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WATER ISSUES IN THE MIDDLE EAST

THE EUPHRATES RIVER BASIN

VOL. I: TURKEY'S SOUTHEASTERN ANATOLIA PROJECT -- GAP

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Chapter 1

INTRODUCTION

The Southeastern Anatolian Project (Guneydogu Anadolu Projesi), referred to in this report as GAP, is a massive planned development program which seeks to both generate vast quantities of electricity and to permit irrigation of lands between the Euphrates and Tigris Rivers within Turkey. The project includes land in southeastern Turkey, along the Euphrates and Tigris river basins, as well as the intervening plains between the two rivers (Fig. 1). The six provinces of Adiyaman, Diyarbakir, Gaziantep, Mardin, Sanliufa, and Siirt are in the project area (Fig. 2-7).

Over the years the Government of Turkey has announced plans to improve Southeastern Anatolia's agricultural deficiency, develop the region both economically and socially, and try to stem the out-migrations from the east to the west. The last and largest program is the Southeastern Anatolian Project (GAP). The GAP consists of several sub-projects. The primary aim of GAP is to increase hydroelectric power for Turkey and to irrigate lands in drought areas. Given that GAP would create economic, social, and spatial (areal) changes once energy and irrigation schemes were "on line", the government viewed the project as a more comprehensive "integrated regional development project".

GAP is a multi-purpose development project. It includes dams, hydroelectric power plants, and irrigation infrastructure to include activities supporting not only agriculture, but also other economic and social quality of life improvements such as accessibility, employment opportunities, and improved education and health services (Table 1).

GAP consists of 13 large projects, seven of which are major projects on the Euphrates (lower Euphrates, Karakaya, Euphrates Border, Suruc-Baziki, Adiyaman-Kahta, Gaziantep-Araban and Gaziantep) and six are major projects on the Tigris (Tigris-Kralkizi(Kiralkizi), Batman, Batman-Silvan, Garzan, Ilisu, and Cizre) (Figs. 8 and 9). For organization convenience, the GAP is divided into the Euphrates and Tigris development plans. Fifteen dams, 14 hydro-electric power stations, and 19 irrigation projects are the core of the GAP. Work on the Euphrates is well underway, with the Keban Dam already completed. The Karakaya Dam is near completion and the reservoir is being filled (1986). And the largest of all, the Ataturk Dam is proceeding at an accelerated pace.(0896)

Turkey's economic planners are truly optimistic about GAP (Table 2, 3). They believe the complex of hydro-electric dams and irrigations canals will greatly improve the economic and social life in this area. In less than 30 years, when GAP is scheduled for completion, about 1.8 million hectares of land will be irrigated in the Tigris-Euphrates project area. This would be a significant increase representing sixty percent of the total public and private land presently irrigated in Turkey (1984) (1,800,000 - 2,990,000). In 1986, irrigation in the GAP region represents only four percent of Turkey's irrigated lands. Using the 1981 price index, GAP, when finished, will annually contribute about 933 million dollars or 70 billion TL (75 TL = $1) to the national economy. Eventually, GAP will increase Turkey's hydro-electric power to 7,620 MW, four times the hydro-electric power presently generated in Turkey. This means that with GAP alone, one-quarter of Turkey's estimated hydro-electric potential of 100 billion kWh will be developed. Today, only about 11% of her potential is being drawn. GAP is expected to generate 22 billion kWh which is approximately the amount presently being produced. GAP is an expensive endeavor, costing in 1981 prices about 30.26 billion dollars (2,270 billion TL). Preliminary cost estimates are by definition tentative; consequently, there are variations in the total estimate for GAP. Obviously, adjustments to cost will be made throughout the development cycle of GAP. The entire project for both the Tigris and Euphrates River basins is scheduled for completion by 2013.

Table 1

DEVELOPMENT BENEFITS EXPECTED AFTER GAP DEVELOPMENT

	BENEFITS AFTER DEVELOPMENT				
Basin	Irrigation (ha)	Flood Protection (ha)	Installed Capacity (MW)	Average Energy (GWH)	Domestic Water (Mcm)
Euphrates	1,506,867	1,220	8,752,36	35,119	82.5
Tigris	525,336	--	3,405,68	12,644	--
Total	2,032,203	1,220	12,158,04	47,763	82.5

Source: Republic of Turkey, Ministry of Energy and Natural Resources, 1983 Statistical Bulletin with Maps, Ankara, 1984, p. 24a.

