

## INTRODUCTION

This study was conducted as part of an EU funded project; "EuropeAid/125541/D/SER/T Technical Assistance for the Establishment of a Turkish Environmental Information Exchange Network (TEIEN)\*". A set of national environment indicators has been developed for Turkey within the framework of this project. This study particularly deals with water theme and describes the development of water indicators for Turkey based on DPSIR model. The selection of indicators was performed based on international indicator sets used by OECD, EEA, EUROSTAT, World Bank, UN and other countries. Five criteria were considered in selecting water indicators and nine water-related indicators were included in the national set of indicators for Turkey. Currently three water indicators can be determined due to lack of data. Turkey needs to improve in-situ monitoring and collection of data to better implement the water indicators included in the national set of indicators.

## METHODS

The selection of indicators was performed based on international indicator sets used by OECD, EEA, EUROSTAT, World Bank, UN and other countries. DPSIR model (Figure 1) is most commonly used model for indicator development. In selecting the most suitable set of indicators, Turkey's reporting obligations was also considered. Figure 2 shows a good description of human and environment interaction analytical approach based on DPSIR framework [1].

In our study, five criteria were considered in selecting water indicators;

1. Reflecting the national needs,
2. Policy compatibility,
3. International standards,
4. Covering water sector,
5. Data availability.

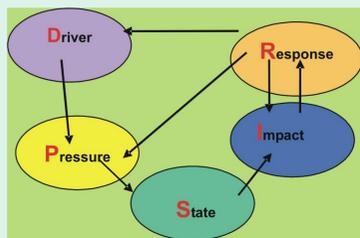


Figure 1. DPSIR model (D: Drivers; P: Pressures; S: State; I: Impact; s R: Responses)

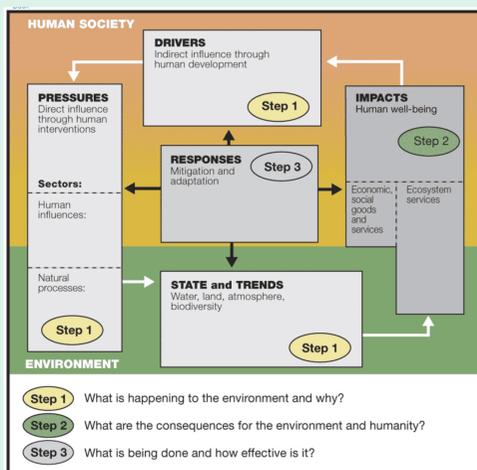


Figure 2. UNEP Human Environment interaction analytical approach built on the DPSIR model [1]

## RESULTS

Based on the international indicator sets, nine water-related indicators were selected and included in the national set of indicators for Turkey (Table 1). The national set of indicators developed in this project includes a total of 106 indicators under 18 themes; population, economy, health, climate change, air quality, water, waste, land use, biodiversity, energy, agriculture, industry, tourism, transport, fisheries, mining, noise and technological and natural disasters.

Table 1. Water indicators selected for Turkey

No.	Name of indicator	DPSIR Type
1	Percentage of annual water use from renewable sources (%)	Pressure
2	Water use per capita (m <sup>3</sup> /year)	Pressure
3	Nutrients in freshwater sources (NO <sub>3</sub> )/L, µg P/L)	State
4	Oxygen consuming substances in rivers (mg O <sub>2</sub> /L, µg N/L)	State
5	Population connected to wastewater treatment facilities (%)	Response
6	Bathing water quality (%)	State
7	Nutrients in coastal and sea water (µg/L)	State
8	Chlorophyll-a in coastal and sea water (µg/L)	State
9	Municipal water supplies (%)	Pressure

Among the set of water indicators selected for Turkey, currently few of them can be implemented due to lack of data. The existing data makes it possible to calculate three water indicators for Turkey; Water use by sectors (Agriculture, Domestic and Industry), Municipal water supplies and Population connected to wastewater treatment facilities [2]. This is quite expected because the experience of European countries with environmental indicator developments since 1990s confirms that there is substantial time lag (i.e. 10 to 15 years) between an indicator proposal and its implementation. This is largely because of the time it takes to put in the place the in-situ monitoring, satellites and statistical surveys and obtain trends [3].

