YEREL VE BÖLGESEL AMAÇLAR ARASINDA PARALELLİK KURULMASI: YUKARI FIRAT-DİCLE HAVZASINDA SU TASARRUFU

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Özet:
Yukarı Fırat-Dicle havzasında sürdürülebilir su tassarufu için Suriye, Irak ve Türkiye arasında imzalancak muhtemel bir anlaşmadan medet ummaktansa Türkiye içinde yerel ve bireysel sorunları çözmek daha faydalı bir yaklaşım olacaktır. Bölgede çözüm bekleyen sulamayla ilgili yerel ve bireysel problemler şunlardır: suyla taşınan kimyasallardan kaynaklanan kirlilik; aşırı sulama dolayısıyla toprakta oluşan tuzlanma; kuraklığa dayanıklı bitkisel cinslerinin geliştirilmesi; iklim değişikliği dolayısıyla artan sıklıkta yaşanacak olan kuraklıklara karşı suyun yeraltı kaynaklarında depolanması. İklim değişikliğinin bölgeye etkisini tahmin etmeye çalışan çalışmaları ve göç dahil çevre kaynaklı sorunları literature taramsı yaptıktan sonra, muhtemel çözüm önerileri değerlendirilmiştir: i) tarımsal pratik eğitimi, ii) biresysel düzeyde su tasarrufu için suyun kullanılan miktarla orantılı olarak ücretlendirilmesi, iii) Sulama Birlikleri reformu. Herkesin hayata geçirilmesi için üstünde anlaştığı öneri, en yeni tarımsal pratikler ve ürün deseninin etkin bir şekilde tarımla uğraşanlara aktarılmasıdır. Yapılan analiz göstermiştir ki en çok üzerinde durulan çözüm önerisi olan suyun etkin bir şekilde ücretlendirilmesi malesef en çetrefilli problem olan Sulama Birliklerinin demokratikleştirilip üst yönetimlerinin sıradan üyelere açılmasından ayrı düşünülemez.

Anahtar kelimeler: Güneydoğu Anadolu, iklim değişikliği, tuzlanma, göç, Sulama Birlikleri

Aligning Local Incentives to Regional Goals: Water Conservation in the Upper Tigris-Euphrates River System

Abstract:
Instead of international agreement between Syria, Iraq, and Turkey, the best hope for sustainable water conservation in the Euphrates-Tigris river basin lies with policies that can be justified on individual and local grounds within Turkey: reducing water run-off and accompanied pollution; reducing soil salinity; developing drought resistant strains of crops; and storing water as an insurance against future droughts that are likely to increase in occurrence and intensity as a result of climate change induced extreme weather. After reviewing the predictions on climate change for the region, irrigation related problems including out-migration, I evaluate policy options for water conservation: i) agricultural training and extension services, ii) escalating user fees for water to encourage conservation at micro level, iii) reforming of Water User Associations (WUAs). The least controversial policy to pursue is on-the-ground agricultural training and extension. Unfortunately, implementing escalating user fees for water – the most advocated solution – cannot be separated from democratizing WUAs – the most vexing problem – to open board seats and management to ordinary members.

Key-words: South-eastern Turkey, climate change, salinity, migration, Water User Associations
JEL Code: Q53, Q57, H41

Introduction

Policies that are required to adapt a drier 21st Century in South-eastern Turkey is also good for increasing economic performance of agriculture in the region. In other words, there is no trade-off between policies pursuing adaptation to climate change and economic performance in South-eastern Turkey. Moreover, less environmental degradation and better economic performance will probably result in less immiserizing out-migration from the rural areas in the region.

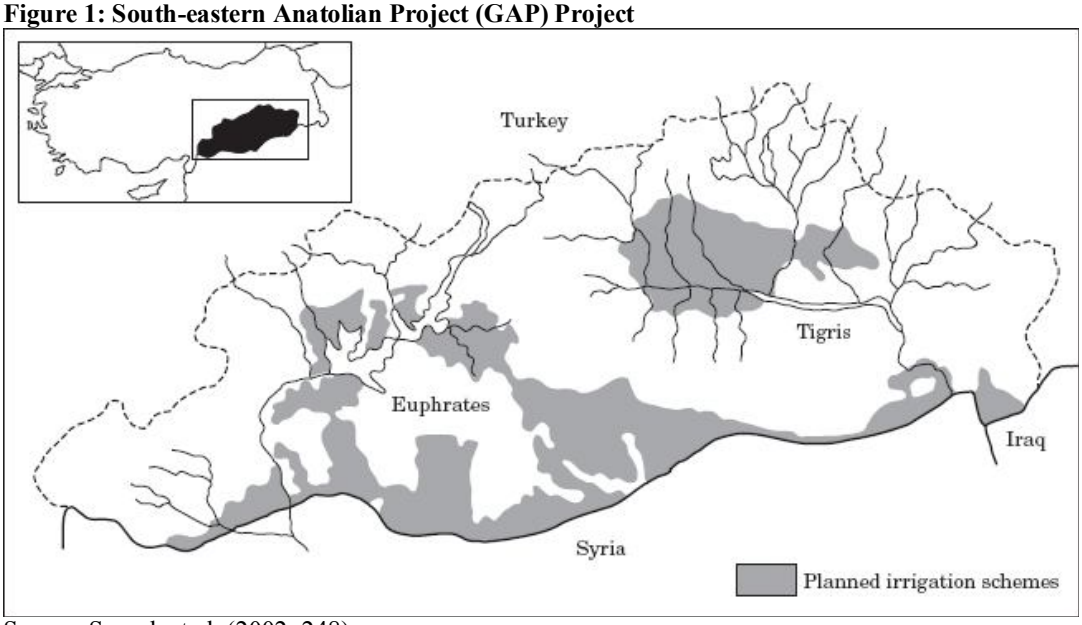
Currently farmers in the region who have access to irrigation water – either from the South-eastern Anatolian Project (GAP) (Figure 1) or groundwater – are over irrigating and as a result are causing soil salinity and exacerbating erosion in their fields. If farmers do not adapt sustainable irrigation and farming practices, drier climate conditions in the coming decades will lead to more evaporation and more soil salinity. Salinity eventually can render fields unproductive. Past experience with out-migration from the region due to environmental degradation indicate that migrants mostly end up worse-off economically. However, if farmers switch from cotton monoculture to water-conserving crops to reduce their overall water use, more water will be available to other farmers both spatially and over time[1]. Moreover, if less water devoted to irrigation in GAP region, more water will be available for hydropower generation and consequently more water will be released to downstream countries (Syria and Iraq) from Euphrates and Tigris rivers.

