TRANS BOUNDRY RIVERS IN TURKEY AND EFFECTIVE USE OF THEIR WATERCASE STUDY. EUPHRATES AND TIGRIS RIVERS

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ABSTRACT

There are mainly two big transboundry rivers,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. . 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. Maritza (Meric) (Turkey-Greece), Arapcay (Turkey-Armenia) ,Coruh (Turkey-Georgia) and Asi (Syria-Turkey) rivers are other transboundry rivers between Turkey and neighboring countries.

Turkey started a very big integrated project called GAP (acronym for Southestern 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.

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 late1980s.

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 cause expanding use of water and energy saving irrigation technologies.

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 for about the same optimum yields. Drip irrigation method was the most effective method as compared with the other methods.

Key words: Transboundry waters**,**Euphrates, Tigris, effective water use, drip irrigation

INTRODUCTION

Water and economic growth are inex tricably linked, and 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 arragements 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 transboundry rivers,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. . 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), Arapcay (Turkey-Armenia) ,Coruh (Turkey-Georgia) and Asi (Syria-Turkey) rivers are other transboundry rivers between Turkey and neighboring countries (Tosun and Filiz,2001).

Turkey started a very big integrated project called GAP (acronym for Southestern 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 (Anonymous, 2005). 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 m^3s^{-1} between the Atarurk Reservoir and the main canals supplying the 4 large irrigation perimeters: Harran, Sanliurfa, Mardin and Ceylanpinar. Currently, this system supplies the quasi totallity of the 130, 000 ha net irrigation area of Harran and Sanliurfa perimeters with arated discharge of 124 $m^3s^{-1.}$ Once all infrastructures in the Mardin and Ceylanpinar perimeters will be completed, it will supply a total net area of 400, 000 ha (Soubrier et al, 2005).

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 late1980s. 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 cause expanding use of water and energy saving irrigation technologies (Sener et al. 2005)

EUPHRATES AND TIGRIS RIVERS

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 Firat 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, including extremely low flow records between July 1957 and January 1963, during which the average flow decreased to only 83% of the long-term average. 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, with 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, as Kolars noted, 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. Although the river allows some transportation to Mosul in the North, it becomes unnavigable afterwards. 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 (http://www.american.edu/TED/ice/tigris.htm).

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 x 10^9 m³ in total at its confluence with the Euphrates, which includes 13.2 x 10^9 m³ from the Greater Zab, 7.2 x 10^9 m³ from the Lesser Zab, and 5.7 x 10^9 m³ from the Diyala (Shahin 1989; Beaumont et al. 1988) http://www.unu.edu/unupress/unupbooks/htm.

The Tigris river is a different case than the Euphrates if contribution patterns compared, where the main stream in Turkey, along with the Khabur river (not to be confused with the Khabur shared by Turkey and Syria farther west) only accounts for an annual flow of 20.5 bmc. At Baghdad, the Tigris records a maximum annual average flow of 70.4 bmc, and 55 % of this flow originates from its tributaries in Iraq. Therefore, Turkey contributes around 51.8 per cent of the Tigris' flow, with Iraq contributing 49.2 % 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.

Southeastern Anatolia Development project, or GAP with its Turkish initials, is the biggest development project ever undertaken by Turkey, and one of the biggest in its kind in the world. It is a project that was envisioned by the Turkish leaders in 1950s and 1960s and began with the construction of the Keban dam in the upper Euphrates river. The main push for the project came during the 1980s and in 1986, the 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 project envisages the construction of 22 dams and 19 hydroelectric power plants on the Euphrates and Tigris rivers and their tributaries. It is planned that at full development, over 1.7 million hectares of land will be irrigated and 27 billion kilowatt hours (kWh) of electricity will be generated annually with an installed capacity over 7,500 megawatts (MW). 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). This project plans to develop the long ignored Southeastern Turkey, where a major outflow of population has been combined with high levels of unemployment and political instability. 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 (Anonymous, 2005).

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 Arab Republic, 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 . At nations' level, the average holding size is 9,2 ha and for irrigated farms is 3,6 ha .

