

**TRANS BOUNDRY RIVERS IN
TURKEY AND EFFECTIVE USE OF
THEIR WATER
CASE STUDY: EUPHRATES AND
TIGRIS RIVERS**

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INTRODUCTION

- Water and economic growth are inextricably linked.
- Water is an important input in all the productive sectors of the world's economies.
- Access to water is also a strong social indicator of progress.

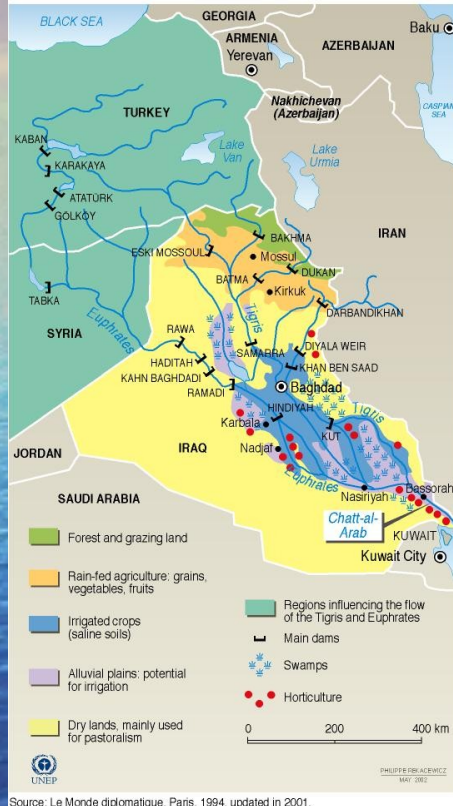
- Given the fact that access to , and use and availability of ,water continue to depend on infrastructure development and natural ecosystems ,it is critical to have sound financing arrangements in place that can generate both commercial and non commercial benefits (some of which may be public goods).

- Cooperative management of a transboundary river basin is an important public good and a source of regional public good benefits.
- Developing and supporting transboundary river basin management are both long –term undertakings, and important catalysts for promoting economic growth and regional stability. (Jogerskog et al. 2007).

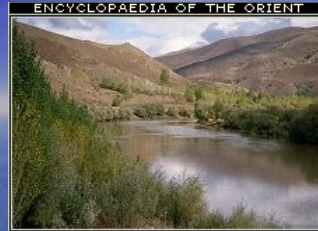
There are mainly two big transboundary rivers in Turkey; Euphrates and Tigris, rising from Turkey and flowing through Syria and Iraq.

Both rivers are fed by snowpack and rainfall in eastern Turkey and in northwest Iran.

Turning the Tides Regulation of the Tigris and Euphrates Rivers



Source: Le Monde diplomatique, Paris, 1994, updated in 2001.



EUPHRATES RIVER (here in Turkey)

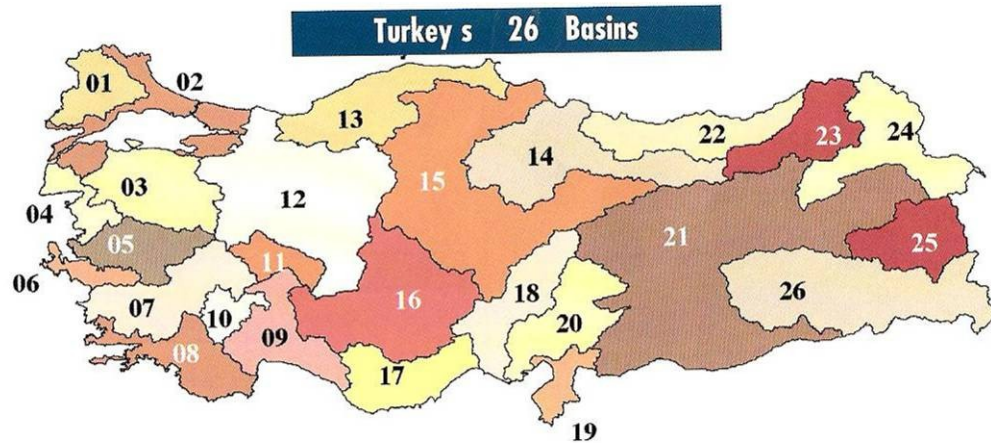
[OPEN LARGE IMAGE](#)



River in the [Middle East](#), rising in [Turkey](#), passing through [Syria](#) before it ends in [Iraq](#) where together with [Tigris](#) it forms the [Shattu l-Arab](#) river way.