Euphrates-Tigris river basin generally conceptualized as an international issue and as a zero-sum game: if Turkey uses more water for irrigation, less water will be available to Syria and Iraq (Anderson and Akinmoladun, 2010; Çarkoğlu and Eder; 2001; Şen, 2006). Predictably there is no overall agreement between these countries other than a protocol signed in 1987 between Syrian and Turkey where Turkey commit to release 500 cu m/sec from Euphrates River until ultimate allocation of water resources and no progress since then. Actually Turkey, Syria and Iraq do not even agree on broad principles about how to share water. Turkey wants to share water proportional to contribution to water basin, whereas Syria and Iraq demands that access to water to be

[1] Most of the time groundwater depletion due to over-use is irreversible, destroys a vital source for future generations (see Section on migration for Suruç).

grandfathered (Şen, 2006: Chapters 5 and 6). In this paper, I deviate from this deadlocked, zero-sum approach. Instead I adapt a micro level perspective and focus on micro (farmer) and local actors (Water User Associations (WUAs) and agricultural extension services) to develop solutions. Grabbing more water from neighbors will neither solve the salinity problem (and water-logging at some places) nor accompanying economic losses and escalating costs.

Figure 1: South-eastern Anatolian Project (GAP) Project



Source: Saysel, et al, (2002: 248).

Hopefully researchers from other MENA countries will find the discussion of micro and local irrigation related environmental problems in South-eastern Turkey and solution proposals stimulating. I first review studies regarding potential direction of climate change in Turkey, especially with an eye on South-eastern Turkey. The verdict of a diverse group of researchers is unanimous: higher mean temperatures, less precipitation and more severe weather conditions (i.e. more droughts) for the region. The implication for the irrigation is increased evaporation and more salinity if current practices continue. Then, I focus on irrigation in GAP region and especially the Harran plain which is irrigated from Atatürk Dam reservoir. Salinity and rising water-table are already serious problems in the plain. The cause is excessive irrigation. Most of the time, the solution is to irrigate less and switch to water-conserving crops. Next I review the nascent literature

on out-migration due to environmental degradation from South-eastern Turkey to learn from these experiences. Kadirbeyoğlu (2010) shows that irrigation from groundwater leads to depletion and also suffers from similar problems associated with surface water irrigation in the region. After investigating the causes of over-irrigation, I review and evaluate solution proposals. I conclude that the least controversial policy to pursue is on the ground agricultural training and extension. Unfortunately, implementing escalating user fees for water cannot be separated from reforming WUAs to democratize them and open board seats and management to ordinary members. The conclusion wraps up the main findings.

Climate Change in South-eastern Turkey in 21st Century

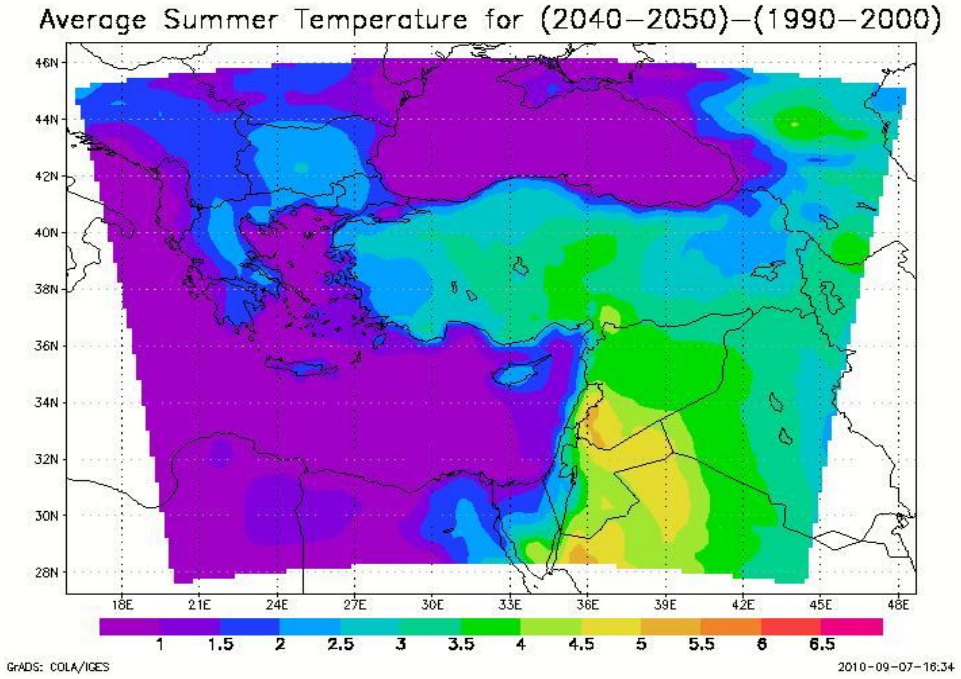
Trying to predict the climate change for the next 20 to 30 years is a tall task. Precise and reliable estimates that can inform policy on the ground are even harder to obtain. Actually, Fay et al., (2010) suggest that instead of trying to obtain precise impact assessment, Southern European countries (including Turkey) should start to design policies and develop capabilities to reduce vulnerability to climate change because the climate has been changing in the region: "increasing variability, warmer temperatures, changing hydrology, and more extremes – droughts, floods, heat-waves, wind-storms, and forest fires" (xix). Within the Central Asia and Eastern Europe, Turkey is expected to experience greatest increase in extreme weather after Russia and Albania (Fay et al., 2010: 5). Fay and Ebinger (2010: 19-21) point out that sensitivity of Turkey to climate change is high and existing adaptive capacity is low hence vulnerability to climate change is only better than Albania in Southern Europe. Likewise, World Bank climate change data portal[2] shows that 20 out of 20 IPCC Global Climate Models predict, on average, 10 percent (9 percent for South-eastern Turkey) decline in mean annual precipitation between 1980-1999 average and 2030-2049 average. Likewise, same models predict 2 degree Celsius (also 2 degree Celsius for South-eastern Turkey) increase in mean annual temperature for the same period.

