Derleme/Review

The Past, Present and Future of Water Resources in Turkey

Tuba BAYRAM*, Ayşe ERKUŞ, Dilara ÖZTÜRK

[1]Yuzuncu Yil University, Faculty of Engineering and Architecture, Department of Environmental Engineering, 65080 Van-Turkey
*e-mail: tubabayram@yyu.edu.tr

Abstract: Water is one of the most vital resources for sustainable development. Although world population has increased three times in the 20th century when compared to 19th century, water resource consumption has increased six times. However, those who benefit from these fast consumption resources do not have sustainable features which provide equal opportunities and benefits. As a result, water crisis has become inevitable all over the world. Water quality in Turkey cannot be monitored in an efficient way and the needed data bank cannot be formed. Water resources have been distributed into 26 hydrological pools in terms of rivers and they are managed by State Hydraulic Works (SHW). SHW measures water quality in certain resources only where dam pools are present. In Turkey, the primary issues related to application of European Union (EU) water framework directive are the distribution of water related responsibilities to many institutions in institutional structuring, lack of coordination and lack of correspondence between river basin borders and political borders. In addition to an ideal managerial and institutional structuring and planning the priority should be placed on taking practice related measures in river basins.

Key words: Turkey. Water, Water resources, Water frame directive,

Türkiye'de Su Kaynaklarının Dünü, Bugünü ve Geleceği

Özet: Sürdürülebilir kalkınma için en önemli yaşamsal kaynaklardan biri sudur. 20. yüzyılda dünya nüfusu 19. yüzyıla oranla üç kat artmasına rağmen, su kaynaklarının kullanımının altı kat arttığı belirlenmiştir. Ancak bu hızlı tüketim kaynaklardan yararlananlara eşit fırsatlar ve faydalar sağlayacak şekilde sürdürülebilir özelliklere sahip değildir. Bunun sonucu olarak da su krizi tüm dünyada kaçınılmaz olmuştur. Türkiye'de su kalitesi gerektiği biçimde izlenememekte ve gereksinimi duyulan veri bankası oluşturulamamaktadır. Su kaynakları akarsular bazında hidrolojik açıdan 26 havzaya bölünmüştür ve idaresi Devlet Su İşleri (DSİ) tarafından yapılmaktadır. Bu uygulama ülkenin bütün kaynaklarının yönetiminden çok uzaktır, sadece suyun kullanımı ile ilgili bazı düzenlemeler getirmeye yöneliktir. Türkiye'de Avrupa Birliği (AB) su çerçeve direktifinin uygulanması konusunda en öncelikli ele aldığı konular, kurumsal yapılanmada su ile ilgili görevlerin birçok kuruluşa dağılmış olması ve bundan doğan koordinasyon eksikliği ile havzaların sınırlarının idari-siyasi sınırlarla örtüşmemesi hususlarına çözüm getirmektir. İdeal bir idari ve kurumsal yapılanmanın ve planlamanın, etkin bir uygulama için büyük önem arz etmelerinin yanı sıra öncelikle yapılması gereken şey nehir havzalarında derhal uygulamaya yönelik tedbirler almaktır.

Anahtar kelimeler: Su, su kaynakları, su çerçeve direktifi, Türkiye.

Introduction

Water is one of the most important requirements of human life. Due to its vital role in surviving a healthy life, it has a distinct position. However, water reserves in our country are consistently being polluted and the demanded amount of water per person is constantly increasing along with population growth. This real regulated in Johannesburg in 2002 II. World Environment Summit in "No Water No Future" emphasized with the slogan (Tamer, 2006). One of the most important sources needed for life in sustainable development is water. In Turkey, neither water quality can be monitored efficiently nor can a required databank be constituted. It is only possible to conserve and evaluate water reserves in a beneficiary way with a combined

management mechanism. All over the country, some basic deficiencies are experienced in the preservation of water reserves from contamination. Priory objective about which European Union (EU) concern in Turkey in the scope of water frame directive is to solve the problem caused by a condition in which the responsibilities about water are shared among different institutions in the institutional formation of Turkey and as a result of which a lack of coordination occurs causing discrepancies between the actual and administrative borders of watersheds (Burak et. al., 1997).

