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Proposed policies for integrated watershed management in order to combat desertification in Euphrates and Tigris basin

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Abstract

Desertification of the arid and semi-arid lands of the world has been proceeding for more than a thousand years. Human-induced degradation in these areas is regularly cited as one of the principal causes of desertification. Euphrates and Tigris Basin as the case study of this research in some aspects is almost unique in the world. But this basin has been confronted to progressive desertification. This research was done for proposing appropriate policies in terms of main driving forces in order to combat desertification in this basin. So qualitative analyses of data banks of the countries involved in this basin have been collected by FAO consultants, showed desertification in Euphrates and Tigris Basin is characterized by climate factors and human activities; water scarcity and unequal distribution of water are major climate factors. The main human activities are overgrazing of rangelands, deforestation, and land use changes. Because of negative impacts of human activities on climate factors and also deep dependency of livelihood in this basin, there is an urgent need to plan an integrated watershed management in order to managing people, water, forests, and range lands together for combating this progressive desertification.

Keywords: Desertification; Proposed Policies; Integrated watershed management; Institutional framework; Human activities; Climate factors

1. Introduction

The term desertification is used in accordance with its definition by the UNCCD (1994) describing land degradation in arid, semi-arid or sub-humid areas. Desertification of the arid and semi-arid lands of the world has been proceeding--sometimes rapidly, sometimes slowly--for more than a thousand years. It has caused untold misery among those most directly affected, yet environmental destruction continues. Because desertification occurs gradually, and the processes responsible for it are understood, it can often be avoided by planning or reversed before irreparable damage occurs. The main forces causing desertification may be divided into human activities and climate factors. Human-induced degradation in arid and semi-arid areas is regularly cited as one of the principal causes of desertification (LeHouerou, 1996).

In Euphrates and Tigris Basin water scarcity and unequal distribution of water are major climate factors and main human activities consist of overgrazing of rangelands, deforestation, and land use changes (changing forests and rangelands into agricultural lands) (Altinbilek, 2004).

The increased awareness about the threats of desertification requires better knowledge about distinct causes of degradation in order to take the most efficient and sustainable actions. These sustainable and suitable actions could be reached through making appropriate policies related to integrated watershed management.

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China's grain-for-green policy of returning steep cropland into forests is one of the most important large-scale initiatives to combat land degradation and desertification in its ecologically vulnerable regions. In this regard, Wang et al. suggest that more attention should be paid to gradual conversion of cropland for food security and ecological purposes, improvement of compensatory regulation for cropland loss and regional integrated development for poverty alleviation (Wang, Fang, and Shen; 2007).

In a research which was done in Spain, it was estimated that only strict environmental policy enforcement together with people education could bring the situation under control. According to the conclusion of this research, implemented policies have over-emphasized the economic dimensions of development at the expense of environmental sustainability, specifically targeted policy instruments having failed to address the issue of desertification (On˜ate & Pecco, 2005).

Regarding the policy of "withdrawal of the animals from forest" in Iran, Shamekhi examined the implementation of this policy in over more than last 15 years; and listed the difficulties in implementation. He concluded that the main challenge is to reach a good arrangement between different stakeholder institutions. To solve this problem, a participatory policy was proposed (Shamekhi, 2004).

Solh et al. believed that there is an urgent need to reform the policies related to land use in drylands. In their opinion this reform should be done in direction of integrating the management systems and increasing participation with stakeholders, especially local people as the main participators and giving more devolution to them (Solh, Amri, Ngaido, and Valkoun; 2003).

Abahussain et al. showed lack of explicit policies related to integrated management and sustainable use of lands in Arab Region caused to accelerate the rate of land degradation and desertification process. Also they showed failures of resource management policies are aggravated by overgrazing, overexploitation of water and land resources, overcultivation of marginal lands, deforestation, and the use of inappropriate technologies due to lack of an integrated management system (Abahussain, Abdu, Al-Zubari, El-Deen, and Abdul-Raheem; 2002). In Namibia several programmes working on aspects of desertification have highlighted the importance of the planning, policy and legislative framework, the environmental framework and the socio-economic framework in an integrated management plan for combating desertification (Seely, 1998).

Euphrates and Tigris Basin as the case study of this research in some aspects is almost unique in the world: having more than 6000-years history; creating one of the greatest civilizations in the world; living people with different religions and races together; several times looted - in some cases exertion- by foreign countries; wars between people with religious and ethnic differences or between these countries and foreign countries, …; but what changed this watershed to such an unsecured region with unstable social, environmental and economic situation?