For Turkey, Kurnaz (2010) predicts that by 2040-50 mean temperatures will increase by 1-3 degree Celsius depending on season (winter-on-winter will experience

[2] Accessed on December 27th, 2010: http://sdwebx.worldbank.org/climateportal/

lowest increase and summer-on-summer highest increase, see Figure 2). Kurnaz (2010) also predicts increase in variance of temperature; higher summer maximums (by 3-4 degree Celsius in South-eastern Turkey); increase in wind speed (relatively no change for South-eastern Turkey); and decline in winter snow cover. Other simulation exercises also indicate increase in mean temperature and variability, increase in consecutive dry days in summer and fall, and decline in precipitation (winter runoff declines in Western Anatolia and spring runoff in Eastern Anatolia) all result in roughly 30 percent losses in precipitation minus evapo-transpiration (P-E) which is a fundamental indicator of agricultural water availability creating water deficits for summer crops (Saysel, 2010: 158-9).

Figure 2: Change in Mean Summer Temperature between 2040-50 Average and 1990-2000 Average



Source: Kurnaz (2010), Personal communication on December 8th, 2010.

Irrigation in South-eastern Turkey

Projections and Predictions

The initial administrative projections for GAP were consisting of 13 individual water development projects involving 22 Dams (total of 1.6 million ha) and 19 hydropower plants on the Euphrates and Tigris rivers (GAP, 1997). The current area

served by main irrigation canals (300 thousand ha) is well short of the initial lofty goals. The current mid-term goal is to complete canals that can serve 1.06 million ha by 2012 and in the long-term to extend irrigation to 1.82 million ha in the GAP region (Benek, 2009: 52, GAP, 2010: 52-55). However, these projections are challenged from the beginning. Saysel et al., (2002) summarize the findings of GAPSIM model developed by Saysel (1999). GAPSIM is a systems approach model with 40 years (1990-2030) time horizon including 2000 variables and 14 sectors (Saysel et al., 2002: 250).

Saysel et al, (2002) considers two scenarios: a reference run and a more optimistic scenario, integrated policy. In the reference scenario land use, crop rotation practices and hydropower generation are evaluated separately whereas in the integrated policy scenario increased hydropower production, increased land use change from rain fed to irrigated, and improved farm rotation practices are allowed to interact. Table 1 from Saysel et al., (2002) is reproduced below. In the reference scenario, irrigated area is well below of original 1.6 million ha projection. Cotton monoculture dominates land use change, and the multi-crop peasant farm disappears. By 2030, pesticide consumption triples, and fertilizer consumption increase by 130 percent and the eventual level of salinity is higher than integrated policy. Saysel et al., (2002) concluded that:

> The reference behavior of GAPSIM indicates a significant potential water scarcity in the GAP region, which is exacerbated by intensive cotton monoculture on irrigated lands. Decreased crop diversity results in measures, which produce deleterious impacts (excessive pesticide and fertilizer consumption). (p. 259)

In the integrated scenario, water released to irrigation is restricted in order to increase hydropower generation. As farmers change their land use from rain fed to irrigated areas, water demand increases but total water release do not match the increase of water demand (due to commitment to hydropower generation). This creates a shift from cotton monoculture to less thirsty summer crops (vegetables, oil seeds etc.). Salinity does not increase as much as reference scenario and so too the fertilizer use since farmers need less to compensate loss in soil fertility due to salinity (Saysel et al., 2002: 257). Population and employment related variables do not vary depending on scenario. Food availability is a little better in integrated policy due to diversion away from cotton production compare to reference scenario.

GAP Regional Administration originally projected only 25 percent of total irrigated area devoted to cotton by 2005. Unfortunately, by 2004 90 percent of all irrigated area within GAP area was devoted to cotton monoculture (Adaman and Özertan, 2007: 535). Most recently the irrigated area devoted to cotton was roughly 80 percent in the region (Figure 3). This ratio is even worse than the pessimistic reference scenario of Saysel et al., (2002) where area devoted to cotton monoculture was roughly 55 percent. I discuss the reasons for the dominance of cotton in the region, and especially the Harran plain, in the next section. However, I believe the most important insight of the simulation exercise summarized in Saysel et al., (2002) still applies: by rationing irrigation water in GAP project, the agricultural and hydropower performance can be improved. Rationing irrigation water will lead to careful use of this scarce resource and the negative externalities of excessive irrigation will be reduced. In other words, with proper integration hydropower, land use and crop rotation policy can improve the domestic performance in Turkey and at the same time will release more water to downstream countries.