Table 2

WATER RESOURCE POTENTIAL OF EUPHRATES AND TIGRIS BASINS

BASIN			AVERAGE AMOUNT OF WATER IN THE BASIN			WATER STORAGE IN THE BASIN	
Name of Basin	Population (in 1980)	Area (km^2)	Annual Avg Precip (mm)	Annual Runoff ($lt/s/km^2$)	Total (1000 Mcms)	Dams	Amount of Water Stored (1000 Mcms)
Euphrates	4,932,905	120,917	582	8,77	33,48	60	114,198.72
Tigris	1,797,272	51,489	814	13,43	21,81	23	7,448.27
TURKEY	44,736,957	766,870	653[a]	206,42	184,93	498	194,178.99

Source: Republic of Turkey, Ministry of Energy and Natural Resources, 1983 Statistical Bulletin with Maps, Ankara, 1984, p. 24a.

[a] Does not include part of basin outside of Turkey.

Table 3

LAND RESOURCE POTENTIAL OF EUPHRATES AND TIGRIS BASINS

BASIN			LAND RESOURCES IN THE BASIN			
Name of Basin	Population (in 1980)	Area (km^2)	Plain Area (ha)	Irrigable Plain Area (ha)	Non-Irrigable Plain Area (ha)	Necessary Investment for the Realization of Development (1000 HT) 1983 Value
Euphrates	4,932,905	120,917	4,947,640	1,716,575	3,171,065	3,088,101,353
Tigris	1,797,272	51,489	1,950,898	402,852	1,548,046	1,211,952,136
TURKEY	44,736,957	766,870	26,712,132	16,222,122	10,490,010	12,826,347,237

Source: Republic of Turkey, Ministry of Energy and Natural Resources, 1983 Statistical Bulletin with Maps, Ankara, 1984, p. 24a.