Euphrates is 2,735 km long and has a discharge of 900,000 litres per second. The surface of the river is 450,000 km². The Euphrates gets 90% of its water from Turkey, through a set of tributary rivers like Karasu, Murat and Khabur.

Land and Water Resources



● Turkey is divided into 26 surface hydrological basins. Annual average flows of these basins amount to about 186 km³. While basin yields vary, the Euphrates and Tigris basins account for 28.5% of total potential of the country.

- The rivers' discharge peaks in March and in May, too late for winter crops and too early for summer crops. The flow of the rivers varies considerably every year. In years of low flow make irrigation and agriculture difficult.

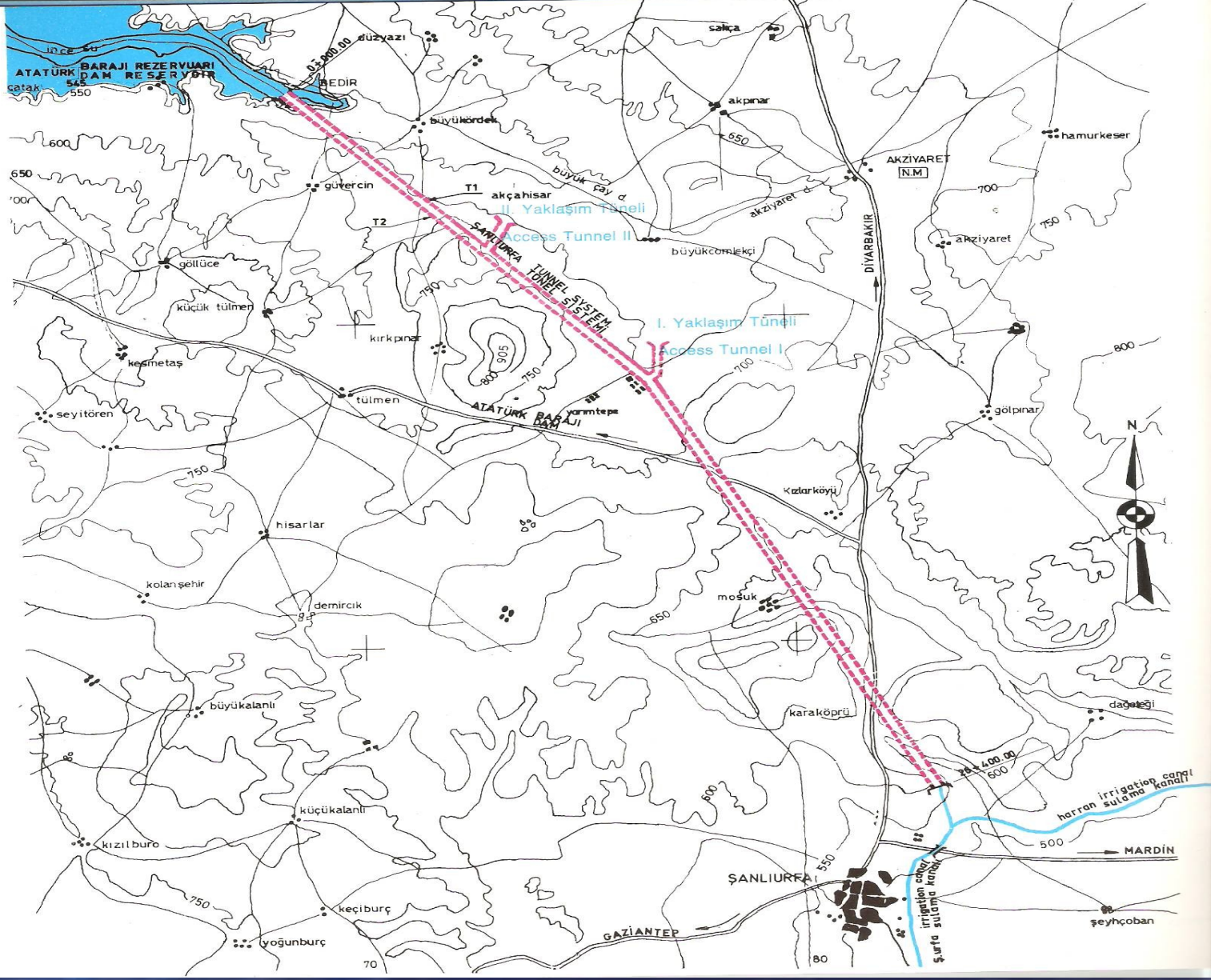
- So construction of storage dams are vital importance to prevent flood damage and to regulate the flow of these rivers. Water is a scarce resource in all three countries as it is throughout the Middle East and agricultural production dependent on irrigation.