Table 1: Comparison of Reference and Integrated Policy Scenarios by 2030

	Reference	**Integrated policy**
Energy production (GWh/yr)	17,500	19,500
Irrigated lands (ha)	1,100,000	1,300,000
Cotton monoculture (ha)	600,000	70,000
Two-crop farm systems (ha)	500,000	950,000
Multi-crop farm systems (ha)	1,000	85,000
Rate of increase in pesticide consumption	3.00	1.00
Rate of increase in fertilizer consumption	1.30	1.18
Salt concentration root zone (mg/l)	3,500	2,900
Cereals supply (billion kg/yr)	1.80	1.50
Pulses supply (billion kg/yr)	0.22	0.50
Cotton supply (billion kg/yr)	2.50	1.50
Oil crops supply (billion kg/yr)	0.09	0.18
Rural population (million capita)	1.50	1.70
Urban population (million capita)	7.25	7.15
Food availability	4.10	4.45
Job availability (jobs/labor)	0.65	0.65

Source: Saysel et al., (2002: 259)

Salinity in the Harran Plain

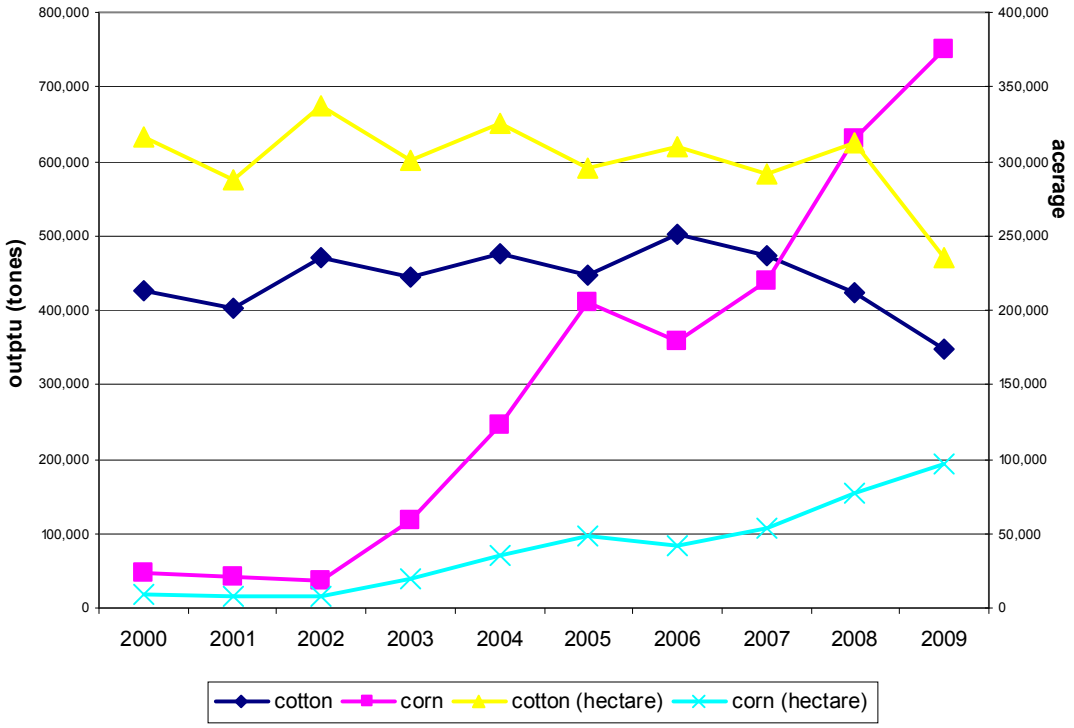
The crop of choice in the irrigated areas of South-eastern Turkey is still cotton but the corn production is experiencing a steep increase in recent years (Figure 3). Actually, compare to rest of Turkey, cotton production in the South-eastern region uphold relatively well against corn. Between 2000 and 2008 (last year data available at national level) share of cotton produced in South-eastern Turkey has increased from 48 to 63 percent. The shift of acreage from cotton to corn is even more prevalent in Aegean and Mediterranean regions. Cotton monoculture especially dominates the Harran plain during summer which is irrigated from Atatürk Dam reservoir. Actually, the initial plan assumed that cotton production would only account for 25 percent of total irrigated area in the plain instead of the current 80 percent (Adaman and Özertan, 2007: 535). Cotton is the choice of farmers due to convenient access to machinery and tools, familiarity with crop[3], and the secure market demand. Despite being one of the major cotton producers, Turkey is a cotton importing country thanks to the domestic textile and clothing industries (Adaman and Özertan 2007: 535; ABGS, 2006) hence demand for cotton is high.

The cotton monoculture in the Harran plain comes with accompanying environmental costs, the most pressing being the soil salinity. The main reason for salinity in arid and semi-arid regions is insufficient rainfall especially between June and September. Annual evaporation is more than 1800 mm in the Harran plain (Kendirli et al., 2005). Salinity is neither unique to surface irrigation nor inevitable. However, canals linking Atatürk Dam reservoir to the Harran plain are completed in 1995 and irrigation in the plain started without completion of drainage canals and the salinity problem in the region took off (ATO, 2005; Kanber et al., 2005). Due to lack of drainage, water rises to surface and then evaporates from the surface leaving behind the salt. The problem is exacerbated by lack of water absorbent trees or plants like halophytes. Moreover, Kanber et al., (2005) reports that 40 thousand ha in the Harran plain (out of 148 thousand ha) are under threat from rising ground water levels. Rising groundwater not only causes salinity

[3] Cotton farming existed in the groundwater irrigated areas even before the completition of dams and irrigation canals (Section on migration). Also, many farmers were already familiar with cotton farming as seasonal workers to other regions.

but also threatens fruit orchards, buildings and other infrastructure[4]. Finally to make matter worse, the Harran plain slopes down from north to south which sends groundwater from north to south to the disadvantage of farmlands in the south of the plain and to Syria (Kendirli et al., 2005).

Figure 3: Acreage and annual total output of cotton and corn



Source: TUIK web-site accessed on December 26th, 2010[5]

The natural rainfall in the region ranges between 250-300 mm historically hence farmers are not familiar with negative side effects of excessive irrigation. In general farmers believe that more water will lead to more output and excessive irrigation is carried via open canals systems (furrows) instead of sprinklers or drip irrigation schemes (Tekinel, 2003). The studies show that roughly 600 mm is optimum for cotton production in the region. However, the actual application in the plain is well above 3,000 mm

4 The total area slated for drainage investment between 2009 and 2012 is 20 thousand ha (GAP, 2010: 52-55).

5 http://www.tuik.gov.tr/bitkiselapp/bitkisel.zul

(Adaman and Özertan, 2007: 536). Moreover, extensive application of water is leading to fertilizer washout further reducing productivity (Yıldırım (2004) reported by Adaman and Özertan, 2007: 539). Finally, cotton is one of the most chemical-intensive crops in the world and pesticides and herbicides applied to cotton are among the most potent and dangerous precisely because cotton is not edible. Still, these pesticides pose serious threat to agricultural workers (Moore, 2002).