We do not want to answer this question. What is important for us is to what extent these social, environmental and economic changes, have been affected the progressive process of desertification in this basin. Destroying deep and friendly relation between people and nature has been one of these avoidable effects; infact, thinking about the nature and the beauty needs to be free but in this unfavourite conditions of life, people missed their interest and motivation to think about the beautiful objects around them, even about forest that their livelihood -directly or indirectly- depends on it. The purpose of this research is proposing appropriate policies in terms of main driving forces in order to combat desertification in Euphrates and Tigris Basin. Also the hypothesis of this research is "lack of an integrated watershed management plan is one of the main reasons of this high rate of desertification in Euphrates and Tigris Basin"; so planning an integrated watershed management as the main policy may decrease the desertification in this basin.

2. Materials and methods

2.1. Study area

The area of Euphrates & Tigris Basin is 765,742 km^2 and the population density is 57 per km^2. 90.9% of the basin is defined as arid area. 1.2 % of this basin is covered by forests (9188 km^2), 25.4% by crop-lands (194,498 km^2) and 47.7% by grass-lands (365,258 km^2) (Figure 1). The Euphrates and Tigris Basin makes one of the habitable and productive harshest environments in the world. The region has a continental subtropical climate, with extremes of heat in summer and cold in winter, as well as great diurnal variations. Rainfall is scanty (FAO, 2005a).

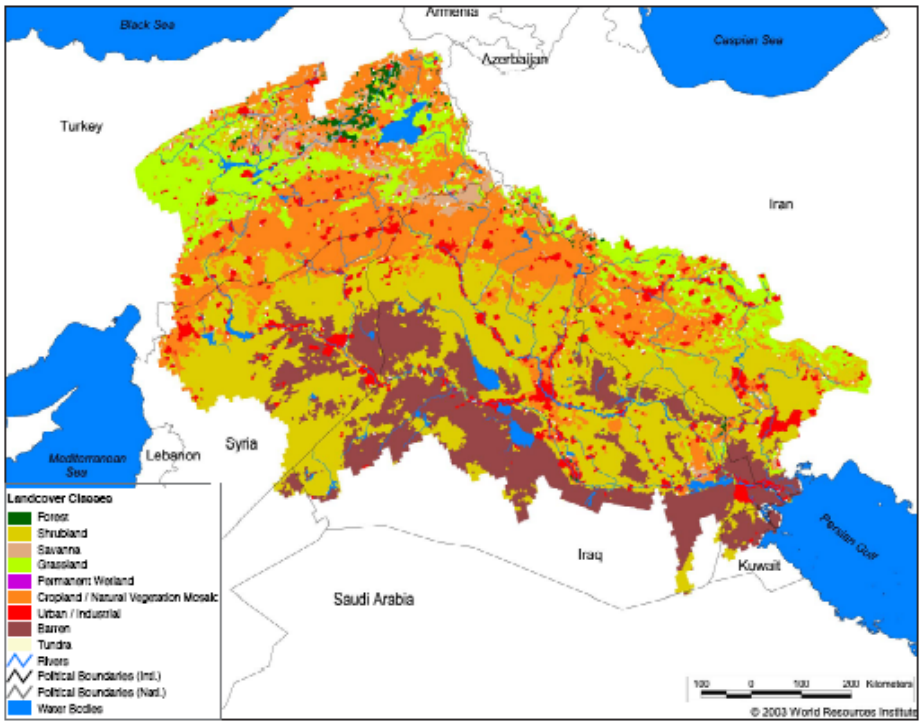

Fig. 1. Land use map of Euphrates and Tigris Basin (FAO, 2005b)

Euphrates & Tigris Basin includes 5 counties: Iraq, Syria, Turkey, and a small part of Iran and Saudi Arabia (Figure 2). However, Saudi Arabia and Iran are not major riparian in this basin; Iran is riparian only to the Tigris; Saudi Arabia is riparian only to the Euphrates. Moreover, the Saudi Arabian stretch of the Euphrates, dries in summer, and because of the specific geographic and climatic conditions, Iran cannot use the waters of the Tigris for agriculture or hydropower (Table 1). Also Saudi Arabia does not have any significant role in this basin. Therefore, these countries have generally been ignored in the studies of the basin (FAO, 2005a) and this study focused on Turkey, Syria and Iraq.