From a general perspective, Turkish water management legislation is far distinct from that of EU in the respect of especially standards, monitoring requirements and measurements methods. In Turkey, water quality cannot be dully monitored and required data bank about this topic cannot be constituted. In the consequence of the present study, it was made clear that an institutional improvement can be performed with many regulations on water management in Turkey.

Water consumption in Turkey

Turkey is one of the most water rich countries of the Mediterranean, but due to an enormous population increase from 28 million in the 1960's to 68 million in 2000 the availability of water resources has already decreased from around 4000 m^3 to 1500 m^3 per capita/year today. Water demand in Turkey approximately has doubled in the second half of the last century. The overall water demand in Turkey continues to increase, even more in the light of the effects of drought (or climate change). Turkey will suffer from water scarcity in the next years (Dogdu and Sagnak, 2008) 73.2% of the total water supply of Turkey is used for agricultural irrigation, remaining 15.5% and 11.3% are used for drinking-domestic and industrial purposes, respectively (Anonymous, 2005).

Turkey, with a surface area of 780 000 km2 and a population over 63 million, is a country with considerable water resources in a region where a sufficient amount of water has never been available, and water is expected to be the key to war and peace in the near future. In Turkey important attempts have been made in the second half of the 20th century to develop the country's water resources. Rapid growth of population plus an increase in the standard of living and accompanying industrialization have raised the water demand considerably and are stressing the quantity and quality aspects of the country's water resources. To meet this demand, Turkey has been constructing dams, hydropower plants and irrigation projects through- out the country.

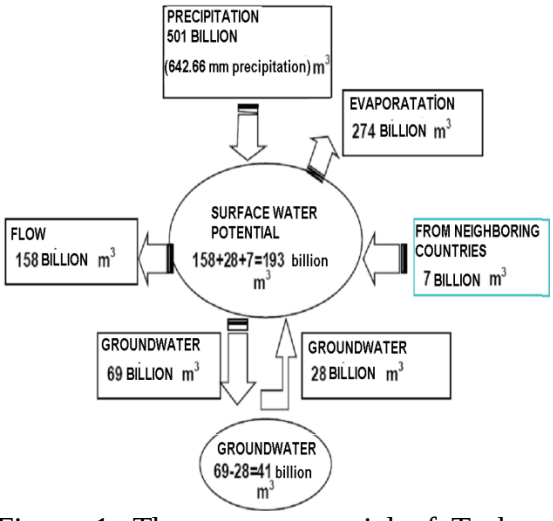

Figure 1. The water potential of Turkey (Altınbilek, 2004)

The areal distribution of water does not fit that of the population and industry, thus making the inter-basin transfer of water and energy necessary. Development of the water resources must be planned not on a regional basis but as a whole in an integrated manner. Despite the serious efforts in this area, a great deal remains to be done. At present less than

one-half of the potential has been developed. Irrigation projects provide water for about 50% of the economically irrigable land. Nearly 40% of the food control projects have been realized. Although more than 35% of the electric power is generated by hydro, less than 30% of the hydropower potential has been developed. The Southeastern Anatolia Project (GAP) will make import- ant contributions to both irrigation and electricity generation. The need for cooperation with neighbouring countries in the development of international river basins increases the difficulty of the management of these resources (Bayazıt and Avcı, 1997). Turkey has completed a large number of water resources development projects and many more are in the construction or planning stages. Today the nation has the technological and management knowledge and experience necessary for the successful accomplishment of these projects. Turkish engineering companies have successfully bid for and realized development projects in the region (TBMM,1995).

Management of Water Resources in Turkey

Water resources management, stability and integrity of all the conditions and methods of collecting relevant to the needs related to rational water use planning, water resources, detailed observations, effective protection under its foundation (Palutikof, 2002). Accordingly, there are many institutions and organizations directly aimed at water or indirectly related to water with the development and protection of water resources in Turkey. These institutions and organizations are composed of three stages as; institutional decision-making, administration and users (Simonovic, 2002).

The investor institutions and organizations on the water management are; the State Hydraulic Works (DSİ), the General Directorate of Electrical Power Resources Survey and Development Administration (EİEİ), the Ministry of Environment and Forestry, the Bank of Provinces (Biswas, 2008).