Moreover, problems extend beyond the irrigated areas. The access to irrigation is also problematic. Kadirbeyoğlu (2008) reports water distribution problems especially at the tail end of existing irrigation schemes. Water is diverted to larger and politically connected landowners. Also, these landowners are more likely to pay reduced fees or not pay at all. Currently, fee collection for water delivery is responsibility of local Water User Associations (WUAs). WUAs in Turkey are relatively large at 6,500 ha on average (for example average size of landholdings in Harran plain is 5.6 ha). WUAs are introduced in mid-1990s as a response to relive pressure on central government budget and to improve the operation and management of existing irrigation canals. Transfer of management, operation and maintenance of irrigation canals also encouraged by World Bank which demanded cost recovery of investments and advocated for user-pays principle instead of taxpayer subsidized irrigation schemes. General Directorate of State Hydraulic Works (Devlet Su İşleri (DSI)) carried out the transfer of water delivery responsibilities to WUAs enthusiastically and within three years after start (1993) 61 percent of publicly managed irrigation networks were transferred (Svensen and Nott, 1999).

WUAs are dependent on user fees unlike DSI and hence they are expected to be more vigilant in collecting fees. WUAs were indeed very successful in increasing fee collection rates. According to Svensen and Nott (1999) water fee collection rate in Turkey has doubled in a short period (Çakmak et al., (2004) also reports high collection rates right after transfer in the South-eastern region). Actually, Turkey is an early success story for World Bank in swiftly transferring the management and operation of irrigation schemes to users. In addition to cost recovery, fee collection was expected to reduce excessive irrigation due to increased effective price farmers were required to pay. As mentioned above, in practice excessive irrigation has not been reduced because the fees

are set very low. More importantly, fees are collected based on area irrigated and crop type. Hence the marginal price of excess water applied to one's filed is zero; only cost of excessive irrigation is farmers' labor, salinity and potentially fertilizer run-off. None of these expenses has the signaling power of out of pocket fees. Kadirbeyoğlu and Özertan (2010) allude that local WUAs are captured by local elites. Harris (2005: 190) reports that main problems with WUAs in the Harran plain are embezzlement of funds, nepotism, and injustice. WUAs are required to allocate 25 to 30 percent of their budget to maintenance, however actual spending on maintenance roughly averages 10 percent since maintenance are the most easily postponeable expenditure kind relative to staff salaries (Kadirbeyoğlu, 2008). In return of low performance, WUA administrations keep water fees low in order to avoid any complaints by users which can lead to outside audit[6].

The semi-arid and arid weather conditions of the region, no natural precipitation during the cotton growing summer months and excessive application of irrigation via furrows combined with lack of drainage lead to serious soil salinity. Farmers prefer to plant cotton because of steady demand and familiarity. Since water price are low, farmers have no immediate reason independent of long-term soil fertility to reduce water application. Finally, cotton is relatively resistant to salt so once the salinity occurs in a farmers fields, there is even less incentive to switch other summer crops like oilseeds, pulses and vegetables (Saysel et al., 2002: 256).

In other words, farmers who have access to water applies it excessively hoping to increase their yields but they inadvertently cause soil salinity in their fields while depriving downstream users from much needed irrigation water. Currently, WUAs face no water shortage from Atatürk Dam even after all the inefficiencies due to low rate of completion. If and when majority of planned channels are completed, the withdrawal from the reservoirs can become limiting.

Farmers' Perspective on Salinity

Kendirli et al., (2005: 121) lists options for potential solutions to salinity and groundwater problems in the Harran plain. They classify options into three groups:

[6] A one-time audit in 2001 by Interior Ministry staff led to several prison terms for some WUAs chairpersons (Kadirbeyoğlu and Özertan, 2010: 184).

technical, management, and education. Most of technical advice concerns construction of appropriate drainage systems. Management solutions are recommendations for administrators and are mainly concerned with monitoring water salinity and water pricing (especially volumetric pricing instead of current area and crop based pricing). Education includes farmers' training and extension services about new technologies, new crops, and marketing. Farmers can directly take action to affect salinity problem (both personally and collectively). Whether they engage in any proactive action depends on their perception of salinity as a problem and on their awareness of options for positive action. If a farmer perceives salinity as a problem, he can individually reduce irrigation and/or can switch from cotton to less-water-intensive crops. Collectively they can co-finance drainage schemes or as a member of WUA can influence water pricing. Alternatively, they can engage in afforestation to reduce salinity problem.

Adaman and Özertan (2007) specifically investigate farmers' perceptions and practices toward the salinity problem by surveying 600 farmers (all male household heads). First, they investigate the determinants of awareness of the relationship between excess irrigation and salinity. Obviously farmers who are already experiencing salinity problems are more likely to be aware of the connection between irrigation and salinity. Apart from that, other significant determinants of awareness are general education and training. Farming experience and ownership status (landowner or sharecropper) are not significant determinants of awareness. Everything else being equal, having attended to any kind of farmer training workshop increases the likelihood of awareness by 16 percent (compare to 2 percent for every year of schooling; Adaman and Özertan, 2007: 543-4). Next, the authors investigate the relationship between awareness and irrigation. Predictably, farmers who are already experiencing salinity and the ones who are aware of the relationship between salinity and excessive irrigation are more likely to irrigate less. Surprisingly schooling, training and ownership have no direct effect on water use (Adaman and Özertan, 2007: 545). Finally the authors investigate the willingness to contribute to collective actions to address salinity problem (for example co-financing drainage) among survey participants. They find that experiencing salinity, awareness of the connection between irrigation and salinity, training, and ownership are all positively influence willingness to contribute collective action (Adaman and Özertan, 2007: 546-7).

