactive approach, giving more importance to co-operation and governance can create an advantage for positive outputs. In addition, if organizations follow a proactive/interactive approach, they can be better prepared for unexpected risks and impacts in the future. The fact that a proactive/interactive approach dominates Türkiye's water policies more may enable a better determination of the resources required for the relevant policies.

Ackoff presents a usable model for active policy formulations and implementations, and this paper focuses on the Ackoff model and Türkiye's water policy and tries to be future-oriented and improve. On the other hand, it should be stated that this study might be insufficient to define Türkiye's water policy with the approach of Ackoff and other planning models because some policy areas could be more complex and should be identified with multiple approaches. This study is limited to defining Türkiye's model with the Ackoff approach and attempts to provide problem-solving for a more accomplished water policy. Furthermore, it could be very supportive of conducting in-depth interviews to get information from the official policy actors of Türkiye's National Water Plan. Another limitation of the study might provide further research with a window of opportunity regarding methodology.

6. Conclusion

Under the impact of climate change, developments such as an increase in summer temperatures, a decrease in winter precipitation, an increase in droughts, and surface water losses impact Türkiye's water resources. A project was carried out by the General

Directorate of Water Management to measure the impact of these developments on Türkiye's water resources and to guide the steps to be taken. With the project, the effects of climate change on 25 water basins in Turkey were calculated through different climate models and scenarios. In addition to the project, impacts were also revealed through various other studies. Based on these efforts, the National Water Plan was published. In the Plan, the bottlenecks that may be encountered through the water management cycle and policies to overcome these bottlenecks were developed, taking into account the regional differences of the country. This plan was analyzed through Ackoff's approach. The analysis reveals that 60% of the strategies and targets set in the national water plan adopt preactive and proactive/interactive approaches. This result shows that Turkey has taken substantial steps at the planning level in protecting and efficiently using water resources and thus in adapting to climate change. The critical point at this stage is based on implementing the targets set at the national scale. Necessary efforts should be made to ensure that the targets set by an effective supervision mechanism are put into practice.

Preactive and proactive measures have been envisaged for effective water use, especially in the next period, and the adaptation approach to climate change's effects must be integrated into water policies in Türkiye. Issues such as water distribution between sectors, water saving, management of demand, control of water use, expansion of the observation network, and increase of large-volume artificial storage structures should be evaluated more strictly. Moreover, there is a need for a more comprehensive determination of changes in land use and vegetation to predict the future status of water resources. Urban infrastructure master plans should be prepared to build infrastructure facilities such as water and wastewater. Efficient use of water resources should be ensured by reducing losses and leaks in existing water facilities. Wastewater should be used in agriculture and industry after treatment. It is necessary to develop a pricing policy, make legal arrangements, and disseminate the SCADA System [Data-Based Control and Surveillance System] at the national level, considering socioeconomic conditions to increase water use efficiency. Therefore, old and new technologies are an essential intermediary for water conservation and efficient use.

For adverse situations created by global climate change, relevant countries should unite and plan to decouple scarce resources humanely. Since water is a human right, there is also a need to determine an ethical framework for sustainable water policies based on the principles of justice and equity. In this context, countries parties to the problem should provide sustainable water policies, and international agreements should be implemented for their ensured accountability.

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