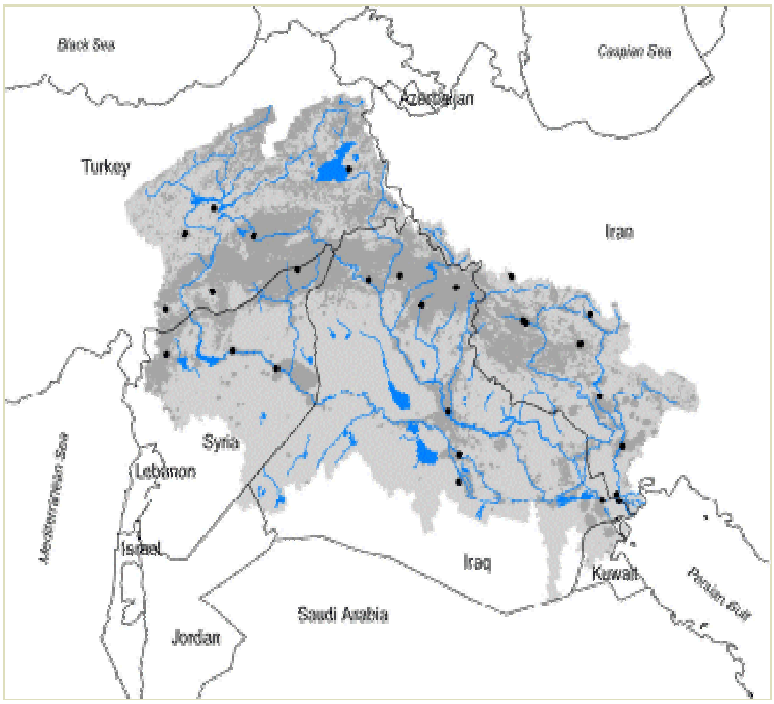

Fig. 2. Euphrates and Tigris Basin (FAO, 2005b)

Table 1. Riparian Contributions to the Euphrates-Tigris Rivers Basin (Macquarie, 2004)

Euphrates & Tigris Rivers	Turkey	Iraq	Syria	Iran	Total
Discharge (%)	78.1	8.1	0.5	13.3	
(Billion m^3 /year)	65.7	6.8	0.5	11.2	84.2
Drainage Area (%)	20.5	46.0	9.0	19.0	
(Km^2)	170,000	469,000	77,000	37,000	819,000
River Length (%)	33.5	51.0	15.5	----	
(Km)	1630	2478	754	----	4862

2.2. Methods

A comprehensive data bank of social, institutional, ecological, environmental and economic situation of each country involved in this basin was collected by national consultants of Forest Economics Service of FAO. After reviewing and analyzing these data banks, a prepared analytical report for each country, consist of physical context, historical and political background, social context, economic situation, environmental aspects, land uses, water resources, institutional arrangements, and also some comparative tables with relative ranking of countries situation (Table 2 & 3). Comparing the various situations of the countries together helped us to know more about the past and present situation of Euphrates and Tigris Basin and main driving forces in this basin. Also some information about implemented and implementing policies relating to human and natural resources in these countries were prepared through conversation with authorities of their ministries, and administrations are responsible for planning, policy-making and policy implementation. Finally the outputs of data banks, analysis reports, past and present situation of the basin, and investigation of management plans and policies were gathered and concluded.

3. Results

According to the analytical report, the followings are main driving forces which have been affected desertification process in Euphrates and Tigris Basin:

3.1. Human activities

Qualitative analysis of social, economic, and environmental situation showed human activities are main effective factor on desertification process in this basin. Human activities consist of:

Table 2. A part of analysis report of countries involved in Euphrates and Tigris Basin (Kangarani, 2005)

Country	Iran	Iraq	Syria	Turkey
Total area (km^2)	1 650 000	438 320	185 150	779 450
Population	70 675 000	26 555 000	18 650 000	73 302 000
Rural population (%)	32	32	47	32
Average annual rainfall (mm)	252	154	252	643
Main social indicators	Education Poverty Health Migration	Education Poverty Health Water supply Sanitation Food supply Refugees	Education Poverty Health Human settlement Nutrition	Education Poverty Health Human settlement
Economic situation				
GDP	$516.7 billion	$54.4 billion	$60.44 billion	$508.7 billion
GDP - per capita	$7,700	$2,100	$3,400	$7,400
GDP - Growth Rate	6.3 %	52.3%	2.3%	8.2%
Unemployment Rate	11.2%	25% to 30%	20%	9.3%
Main environmental problems	Desertification Deforestation Industrial and urban waste water Depletion of water resources	Desertification Deforestation Poor water quality Air pollution	Desertification Deforestation Depletion of water resources Air pollution Unsound agricultural practices	Desertification Deforestation Air and water pollution
Water resources				
Water withdrawal	70 km^3/year	48.2 km^3/year	14.41 km^3/year	31.6 km^3/year
Institutional arrangement				
Ownership of natural resources	State ownership	State ownership	State, private and public ownership	State ownership
Centralization	High	High	Medium	High