Survey participants are well past their schooling age so from a policy standpoint increasing frequency and possibly intensity of training will be most practical advice. Gains from training are likely to be very high: roughly a quarter of survey participants are not aware of the relationship between irrigation and salinity. Also, even though three quarters of farmers express some willingness to contribute collective action issues but there is no outlet to facilitate cooperation. Adaman and Özertan (2007: 548) note that:

> ...the need for farmers to organize themselves within an institutional set-up emerges as important as ever, as otherwise due to free-rider/externality problems it would not be possible to properly take care of the salinity issue. The survey results indicated a positive attitude of farmers towards joining their forces – what is missing is therefore an institutional structure that would make it sure that the collective decisions be implemented effectively.

WUAs are supposed to fill this need but their current state is already recounted above. In other words, in addition to improve their operation and maintenance performance and raising water price, reforming WUAs to make them more inclusive is paramount.

Migration from Region

South-eastern Turkey has long been a source of net out-migration. However, the great majority of literature on internal migration (especially originating from South-eastern Turkey) focuses on increasing rural-urban difference in income and living standards, population pressure and mechanization of agriculture, and political conflict as potential reasons. Therein lays the problem with trying to tease out the effect of slow-setting environmental degradation from all other simultaneous reasons on rural-urban migration. However, studying cases of previous episodes of out migration that is mostly resulted from environmental degradation is important if we want to understand the potential impact of future climate change on migration behavior.

The most clear-cut cases of out migration due to environmental degradation from South-eastern Turkey are relocation of Samsat (in Adıyaman province) when the district centre and most of the surrounding area is flooded by Atatürk Dam reservoir and out-migration from Suruç (in Şanlıurfa province) as a result of depletion of groundwater due to irrigation. Atatürk Dam construction had started in 1983, and was completed by 1992.

The Dam reservoir flooded entirety of Samsat district and also another 85 settlements in Adıyaman, 48 in Urfa and 12 in Diyarbakır. More than 18,000 families (or 113 thousand inhabitants: the majority of the displaced are not from Samsat but I study Samsat since it is flooded completely and previous inhabitants had to relocate (Guler Parlak, 2007: 11). Cotton cultivation with groundwater irrigation has started in 1950s in Suruç. The water table started to decline in 1970s (farmers eventually needed wells 200 m deep compare to one meter deep ones in early years) and vanished by 1990s (Kadirbeyoğlu, 2010: 226). Between 1965 and 2009, the population of Samsat has increased by 29 percent; in the mean time total population of Adıyaman has increased by 120 percent. If the population in the district had kept up with the rest of the province, the population would have been 70 percent higher than current actual population. The population of Suruç has increased by 139 percent whereas total population of Şanlıurfa has increased by 258 percent. Likewise, if the population of Suruç had kept up with Şanlıurfa average growth rate, current population would have been 50 percent higher[7].

The experiences of inhabitants of both districts are very instructive. Since Samsat is flooded by Atatürk Dam, the land owning residents were entitled to compensation. Clearly the hardest-hit group after the flooding is the landless unless the village headsmen registered them to be resettled to New Samsat (Kadirbeyoğlu, 2010: 230). The landowners were given three options: i) cash compensation, ii) relocation to New Samsat at a nearby site or iii) relocation to a town in Western Turkey (Yalikoy and Bulgurca in Izmir province). The most common complaint of all previous land owning groups was the delay between flooding and eventual compensation (Guler Parlak (2007) reports that households has to wait between two to ten years). Another common problem was that most of the poorer families under-reported the value of their holdings because they did not believe that their villages would be flooded and perceive it as a cover for taxation. The group that was resettled to Yalikoy and Bulgurca are given 30-40 da land. Initially, they experienced the animosity of locals because state-owned area that they were resettled was only nominally empty and in actuality were used by surrounding villages. Nevertheless, they are the only group that reports, on average, being better-off financially

[7] The calculations are available from the author upon request. The original data is obtained from TUIK web-sites: http://tuikapp.tuik.gov.tr/nufusmenuapp/menu.zul and http://tuikapp.tuik.gov.tr/adnksdagitapp/adnks.zul

despite the unemployment and ethnic discrimination. Household who chose to resettle New Samsat report that they are worse off. Most of them were used to producing their own food stuff but their current plots are insufficient for this purpose (Guler Parlak, 2006: 94). Their most common complaint is unemployment; many became seasonal migrant agricultural laborers. Households with out-migrant members have increased from 21 to 57 percent, and more than 70 percent are considering migrating to provincial centre or big cities (Guler Parlak, 2006: 102). The worst-off group is the cash-compensated. Most have chosen to relocate to provincial centers or big cities. The compensation amount was too low in the sense that it was not enough to buy a house in urban centers. Most of the time compensation money is spent to meet suddenly ballooning current consumption needs in urban environment. Finally, Guler Parlak (2006: 140) reports that many households who never had such cash were hard pressed to spent it wisely.

The experience of Suruç shows that excessive irrigation is not only a problem of surface but also of groundwater irrigation. Figure 3 shows that total irrigated area planted with cotton and corn is close to 400 thousand ha whereas as mentioned before, the total irrigated are as a part of GAP projected is so far 300 thousand ha. The difference is irrigated with groundwater. In other words, in addition to salinity and other associated environmental problems of cotton monoculture, the groundwater resources face the irreversible threat of depletion. In Suruç, abundant groundwater has been depleted in a matter of 30 years, and currently many villages in Suruç are even short of drinking water (dependent on water tankers) let alone irrigation. All but one of twenty interviewees reported that their migration from Suruç is due to water depletion (Kadirbeyoğlu, 2010: 231). People remaining in the Suruç are the ones without resource to permanently migrate to city centers. Many of the remaining people in Suruç work as seasonal agricultural laborers in other areas despite the fact that they are also landowners. Their children generally accompany them in seasonal migration and miss first two months of school term (Kadirbeyoğlu, 2010: 231). Unlike Samsat, the state provided no special compensation to Suruç area, because depletion of groundwater is not a direct result of state action.