- Maritza (Meric) (Turkey-Greece), Arapçay (Turkey-Armenia), Coruh (Turkey-Georgia) and Asi (Syria-Turkey) rivers are other transboundary rivers between Turkey and neighboring countries (Tosun and Filiz, 2001).

- Turkey started a very big integrated project called GAP (acronym for Southeastern Anatolian Project) for the economic and social development of the region. The project covers the lower parts of the Euphrates and Tigris rivers and 9 provinces in the region.

- A total of 6.47 million people live in these provinces. When completed 14 dams (already 6 dams in operation and one dam is under construction) on Euphrates and 8 dams (3 dams in operation) on Tigris river will be constructed and 1.7 million ha of land will be irrigated by this project. At present 213 000 ha under irrigation in GAP region.

- Located downstream of Keban and Karakaya Dams, in the ultimate foothills of the Anatolian range, The Ataturk Dam is the third large development step along the Euphrates. The Sanliurfa Tunnel and Feeder Systems ensures the conveyance of 328 m³/s between the Ataturk Reservoir and the main canals supplying the 4 large irrigation perimeters: Harran, Sanliurfa, Mardin and Ceylanpinar.



- Syria and Iraq have similar storage and irrigation projects. These projects will be complementary for each other and help the sustainable use of existing water resources.
- Despite cordial relations between Turkey, Syria and Iraq the issue of water allocation has continued to cause some friction between the governments since late 1980s.

- Turkey is doing her best to comply with the Syrian-Turkish water sharing agreement that proposes the flow of 500 cubic meters per second of Euphrates water to Syria (Tosun and Filiz, 2001).
- But the effect of global warming and unusual dry years sometimes cause also drought in South Eastern Turkey.

- Rapid rise in population in Turkey, Syria and Iraq make it necessary to increase the area of irrigated land; in addition to improvement of the agricultural inputs to meet the food requirements of increasing population.

On the other hand,

limited water resources, increasing labor cost, development in plastic industry, fertigation applications and partially improved purchasing power of the farmers supports expanding use of water and energy saving irrigation technologies (Sener et al. 2005)

- **Euphrates River**

Euphrates is 2,735 km long and has a discharge of 900,000 litres per second. The surface of the river is 450,000 km². The Euphrates gets 90% of its water from Turkey, through a set of tributary rivers like Karasu, Murat and Khabur.

- The Euphrates has a relatively regular regime, characterized by two months of very high average flow in April and May and a period of eight dry months from July to February. The annual flow varies considerably from year to year.