Table 3. Equitable use relative ranking for Euphrates and Tigris Basin (Kangarani, 2005)

Country	Turkey	Syria	Iraq
Share in drainage basin	2	3	1
Country's water contribution	1	3	2
Climate	3	2	1
Conservation of water	2	1	3
Environmental policy	2	1	3
Patterns of utilization			
- Past	3	2	1
- Present	1	3	2
Social Indicators			
- Life expectancy	1	2	3
- Infant mortality	1	3	2
Total population (2001)	1	3	2
Population growth (1990-2000)	3	1	2
Energy needs	1	2	3
Economic indicators			
- Per capita income	3	2	1
- Total debt	3	2	1
Cereal imports	3	2	1
Food production per capita	1	3	2
Alternative sources (virtual water)	2	1	3
Total(summation)	35	34	33
Average score	2.06	2.00	1.94

3.1.1. Overgrazing of rangelands

The use of previously unexploited lands for pasturing increased dramatically in the 1980s as the region expanded its wool markets overseas, supporting the demand for wool with large commercial herding operations (FAO, 2005a).

Overgrazing robs the soil of its ability to hold water and at the same time removes much of the vegetative cover that serves as a shield against erosion. The consequence is that much of the topsoil in affected regions of this basin simply dries up and blows away. In the process of desertification, this dry, sterile soil forms drifts, which swallow and kill other plant life.

3.1.2. Deforestation

Forests cover only 1.2 Percent of Euphrates and Tigris Basin. Therefore, forests have not a significant weight in terms of land uses. Forest vegetation in this basin has been very dense but with time has become very poor due to years of degradation activities. Large-scale deforestation schemes intended to produce wood for fuel, cooking, heating and other purposes such as commercial harvesting completely alter or destroy natural vegetation communities in this basin.

Human impact has resulted in a decline in the habitat as well as plant diversity. Nearly 50 percent of the forests have been heavily destroyed; an open canopy, well-developed grass layer and a patchy distribution resulting from human exploitation characterize these forests. Forests are presented at the edge of plains in tectonic depression. Dry forests are found at high elevation, being sparse and poor due to aridity as well as heavy biotic pressures. Nearly 50 species have been recorded to be under a threat of extinction. In particular endemics are facing a greater threat. This area shows an endemic ratio of 20-25% (FAO, 2005a).

3.1.3. Land use changes

In a region already far from being self-sufficient in food and with a growing population, desertification poses a very real threat to food security. Infact in order to meet the demand of food, large areas of pastoral land and some previously unused land were put under cultivation. The growth of cities, generally situated a top of the regions most productive agricultural land, pushed cultivation onto areas which had previously been primarily pasture. This in turn displaced herders onto land which was unsuitable for permanent agricultural operations.

Due to irrigation of agricultural lands without adequate drainage reduction in the quantity of organic matter, salinity, alkalinity, or acidity of soils have been occurred. The Euphrates and Tigris Basin is presenting an alarming situation with over 75,000 ha facing salinity-alkalinity problems (FAO, 2005c).

In the other hand, Industrialization and demographic explosion have been important driving forces in the heavy urbanization of Euphrates and Tigris basin. This basin experienced greatest constructional activities during the last decade loosing 16,000 ha of prime quality land. Latest trend in this basin has

been use of best quality arable lands for urbanization sectors such as highway construction, tourist establishments, sports complexes, universities, airports and other activities (FAO, 2005a).