GAP region is no foreigner to out-migration caused by environmental degradation. The submersion of Samsat under Atatürk Dam reservoir can be a harbinger

to other districts who are under similar threat in the region. Most recently, Hasankeyf district (in Batman province) - which will be submerged under Ilısu Dam reservoir – became well-known due to cultural significance of city of Hasankeyf[8] but it is also home to close to 80,000 people (Saysel, 2008). The experience of Suruç with out-migration is also very relevant. In the case of Suruç, the immediate reason for out-migration was depletion of groundwater. For the Harran plain the immediate environmental degradation issue is soil salinity. However, salinity can lead to great decline in the output just like depletion of groundwater. In this sense the experiences of previous inhabitants of Samsat and Suruç are instructive for the future of potential out-migrants from South-eastern Turkey. The great majority of out-migrants from Suruç and Samsat ended up worse-off financially (Guler Parlak, 2006 and 2007; Kadirbeyoğlu, 2010). The low level of general education in the region and lack of experience with urban jobs seriously reduce the chances of out-migrants to transition productive urban livelihoods. The only people that report to improve their situation financially are the ones who are resettled to Yalikoy and Bulgurlu in Izmir. Whatever one thinks about resettling people to far-away regions, the most glaring problem of such a 'solution' is that there aren't many 'empty' villages in more prosperous Western Turkey for resettling. In other words, it is not a scaleable solution. Since out-migration generally leads to worsening-off of economic situation, in the next section I review the solution proposals that address irrigation and salinity to reduce the pressure to out-migrate.

Solution Proposals

Farmer Training and Extension Services

General education is an end in itself, and one should not need the excuse of soil salinity to advocate for improved education. However, farmer training and agricultural extension should be pursued vigilantly. Adaman and Özertan (2007) show that farmer training is very effective in raising awareness about the linkage between excessive irrigation and salinity, and reducing total water applied. Additionally, attending farmer training improves the likelihood to contribute to collective action projects (at least on

[8] Another important archeological site (Zeguma) in thew region is also submerged under Birecik Dam.

paper). They also cite evidence that resources devoted to farmer training is very low, and education materials are poorly targeted: mailing written material to farmers are not effective (literacy among farmers are low), and conferences in classroom setting are not very engaging[9]. More agricultural extension workers on the ground engaging farmers are necessary.

Moreover, farmer training should include encouraging farmers to shift away from cotton monoculture. Farmers prefer cotton because of familiarity and steady returns but they do respond to incentives. Figure 3 shows that the shift from cotton to corn has been going on parallel to rising grain prices worldwide. However, replacing one water-thirsty crop with another is not a real solution. As review of climate models made clear, to our best of knowledge mean summer temperatures will increase and mean precipitation will decline in the region due to climate change. So switching to less-water intensive crops such as oilseeds, legumes, and vegetables and appropriate tillage methods are also necessary. Moreover, even if the farmers apply optimum amount of irrigation, monoculture still is more fertilizer and pesticide intensive[10]. Planting same crop year after year develops pest resistance requiring escalated use of pesticide. Likewise, planting same crop year after year depletes certain minerals (especially nitrate for cotton and corn) requiring escalated application of fertilizers over the years. In short, ongoing, face-to-face farmer training is a relatively low-cost, uncontroversial and high return policy that should be encouraged. For example, Adaman and Özertan (2007) propose to tie subsidy payments to training attendance if and when reasonable training sessions exist.

Another important agricultural extension issue is integrating farmers to plant breeding appropriate to their surroundings. A promising approach is participatory plant breeding where plant breeding is integrated to 'how farmers' acquire and manage seeds' Saysel (2010: 163). Even though General Directorate of State Breeding Farms (now called the General Directorate of Agricultural Enterprises, TIGEMs) are weakened and lost some of their importance in recent years, GAP region still posses public research institutions including Ceylanpınar TIGEM (in Şanlıurfa province). However, both

[9] See Adaman and Özertan (2007: 538) and studies cited.

[10] Table 1 show that in the reference scenario – which is dominated by cotton monoculture – pesticide and fertilizer use increases and more than integrated policy.

participatory plant breeding and more agricultural research require even more active agricultural extension services than currently available.

Pricing Water in Line with Total Use

Adaman and Özertan (2007), Saysel (2010) and countless others stress the importance of replacing open furrows with closed pipe pressurized irrigation systems, drips and sprinklers. After all, a substantial amount of water is lost to evaporation and leakage during the transfer between reservoir and fields. Moreover, these systems will allow more control to farmers to micromanage filed irrigation. Surely, introducing these new technologies should be a part of agricultural training. Additionally, arranging credit to finance the initial investment may quicken the adaptation. But it is unlikely that farmers will adapt these costly technologies en masse without the incentive provided by volumetric pricing of water. It is even conceivable that farmers will resist drips and sprinklers sensing that these are the first steps to volumetric pricing.

Currently water price depends on irrigated area and the crop planted. In other words, farmers do not pay in accordance with actual water application. Only private benefit to the farmer who refrains from over-irrigating is less soil salinity. But even that is no great respite because negative effects spill over from neighboring fields and water logging, where it happens, affects everybody in the vicinity irrespective of individual practices. Moreover, salinity is rather a distant and non-visible threat at first. The purpose of volumetric pricing is to give an immediate reason to farmer to reduce water application. Furthermore, volumetric pricing strengthens the user-pays principle.

Unfortunately, volumetric pricing cannot guarantee that total water used for irrigation will not exceed sustainable levels. The GAP administration is investing heavily in order to triple the reach of irrigation canals by 2012. Even if every farmer uses the state of the art technology and applies optimum amount of irrigation, it is very possible that total water diverted to irrigation from Euphrates-Tigris river basin can exceed sustainable levels as long as returns to irrigated crops are more than water cost. In this regard, charging for bulk water from reservoir to WUAs can be necessary (Adaman and Özertan, 2007). Volumetric pricing and bulk sale of water (with a quota on total release from dam reservoir) are fundamentally different. The goal of volumetric pricing is to

raise funds for operation and management of water canals and to discourage wasteful irrigation whereas purpose of selling water in bulk is to allocate a scarce resource to highest bidder. Volumetric pricing of water can be accepted by many as a way to conserve water. However, many people (including in the Harran plain (Adaman and Özertan, 2007)) perceive water as a right and are against buying and selling of it as a means of allocation. But a more fundamental problem in the region is the performance of WUAs that are and will be administering any water pricing and collection.