The primary monitoring and controlling institutions and organizations are; the Ministry of Agriculture and Rural Affairs, the General Directorate of Meteorology, the Provincial Special Administrations, Municipalities, the Ministry of Environment and Forestry, the Ministry of Health, the Ministry of Finance, the Environmental Protection Agency for Special Areas, the Under-secretariat of SPO, DİE (State Institute of Statistics) and Universities. The State Hydraulic Works (DSİ), affiliated to the Ministry of Environment and Forestry, was created in 1954 (Cakmak et. al., 2007). DSİ is responsible for the planning, appropriation and development of ground and surface waters in accordance with the objectives; for gathering, monitoring, flood protection, planning and construction of the hydraulics to be made for the purpose of irrigation and hydroelectric production. DSI created the organizational structure according to the river basins (Anonymous, 2009). This structure started to change upon the establishment of the Ministry of Forestry and Water Affairs, the changes in some legislation and legislative decrees, and upon the decision of the Council of Ministers, by the power of Law dated 6/4/2011 and numbered 6223. The establishment, organizational structure, and duties of the Ministry of Forestry and Water Affairs were published in official journal dated 4 July 2011 numbered 27984 (Anonymous, 2009).

It is estimated that mainly DSI and other public institutions and the private sector to by developing additional projects

various sectors of consumption until 2030, will be able to provide fresh water 110 billion. For realizing this aim, financial resources should be increased year by year (Tahmiscioğlu et al., 2006).

Material of the study is composed of works, reports and statistical data by public and private institutions.

Water Potential of Turkey

Annual rainfall of 501 billion m^3 of 274 billion m^3, is assumed to leak through plant and evaporation from surface. There is a constant interaction between the runoff and groundwater, but it is estimated that 28 billion m^3 of groundwater feeding the river. Portions of the surface flow, groundwater and inflow from countries on the border, and groundwater are 95, 3, and 12 billion m^3, respectively. Thus, the total of utilized water resources amount to 110 billion m^3 (Table 1).

Table 1. The total amount and consumable water in Turkey (Tahmiscioğlu et al., 2006).

Surface water	Rainfall (mm)	Water amount (billion m^3/ year)	Grosswater potential (billion m^3/ year)	Utilized (billion m^3/year)
Turkey	643	501	186	95
From Bordering Countries			7	3
Groundwater			41	12
Total			**234**	**110**

It is estimated that with the essentially DSI and other public institutions, for consumption by various sectors will be able to provide 110 billion of fresh water by developing additional projects until 2030.

Results and Discussion

Turkey, having four seasons in a year, shows considerable differences in climatic conditions in the inland and coastal regions, the precipitation-flow relationship, which changes seasonally also shows considerable differences from year to year and natural water supply falls to minimum levels in summer time when the demands are maximum. Turkey is currently experiencing a tremendous fast growth in the economy and significant migration rural to urban areas, it is necessary to "re-engineer" present system to be more effective and efficient in their planning and to better handle the operation and maintenance of their facilities to be able to meet the increasing demands for water resources. The solution for these problems and updating of technologies can be found in a comprehensive and centralized information. Like in other parts of the world, Turkey faces the high population rate problems, which impose a significant pressure on meeting demands by developing new water resources projects. This makes necessary to implement new technologies and management strategies on the issue of water resource management. Sustainable use of water resources requires maintaining the integrity of the hydrologic whole. It is thus evident that isolated treatment of any component of the water resource system results in sub-optimal, if not unsatisfactory, solutions. For this reason, an integrated approach is necessary for the rational management of water resources. In Turkey, there is a great deal of effort in adopting and exercising an integrated approach to water resources management.
In addition to, infrastructure organizations;

- Increasing freshwater reserves,
- Prevention of pollution of groundwater and surface water resources,
- Recovery of used water

- Minimization of water losses in urban Networks

It should work in as matters, to continuation water essential components of life must agree on a common vision within the framework of the law.

Finally, water resources management system is composed of supply and demand sides in order to achieve the community's objectives consists of public and private sector activities and relationships associated with compliance. Recognition of each a detailed analysis of components and the interactions among them no doubt be able to produce better results in the management of water resources.

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