FIGURE 1

THE REPUBLIC OF TURKEY

Six Provinces Directly Effected by the Southeastern Anatolian Project

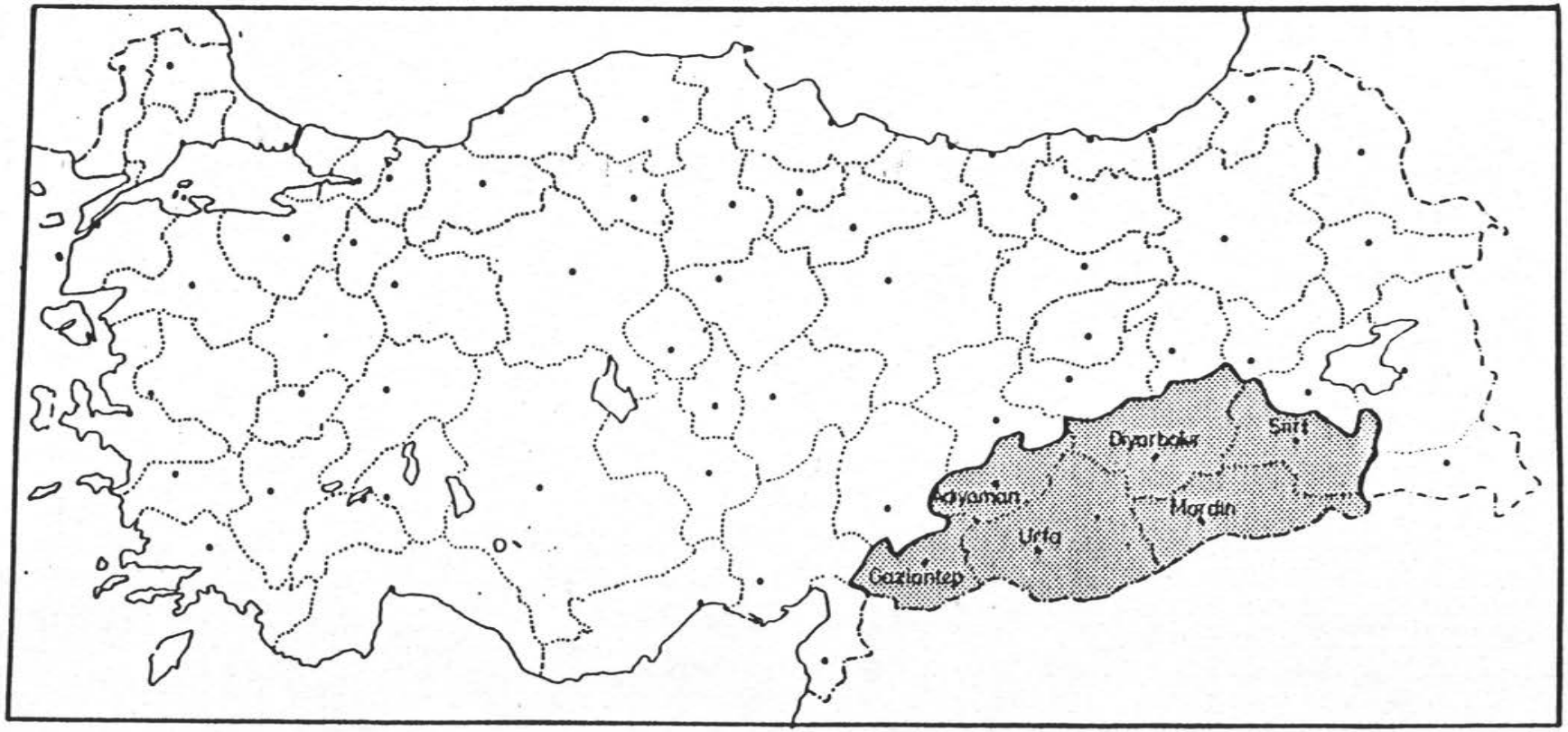
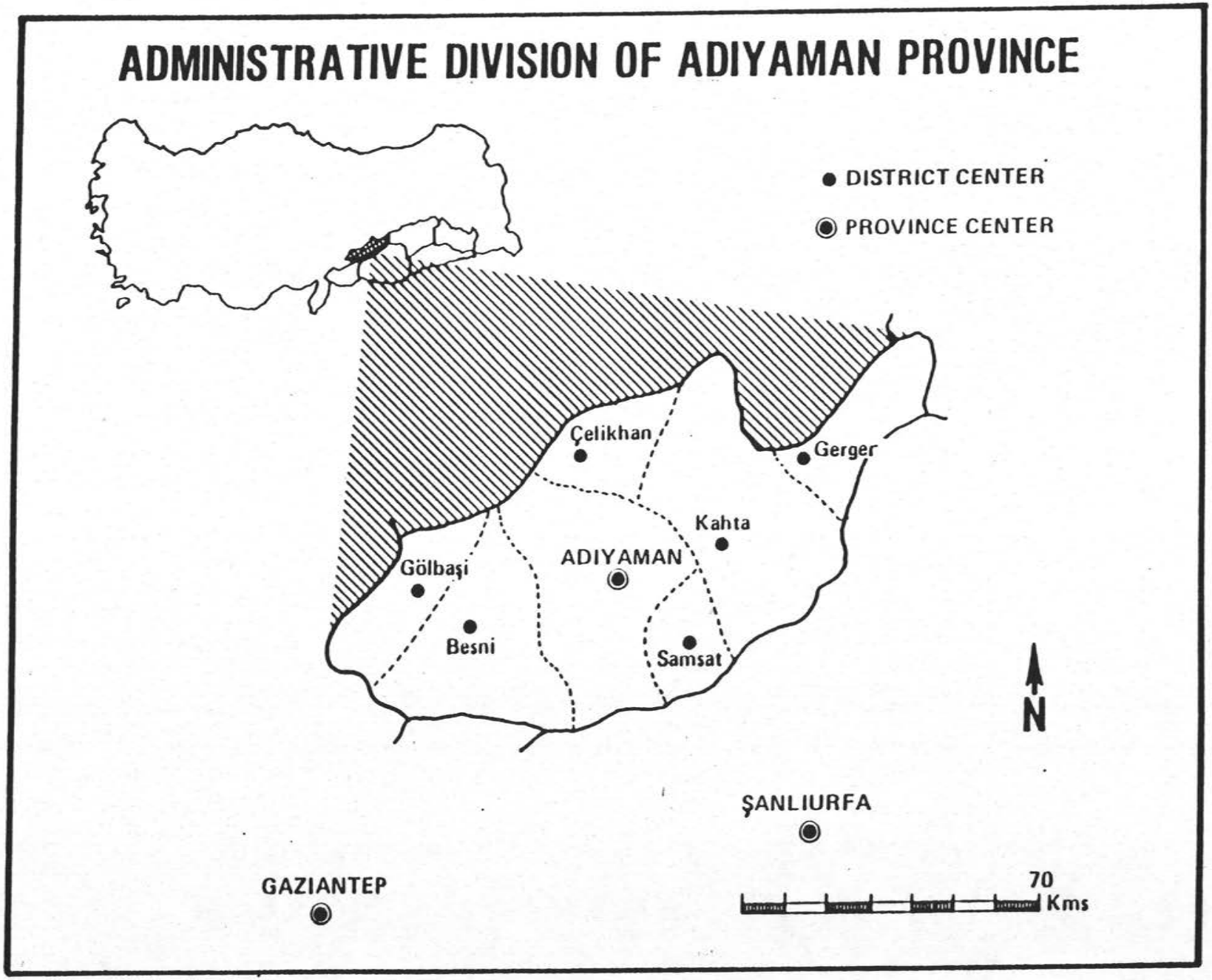