- The average **winter flows**, varying between **200 and 300 m³/sec**, increase in February from early spring rains at lower elevations. The increase continues during March, when the snow begins to melt, and **in April and May** monthly average flows of **2,000 m³/sec** and more are reached.

- Maximum floods occurring between mid-April and early May under the combined effect of melting snow and rains. The flow rapidly diminishes after June, reaching its minimum values in September and sometimes October.

- According to the official estimates Syria contributes around 12 per cent of the total, however, 10 per cent of that 12 per cent originates from the northern tributaries, the Khabur and the Balikh, and both have their catchments in Turkey.

- The observed average annual flow across the Turkish Syrian border is 29.8 bmc. The natural flow of the river can be given as 33.4 bmc annually. No other tributaries flow into the Euphrates after the Khabur, except in Iraq, where some of the Tigris' waters are added to the Euphrates.

- **Tigris River**

The Tigris is the second longest river in Southwest Asia at 1,840 km. The city of Baghdad is located on the conjunction of the Tigris and Diyala rivers and navigation is possible from Baghdad downstream.

- Because of the irregularities of the tributaries' flows, the Tigris is widely known for its infamous floods.
- To control these floods, the Iraqis divert water from the Tigris to the Euphrates, where the Euphrates has less alleviation than the Tigris

- The flows of the Tigris and Euphrates in Iraq are largely dependent on the discharges in Turkey. Much of the discharge of the Tigris results from the melting snow accumulated during the winter in Turkey.
- However, winter rains, which are common in late winter and early spring, falling on a ripe snowpack in the highlands, can greatly augment the flow of the main stream and its tributaries, giving rise to the violent floods for which the Tigris is notorious.

- The period of greatest discharge for the Tigris system as a whole is from March through May and accounts for 53% of the mean annual flow. The highest mean monthly discharge takes place during April.
- Minimum flow conditions are experienced from August through October and make up 7% of the annual discharge.
- The mean annual flow of the Tigris is 48.7×10^9 (billion) m^3 in total at its confluence with the Euphrates, which includes $13.2 \times 10^9 m^3$ from the Greater Zab, $7.2 \times 10^9 m^3$ from the Lesser Zab, and $5.7 \times 10^9 m^3$ from the Diyala

- The Tigris river is a different case than the Euphrates if contribution patterns compared. Turkey contributes around 51.8 per cent of the Tigris' flow, with Iraq contributing 48.2 % and Syria contributing nothing at all.

- Some of the waters of the Tigris river have been diverted to the Euphrates river, and the irregular water flow from the tributaries makes the Tigris a very unstable and unreliable river, in terms of annual water flow and floods

- **Turkish use of Euphrates River**

Currently there are three major dams operational on the Euphrates river: Keban, Karakaya, and Ataturk. The Birecik dam is being constructed and the fifth and final dam, the Karakamis, is at the beginning stages of its construction.

- Only the Ataturk, Birecik, and Karakamis dams are going to be an integral part of the GAP, and the Keban and Karakaya dams were designed primarily for hydroelectric power production.

- The Ataturk dam and its reservoir have been completed and filled to final levels, and the Urfa tunnels have been delivering the waters of the Euphrates into the Harran plain. However, those are only a small part of the GAP, and a full utilization of the Euphrates river will not be achieved until the year 2020 according to current plans.

- Turkish government established the GAP as one of the main regional development programs in the country. The integrated, multi-sectoral project includes 13 major projects which are primarily for irrigation and hydropower generation, planned by the State Hydraulic Works.

- The area to be irrigated accounts for 19 % of the economically irrigable area in Turkey (8.5 million hectares), and the annual electricity generation accounts for 22 per cent of the country's economically viable hydropower potential (11.8 billion kWh).