3.2. Climate factors

Because of the following reasons, water is the most limiting climate factor in this basin:
- First, water is not a plentiful resource in Middle East, the arid Middle East that is. There is a huge disparity between the water scarce arid countries and water rich Turkey, Iraq, Iran and Syria although with exception of Iraq, the three have large populations.
- Second, many of populations of this basin depend on these rivers that transverse an international boundary before reaching them. Some people have no rivers and depend on diminishing wells or expensive desalinised water from the sea.
- Third, water use in Euphrates and Tigris Basin is characterized by over-use (Table 4&5), wasteful practices and polluted groundwater and aquifers. Over irrigation and flooding of fields have raised water tables polluting soils with salinised water, even impinging into the root zone causing crop failures. Massive dependence on agriculture and a heavy dependence on irrigation, fertilizers and chemicals, combined with largely sandy and Gypsiferous Soils, have caused massive leaching of chemicals into the groundwater. Subsequent over pumping of wells has exacerbated the problem. Major development and hasty irrigation projects have sent polluted and highly saline return flows into water of these rivers, as is the case in the Euphrates River upstream from Syria and Iraq.

Table 4. Revised water demand figures for the Tigris River for the period after the year 2020 in MCM/year (Beaumont, 2003)

Country	Irrigation Water Use	Evaporation	Total
Turkey	5,600-6,700	630	6,200-7,300
Syria	0	0	0
Iraq	37,200-60,000	1,000	38,200-61,000
Total demand	44,400-68,300		
Available water	52,700		
Balance	+8,200 to -15,700		

Table 5. Revised water demand estimates for the Euphrates basin for the period after the year 2020 in MCM/y (Beaumont, 2003)

Country	Irrigation Water Use	Evaporation	Total
Turkey	10,830-13,000	1,100	12,000 -14,000
Syria	4,750-12,500 0	630	5,400 -12,600
Iraq	24,400-27,500	600	25,000 - 28,100
Total demand	42,300 - 54,800		
Available water	31,800		
Balance	-10,500 to 23,000		

Addition to main driving forces in Euphrates and Tigris Basin, institutional and political situation showed formal and informal institutions have ancient root and immense existence in the political and social history of this basin. Infact informal institutions arrange the relationships between people and nature; in the other hand, these relations affect by traditional systems have been shaped by institutions.

Nomadism is one of these institutional and traditional systems that because of special life style of nomads, their livelihood depend deeply on nature. Until recently, most pastoralists traveled as nomadic and semi-nomadic tribes. Constant movement prevented the overgrazing of the fragile vegetative cover that is characteristic of much of this basin. Beginning in the mid twentieth century, however, the privatization of land resources led to the creation of fenced enclosures and fixed settlements. Fixing the location of herds placed unsustainable stress on the grazing land, and left much of it barren and vulnerable to erosion.

4. Discussion & conclusions

Human activities and their negative effects on desertification process in Euphrates and Tigris Basin have been caused to increase the negative effects of non appropriate climate conditions and water scarcity. Thus, it is better to avoid of separating human activities from climate factors and managing them together. In the other hand, ancient close relationship between people and nature and deep dependency of most people livelihood to the nature in this basin showed that planning an integrated management system is not avoidable. With this plan, managing people and natural resources together, without sacrificing another factor, and with a sustainable development pattern would be possible. Regarding this kind of management, close collaboration between

local people and governments that plays important role in ownership and management of natural resources in this basin is necessary. So this integrated management plan is an inter-sectoral management system with the central pivot of people. In general, participation with local people as the main stakeholders, in planning and implementing of all management plans could be useful in integrated management of this basin.

5. Recommendations

Followings are main proposed policies relating to human activities and climate factors in the framework of an integrated watershed management plan:

5.1. Relating to clime factors

- Making an official agreement between Turkey, Syria and Iraq related to equitable distribution of water
- put more strong limitations in order to sustainable use of natural resources such as rangelands, forests and water resources
- Developing demand management plans for municipal and irrigation water supplies, especially for possible drought periods
- Utilizing equitably and effectively from the waters of the Euphrates and Tigris Rivers and taking into account seasonal and yearly variations in flow due to floods and droughts
- Developing water-augmenting techniques such as water harvesting, conjunctive use of surface and groundwater sources reuse of return water

5.2. Relating to human activities

- Making rural societies with real devolution in order to participate in management of natural resources
- Putting more attention into the traditional and institutional rights of local people on natural resources
- Making local institutions with real devolution in order to increase decentralization
- Promoting the culture of conservation of natural resources in order to teach people how dealing with the nature
- Legalizing the identification of institutions - especially nomads- and improving their construction

According to implementation of these proposed policies "Institutionalism Approach" could be an appropriate theory that in it "institutions are the main actors and their regulations, laws, relations, manners, usages, and traditions have been investigated" (Chandler, 1969).

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