FIGURE 2


ADMINISTRATIVE DIVISION OF ADIYAMAN PROVINCE
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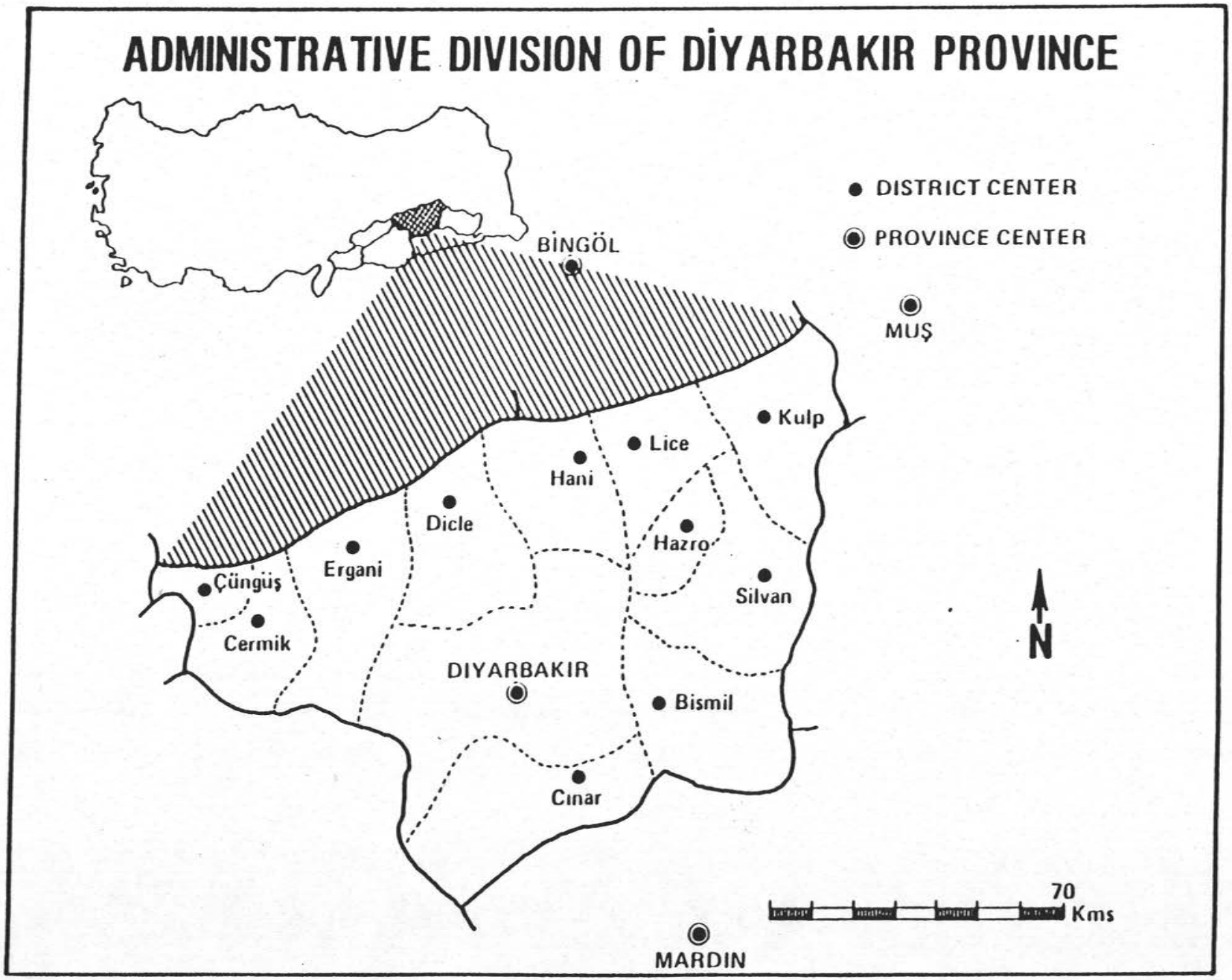
ŞANLIURFA
GAZIANTEP
70
Kms