## DISCUSSION

Figure 1 shows that Turkey is not a water-rich country. Available water potential per capita is expected to decrease down to 1120 m<sup>3</sup> by 2030 due to population increase and adverse impacts of climate change. A country with less than 1000 m<sup>3</sup>/cap of water potential is classified as a water-poor country. Turkey needs to take serious precautions and adopt sustainable water use strategy to minimize water stress in the future.

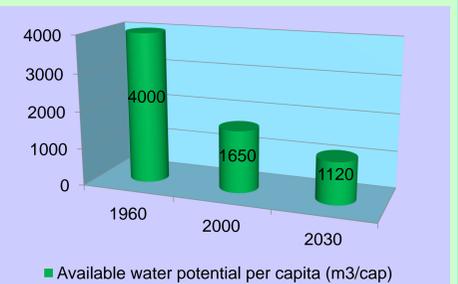


Figure 1. Water potential per capita [2].

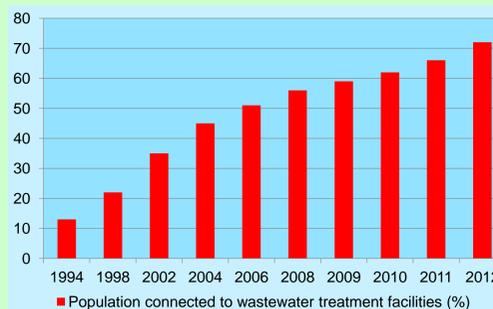


Figure 2. Population connected to wastewater treatment facilities [2].

Figure 3 shows that almost half of the water demand for human consumption in municipalities is supplied from surface water (reservoir, river, lakes and lagoons) and the other half is supplied by groundwater resources (wells, springs). Turkey needs to avoid excess use of groundwater resources.

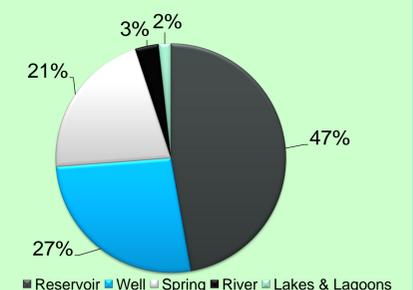


Figure 3. Municipal water resources for human consumption (2010) [2].

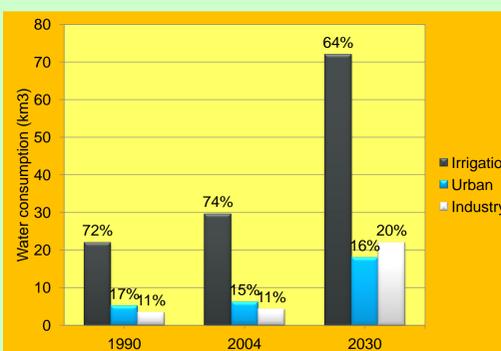


Figure 4. Water use by sectors [2]

Figure 4 shows that in Turkey, currently water use by agriculture is above 70%. Although it is expected to decrease to 64% of total water use by 2030, the amount of water used for irrigation will increase from 30 km<sup>3</sup> to 72 km<sup>3</sup> in 2030. According to the comparison of Turkey with Europe based on water use by agriculture sector; despite the decrease of water abstractions in most countries, and a stable trend in Southern Europe, it has increased by more than 30% in Turkey from the 1990 level [3].

Similarly, domestic water use is expected to increase from 6 km<sup>3</sup> in 2004 to 18 km<sup>3</sup> in 2030, with a stable ratio of 15-16%. In terms of abstraction for public water supply, in southern Europe, domestic water use has increased since the early 1990s by 12%, however the increase was around 40% in Turkey (from 5 m<sup>3</sup> to 7 m<sup>3</sup>). On the other hand, industrial water use is expected to increase from 4.3 km<sup>3</sup> to 22 km<sup>3</sup>, corresponding to an increase from 11% in 2004 to 20% in 2030.

## CONCLUSIONS

- ✓ These indicators reveal that Turkey needs to take serious precautions and adopt sustainable water use strategy to minimize water stress in the future.
- ✓ Turkey also needs to improve in-situ monitoring and collection of data to better implement the water indicators included in the national set of indicators.

### References:

- [1] UNEP (2006), "Environmental Indicators for North America." Division of Early Warning and Assessment (DEWA), P.O. Box 30552 Nairobi, Kenya.
- [2] Environment Indicators Booklet of Turkey, Ministry of Environment and Urbanization, 2012.
- [3] Environment Indicator Report, European Environment Agency (EEA), 2012.

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