- The Turkish government perceives the GAP as a solution to the problems in the region and places heavy emphasis on its existence. This is a very critical point to understanding the Turkish attitudes towards the entire issue

- **Turkish use of the Tigris river**

If **Turkey uses** a limited portion of the waters of the Euphrates river, it certainly uses **only a minimal fraction of the waters of the Tigris river.** There are no major dams built on the river and a number of projects are continuing, including the construction of the Kralkizi and Dicle dams, eight more dams are at the stage of being planned and designed.

- Because of its geographic location, the Tigris river has been the last major river system in Turkey to be developed. Its waters travel through mountainous terrain, and only the lower parts of the Tigris river are going to be utilized for the irrigation purposes. Also, the Turkish government plans to use the Tigris river for extensive hydroelectric production.

- **Syrian use of the Euphrates and Tigris rivers**

From the 18,5 million ha of total lands of the Syrian , cultivated land extends over an area of 5,484,000 ha of which 1,213,000 is irrigated land (22%), 3,655,000 ha is rain-fed land (67%) and 616,000 ha is fallow land (11%) (FAO-MAAR, 2001).

- **Irrigated lands** are not distributed evenly across the country and **most concentrate along the Euphrates river**, in the coastal areas and in the central regions. The size of the irrigated holdings is substantially smaller than the size of the rain-fed holdings and varies distinctively across regions .

- Lake Assad was formed behind the Tabqa Dam, and it was used for Syria's increasing irrigation needs, which was predicted by the Syrian's to be around 640,000 hectares (ha).
- The Euphrates basin soils are in large part gypsiferous, crust, prone to erosion, and suitable only for careful applications of irrigation water. Therefore, the recent reports from Syria suggest that the waters from Lake Assad have been utilized to an absolute maximum of 240,000 ha.

- The Tigris river only contributes to the Syrian demands on local and private land owners small scale agricultural and sanitary needs, but there are certain projects that have been evaluated by the Syrian government on future use of the river's waters.

- **Iraq use of the Euphrates river**

Iraq has been using the Euphrates river since the ancient times, and the ancient irrigation systems and the use of water in Mesopotamia are some of the Iraqi claims that responds to the situation in the Euphrates-Tigris basin.

- Currently Iraq has seven dams in service; the Haditha Dam, the Bagdadi Dam, the Ramadi Barrage, the Hindiya Barrage, the Fallouja Dam, and the Hammurabi Dam.
- The Haditha Dam is used for hydroelectric production, and the others either regulate the river or divert water to irrigation canals.

- According to estimates, Iraq irrigates 1.2 million ha of land with the waters of the basin. The amount of land used is believed to reach to 1.8 million ha with full utilization of the Euphrates river. Only limited data is available on the Iraqi development projects and the current political strains transferred the priority of the water behind political and economical issues.

- **Iraqi use of the Tigris River**

Along with the Euphrates river, the Tigris has been heavily dammed by the Iraqis and the Ottomans. Out of the current operational dams, the Mosul Dam is used for hydropower production, irrigation, and flood control, and the Samara Dam and the al-Kut Barrage regulate the river with limited irrigation responsibilities.

- Increasing use of the Euphrates river by Turkey and Syria presents a great challenge for the Iraqi government, and they may have to divert more water from the Tigris river in order to utilize the basin to their needs.

- Status of Conflict in the Basin: **Between Turkey, Syria, and Iraq, there have been no war or an armed conflict relating to the water issues.** However, there were open hostilities between the groups, especially during the filling stages of the great reservoirs of the mega dams.

- Currently, Syria and Iraq are complaining about the Turkish development projects, which they believe will reduce the flow of the Euphrates river to Syria and Iraq by 40 per cent and 90 per cent respectively.

Position of Turkey in the Issue

- Turkey, on its 2763 km of borders, has 615 km of wet borders, and this fact presents us a good chance to look at the past record of Turkey on cooperation issues.
- The most notable agreements about this issue are with Greece and the former Soviet Union. In 1927, Turkey and the USSR signed a 'Treaty on the Beneficial Uses of Boundary Waters'. This treaty addressed the use of the Coruh, Kura, Arpa, and Aras rivers, the waters of which they agreed to share on a fifty-fifty basis.