5.3 Reforming WUAs

WUAs in GAP region will probably fail trying implementing bulk pricing (or even volumetric pricing). Kadirbeyoğlu and Özertan (2010: 185) note that:

> Especially in regions where there are significant inequalities in the distribution of resources and power, WUAs are unable to ensure equitable distribution of water and fail to enforce irrigation fees equally—executive committee members and powerful farmers either evade fees or get significant reductions.

By and far, WUAs in GAP region fit in above description. They are dominated by local elites; they do not perform the necessary maintenance; and they are not effective in disseminating valuable information on irrigation to their members (Kadirbeyoğlu and Özertan, 2010). Members tolerate WUA administrations because they are holding water price low and independent of volume. In other words, any effort that is serious to introduce volume pricing and bulk sale of water has to deal with reforming WUAs in GAP region in order to increase their performance in operation and management and increase their inclusiveness and responsiveness to members. The surest way of breaking the hold of local elites on WUAs is land reform. Griffin et al., (2002, 2004) presents compelling evidence from South Korea and Taiwan in defense of confiscatory land reform which had led there to substantial increase in paddy rice yields. In S. Korea and Taiwan, land reform had broken the economic and political hold of landlords in rural areas and in the ensuing more equitable environment, with the help of central government, farmers were able to organize themselves to solve the most waxing problems of paddy rice farming: constructing and maintenance of irrigation and drainage canals. Unal (2008) demonstrates that inverse relationship between per hectare farm

yields and farm size still holds for Turkey. In other words, land redistribution can also increase total output in Turkey. Boyce et al., (2007) reviews land reform movements around the world and highlight the positive links between equitable land ownership and sustainable agriculture.

Land reform, unlike farmer training, is a very controversial proposal and it is not on the political agenda. Kadirbeyoğlu and Özertan (2010) propose regular outside audits of WUAs by state agencies (similar to the 2001 audit by Ministry of Interior) at minimum to ensure proper use of resources and to reduce nepotism, and shirking of irrigation canal maintenance. Even though the monitoring and oversight by state agencies can improve the maintenance of irrigation canals, it is no guarantee that the water will be distributed in any equitable fashion. As it is well documented in common pool resource literature, it is very hard to establish sustainable, viable and equitable irrigation schemes as long as the distribution of resources and power are highly unequal (Ostrom, 2008: ch. 5-6).

Putting term limits for chairpersons and rotation of board members every year can improve the representative capacity of WUAs by opening up WUAs board seats to a wider membership. This is the set up in irrigation schemes in Spain which are among the most sustainable and long-lived irrigation systems in semi-arid environments (Ostrom, 2008: chapter 3). Currently, some local authorities (such as the village headsmen and the mayor) are permanent members and others are elected for four years (Kadirbeyoğlu and Özertan, 2010). However, for this approach to work, ordinary members should be motivated to take these seats and use their new-found power to address collective action problems. Kirindi Oya irrigation project from Sri Lanka presents a promising approach to raise the demand for participatory management from ordinary members in the presence of inequitable land and power. Farmers were initially organized as very small groups (7-8 members) to solve their immediate collective action problem: drainage. Once farmers get used to working together and developed trust, each group selected one member to represent them in the meetings of the immediate neighboring groups concerning maintenance of irrigation canal serving all neighboring groups. Same member represents his group in the general assembly of the WUA ensuring both active participation and flow of information from members to assembly and from assembly back to members (Ostrom 2008: 159-65). In short, democratic participation is a costly process for ordinary

members and they need to be convinced that they will get a reasonable return to the time and effort they need to invest addressing collective action problems.

Conclusion

I believe that market versus regulation debate that flares very often in mitigating climate change discussions is a false dichotomy[11]. Climate change is a very formidable problem and one should not discard any tool that can be useful. In the above paragraphs, I lend support both to non-market solutions like public agricultural extension services, and to market mechanisms like volumetric water pricing to discourage over irrigation. In this essay, I investigate the water conflict in the Euphrates-Tigris river basin not from the macro perspective which is very common on this issue. Instead, I focus on micro level issues of crop selection, irrigation technologies and practices, and local collective action problems. As a result of this different orientation, I reach a refreshing conclusion: conserving water and releasing it to downstream countries is beneficial for Turkish farmers (less soil salinity) and increases hydropower generation within Turkey.

The most formidable obstacle to accomplish water conservation in Turkey is the collective action problems that hold back co-financing of drainage systems and disinvestment to maintenance of irrigation canals that can ensure an equitable allocation of water. Past experiences with collective action issues in Turkey and elsewhere show that technically viable projects flounders because they cannot solve collective action problems (Ostrom, 2008). One can design a water distribution system with appropriate quota of total water withdrawal for irrigation to ensure adequate water release to downstream countries. One can even invest in state of the art water delivery systems to minimize water loss during transportation and educate water users about soil salinity and rising water tables. However, if WUAs are captured by local elites who will govern with impunity from ordinary members, ordinary members will not contribute to projects if they do not expect to get any return or if they have no say in the formulation of project. The foundering of such well-intended irrigation schemes, then, quickens the out-migration from the region which is immiserizing to people who experience it. The most promising policy proposals are on the ground and ongoing farmer training and extension

[11] For example see the heated debate on carbon credits and trading.

services. If these farmer training sessions are organized such that immediate neighbors get experience in solving common resource problems and develop trust (i.e. build social capital), these experiences can be applied to more vexing problems at WUA level. However, it is also necessary to reform and open up WUA administrations to both to their members and increase their transparency. Democratizing WUAs and increasing their transparency is not only an end in itself but also the only possible mean to increase economic performance and reverse environmental degradation in the GAP region. Democratizing WUAs is a central theme to achieve sustainable collective action.

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