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 and international pressure on weapons issues 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. The Bekhme Dam on the Greater Zap, the

Dokan Dam and the Dibbis Dam on the Lesser Zap, the Darbandikhan Dam and the Hamrin Dam on the Diyala are the remaining operational dams on the Tigris river. Supposedly, there are four more dams are either being planned or constructed for future use. Also, the Main Outfall Drain, 500 km in length, with an average depth of 4 meters and a width of 180 meters, is intended to remove excess drainage water from the area between the twin rivers south of Baghdad and to discharge it to the Gulf near the Fao Peninsula after transferring it by siphon across the Euphrates river near Nasiriyah. Some reports indicate that this canal has already completed and ready for use.

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. One must look at the present situation in the basin with an emphasis on an assessment of the degree and the shape of the conflict in the region. Across examination of the relations linked to the water issues would provide us a better understanding of the status of the conflict in the basin.

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. Later, a Joint Boundary Water Commission was established and in 1973 the two governments signed an additional Treaty on the Joint Construction of the Arpacay Storage Dam, which has been operated by a joint technical commission.. Similar cooperation was possible between Turkey and Greece. Beginning with the Treaty of Lausanne and continuing into the 1950s, 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

The past record of Syria certainly reflects a different picture than the Turkish example, and Syria demonstrates past efforts to cooperate on water issues where the Syrian government holds the upper hand. The main agreements on water issues are between Syria and Lebanon

on the use of the Orontes river, where Turkey happens to be the downstream riparian. Except with Lebanon, Syria has not been cooperative about the water issues, but the Syrian government carried out multiple bilateral talks with the concerned parties at almost all cases. 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. As international waters, 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 -Hydrologic data will be exchanged on Euphrates and Tigris rivers -After gathering all relevant data, the Joint Technical Committee (JTC) will, first of all, calculate the demands of water for the projects under operation, then for the projects under construction and finally for the planned projects. The determination of needs for these projects will be made separately. Besides these proposals, Iraq demands that Turkey should release more than 500m3/s, favorably around 700m3/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 (http://www.american.edu/TED/ice/tigris.htm).

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 . Before the 1970s, when both Turkey and Syria built a series of large dams on the Euphrates, Iraq received 33 x 10^9 m^3 of river water per year at Hit, 200 km downstream from the Syrian border. By the end of the 1980s, the flow discharge at Hit had decreased to as little as 8 x 10^9 m^3 per year (WPDC 1987) http://www.unu.edu/unupress/unupbooks/htm.

The total flow of the Euphrates is not as great as that of the Tigris, although the river regimes are similar. It, too, rises in the highlands of Turkey and is fed by melting snows, to an even greater extent than the Tigris, but it lacks the major tributaries which the Tigris has. 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. The mean annual runoff of the Euphrates is 35.2 x 10^9 m^3 at its confluence with the Tigris (http://www.american.edu/TED/ice/tigris.htm).

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 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 pressurized irrigation systems. surface irrigation is the most commonly used irrigation method, pressurized irrigation systems cover only 5 to12 % of all irrigated areas In three countries . This ratio reaches to 40% in Italy, 70% in France, 90-95% in Israil and Cyprus (Şener, 2005; Paola, 2005).

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 (table 1).

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.

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 are more popular for the farmers in these countries

Table 1. Optimum cotton lint yields and feasible irrigation water quantities in GAP Region (Sener and Cetin,2002)

Irrigation System	Irrigation Water (mm)	Yield Kg ha-1	Relative Irrigation Water	WUE Kg ha-1 mm-1
Furrow	986	3079	100	3,12
LEPA	1076	3078	109	2,88
M. Drip	1059	3020	107	2,85
M. Nozzle	732	3612	74	4,93
Sprinkler	717	3714	72	5,17
Drip	678	3413	69	5,03

CONCLUSIONS

It has become a 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 manegement: To protect the sources of fresh water and to manage its use in a manner that it is both equitable and ecologically sustanible. 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 (aternative energy),restoration techniques to re-establish ecosystem services in heavily degrade freshwater systems (Divrak, B.B. 2005).

It used to be arqued that water that crosses boundries would be a source of conflict if not war. However, more recent reseach has shown that parties that share a water recource 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 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. **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.