- Similar cooperation was possible between Turkey and Greece. Beginning with the Treaty of Lausanne , the two governments established development projects that would allow Turkey and Greece to regulate the flow and irrigate 16,900 ha and 11,600 ha respectively.

- These border rivers that Turkey shares with other countries have been classified by the Turkish government as **international rivers**, but there are a number of rivers which cross the borders of Turkey at an angle rather than forming mutual boundaries, and they have been classified as **transboundary rivers**.

- Finally, Turkey believes that an equitable, rational, and optimum utilization of water resources can be achieved through a scientific study which will determine the true water needs of each riparian country.

Position of Syria in the Issue

- For the Euphrates-Tigris basin, Syria acknowledges that the rivers are international rivers and the Syrian government claims that it had acquired the rights to these rivers dating back to ancient times. Syria wants to share the Euphrates and the Tigris rivers through a "mathematical formula," which foresees that: -Each riparian State shall declare its demands on each river separately -The capacities of both rivers in each riparian State shall be calculated -If the total demand does not exceed the total supply, the water shall be shared accordingly to stated figures -In case of total demand of water, declared by the three riparians, exceeds the water potential of a given river, the exceeding amount should be deducted proportionally from the demand of each riparian state Further, Syria believes that the UN must be present at all negotiations, and it requests that the International Law Commission's studies be finalized and that rules and regulations be established as soon as possible.

Position of Iraq in the Issue

- Iraq, as the out most utilizing riparian of the both rivers, also claims that it has ancient rights, acquired through thousands of years of irrigation in Mesopotamia. Iraqi government believes that construction of such dams in the upstream countries would eventually damage the downstream riparian countries. Therefore, the Iraqi officials also came up with a "mathematical formula" to share the waters of both rivers: -Each of the riparian states will notify the Joint Technical Committee its water demand for each of its completed project as well as for the projects under construction or planned projects.

- Iraq demands that Turkey should release more than $500\text{m}^3/\text{s}$, favorably around $700\text{m}^3/\text{s}$, which would add up to $2/3$ of the water flow carried by the Euphrates river. Iraq believes that, this type of action can be acknowledged as an "equitable and reasonable" sharing of the Euphrates river

- The Tigris and Euphrates Rivers are the main sources of water in Iraq. Because of flood irrigation, 1,598,000 ha of land have been affected by salinity, and the government is trying to reclaim this land .

- In Iraq, the period of maximum flow on the Euphrates is shorter and later than that of the Tigris and is usually confined to the months of April and May. Discharge during the two months accounts for 42% of the annual total. Minimum flows occur from August through October and contribute only 8.5% of the total discharge.

RESEARCH ON WATER AND ENERGY SAVING IRRIGATION SYSTEMS

- Agriculture is the single largest user of the freshwater resources, using a global average of 70% of all surface water supplies. This ratio goes to 75 % in Turkey 85 percent in Syria and Iraq.
- That's why, pressurized (water and energy saving) irrigation systems must become more common than surface irrigation methods in order to increase the efficiency of the irrigation water application.

- Mainly, there are two methods of the water application to the soil:
- Surface or gravity irrigation and (2) pressurized irrigation systems.

Surface irrigation is the most commonly used irrigation method, pressurized irrigation systems cover only 5 to 12 % of all irrigated areas in three countries.

This ratio reaches to 40% in Italy, 70% in France, 90-95% in Israel and Cyprus (Şener, 2005; Paola, 2005)

WATER AND ENERGY SAVING IRRIGATION SYSTEMS

- Şener and Çetin (2002), carried out an experiment to compare the water and energy saving new irrigation technologies with conventional surface irrigation methods in Aegean Region and South Eastern Anatolia (GAP area). Sprinkler, mobile sprinkler, drip, mobile drip and LEPA (Low Energy Precision Application) systems were compared with furrow irrigation method to determine the effects of irrigation systems on the yield and water use efficiency of cotton (*Gossypium hirsutum*).