Although rapid expansion of these systems in the last two decades, pressurized irrigation systems are practiced only on about 10-12 % of the total irrigated area in Turkey. 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 it will be a growing market for private enterprise and irrigation companies.

The examples taken from water resources strategies developed for Jordan, Oman and Tamil Nadu, India indicate some of the promlems that are being addressed. In all these examples, the Irrigation sector, which consumes more than ninety percent of renewable resources in these regions, is under pressure to reduce consumption (Stacey, 2005).

Effective use of world water resources will prevent disputes on transboundry waters and will ensure maximum sustainable productivity without creating environmental problems. World food security depends on improving irrigation efficiencies. For these reason private companies, state organizations, universities and international organizations should support the new research activities on effective use of world water resources.

REFERENCES

Anonymous, 2003. "Turkey Country Report. Prepared for the 3rd World Water Forum March, 2003". World Water Council; Ministry of Foreign Affairs, Department of Regional and Transboundry Waters, General Directorate of State Hydraulic Works (DSİ)

Anonymous, 2005. "DSI in Brief (1954-2005)" General Directorate of State Hydraulic Works (DSİ), Ankara

Anonymous. 2003. FAO. "Water management: towards 2030". www.fao.org/ag/magazine

Divrak, B.B. 2005. "A New Approach on the Management of the Water Resources: Integrated River Basin Management" International Symposium Water for Development Worldwide. Republic of Turkey Ministry of Energy and Natural Resources General Directorate of State Hydraulic Works (DSİ) 7-11 September 2005, İstanbul-Turkey.

Chandrakant, D.T., 2002. "Water Resources Management Cross Cutting Issues.Water and Food Security- How the Poor will get their food?" Middle East Technical University Development Foundation Publishing and Comunication Company- Ankara. p. 3-11.

Jogerskog, A.,J.Granit,A. Risberg, and W. Yu. 2007. Transboundary Water Management as a Regional Public Good. Financing Development - An Example from the Nile Basin. Report Nr. 20. SIWI' Stockholm.

.

Paola, J. C. D. 2005. "Opportunities and Challenges for the Irrigation Industry in the Mediterranean Basin"The 3rd New Ag International Conference&Exhibition Programme. Antalya, Turkey, 16-18 March, 2005.

Sener, S., Yildirim, M., Erken, O., 2005. "Research on Water Saving New Irrigation Technologies in Turkey". International Symposium Water for Development Worldwide. Republic of Turkey Ministry of Energy and Natural Resources General Directorate of State Hydraulic Works (DSİ) 7-11 September 2005, İstanbul-Turkey.

Sesveren, S., 2001. "GAP (Güneydoğu Anadolu Projesi) Bölgesinde Pamuğun Lepa ve Damla Sistemi ile Sulanması." KSÜ. Fen Bil. Ens. Kahramanmaraş.

Sener , S., O. Cetin, 2002. "Comparative research on water and energy-saving irrigation systems in the GAP and Aegean regions of Turkey." International Journal of Water. Vol.2, No : 2/3, 2002.

Soubrier, G., I.Yerdelen, U. Buyukhatipoglu, "The Ataturk Dam and Sanliurfa Feeder Scheme, Heart and Aorta of the Southeast Anatolian Project" International Symposium Water for Development Worldwide. Republic of Turkey Ministry of Energy and Natural Resources General Directorate of State Hydraulic Works (DSİ) 7-11 September 2005, İstanbul-Turkey.

Stacey, D.B.2005." Managing and Meeting the Demand for Water- Theory and Practice" International Symposium Water for Development Worldwide. Republic of Turkey Ministry of Energy and Natural Resources General Directorate of State Hydraulic Works (DSİ) 7-11 September 2005, İstanbul-Turkey.

Tosun, M., M.Filiz 2001 . "The Legal Status of the Waters that Surpass Border". International Symposium on Water Resources and Environmental Impact Assesments. Ed. Z.Sen, F.Karaosmanuglu, S.Sirdas. July 11-13, Istanbul, Turkey

http://www.american.edu/TED/ice/tigris.htm

http://www.unu.edu/unupress/unupbooks/.htm

http://en.wikipedia.org/wiki/Euphrates