- Research results showed that, the quantity of irrigation water applied in drip, sprinkler and mobile sprinkler systems were 31 percent, 28 percent and 26 percent less respectively than furrow irrigation method in GAP area, and 37 percent and 33 percent less irrigation water applied in drip and mobile drip irrigation respectively when compared to furrow irrigation in Aegean Region, for about the same optimum yields. Drip irrigation method was the most effective method as compared with the other methods.

- Sesveren (2001) compared the feasibility of the two systems; LEPA and drip irrigation systems in the Southeastern Anatolia region. The applied water was 814 mm in control plots for both systems,. The applied water varied from 383.3 to 854 mm in the whole growing period at LEPA; from 456.4 to 868.5 mm in drip irrigation system, **The highest cotton yield obtained from drip irrigation was 5850 kg/ha, and 4750 kg/ha from LEPA system.** According to research results, both methods produced higher yields than local conventional irrigation methods.

CONCLUSIONS

- It has become a necessity for the experts, people, and institutions to manage water resources in a planned and integrated manner. Two major challenges can be identified for the water resource management:
(1) To protect the sources of fresh water,
- (2) To manage its use in a manner that it is both equitable and ecologically sustainable. In order to cope with these challenges, some tools can be developed such as:

- Protected area networks to safeguard headwaters and wetlands that contribute to maintaining water quality and quantity, fresh water-sensitive forestry practices,
- Watersaving and non polluting agriculture (modern irrigation methods, organic agriculture),
- more efficient use of water by water intensive industries,

- Innovative ship designs to reduce the need to alter natural river channels, Dam and reservoir operations that imitate natural flow regimes,
- New sanitation and energy production processes that reduce water consumption (alternative energy), restoration techniques to re-establish ecosystem services in heavily degrade freshwater systems.

- It used to be argued that water that crosses boundaries would be a source of conflict if not war.
- However, more recent research has shown that parties that share a water resource actually tend to find ways to cooperate in mutually beneficial ways.
- In fact, transboundary water resources that are cooperatively managed can make a significant contribution to global and regional peace and stability and to sustainable economic growth (Jogerskog et al., 2007).

- Since the Agriculture is the major consumer of the fresh water resources, water and energy saving irrigation technologies and releveant research are emphasized on this paper.
- Water and energy saving irrigation systems becomes a major option for sustainable irrigation development. Water saving irrigation is expected to benefit not only the farmers and agriculture but also whole society and environment sustainability.

- Although rapid expansion of these systems in the last two decades, **pressurized irrigation systems are practiced only on about 5 to 12 % of the total irrigated area in these countries.** Big increases are expected in the application of new irrigation technologies in the future when compared with other countries having similar climatological conditions in Mediterranean Region.

- Demand for new irrigation equipment and technologies will grow up in the near future and these countries will be a growing market for private enterprise and irrigation companies.

- But smaller parcel sizes , irregular shaped farms and old legacy codes, limits the use of mobile irrigation machines , drip irrigation and portable sprinkler systems which can be adapted all types of the soil and farm conditions, for the farmers in these countries.

- **Governments of three countries** must adopt a series of policy innovations including strengthening water resources governance, reforming institutional structures, improving infrastructural system and disseminating technologies.

- The Irrigation sector, which consumes more than eighty percent of renewable water resources in these regions, is under pressure to reduce consumption.
- Effective use of world water resources will prevent disputes on transboundary waters and will ensure maximum sustainable productivity without creating environmental problems.

- World food security depends on improving irrigation efficiencies.
- To achieve this target; private companies, state organizations, universities and international organizations should support the new research activities on effective use of world water resources.



**THANK YOU
FOR YOUR PATIANCE !**