FIGURE 3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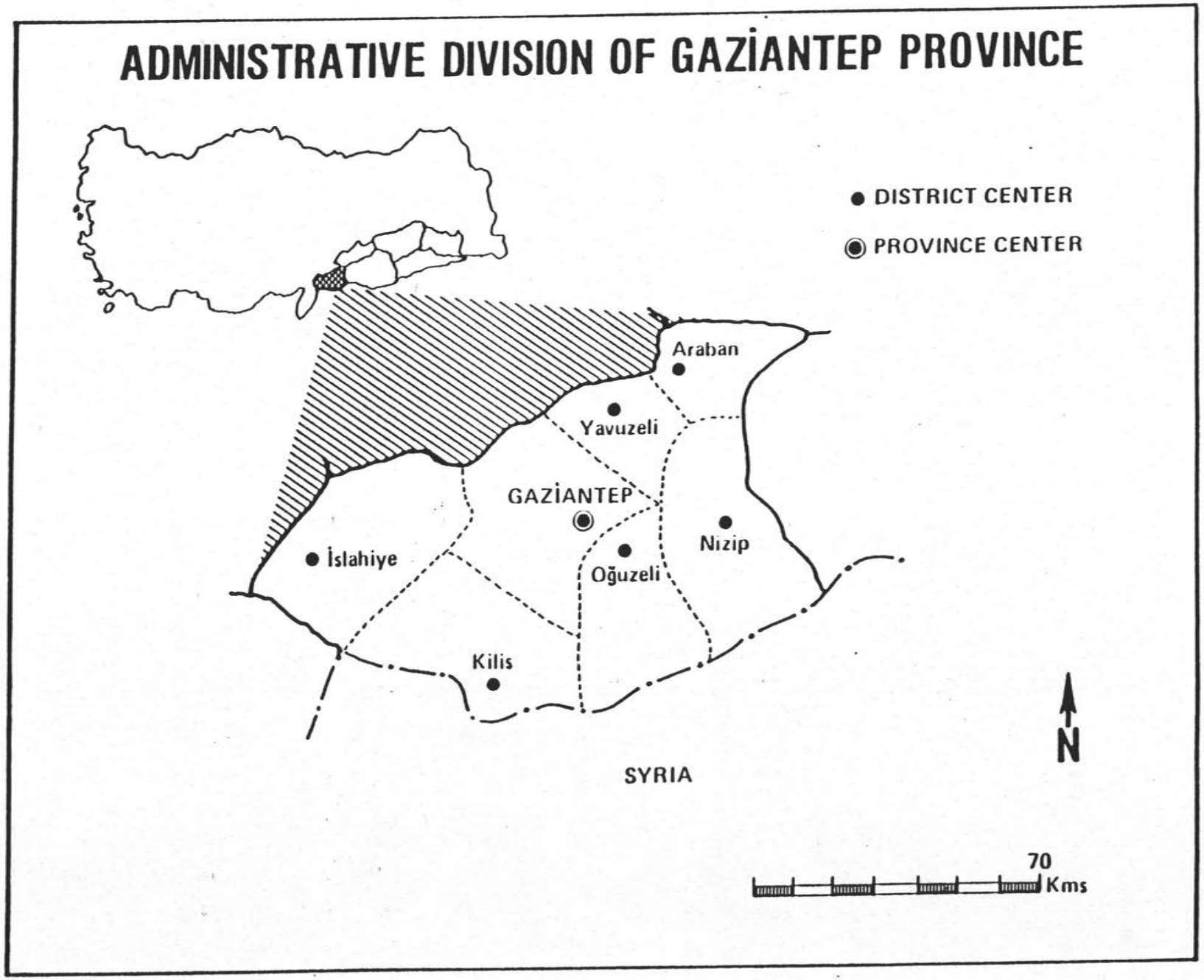
Kms

FIGURE 4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PROVINCE CENTER
Araban
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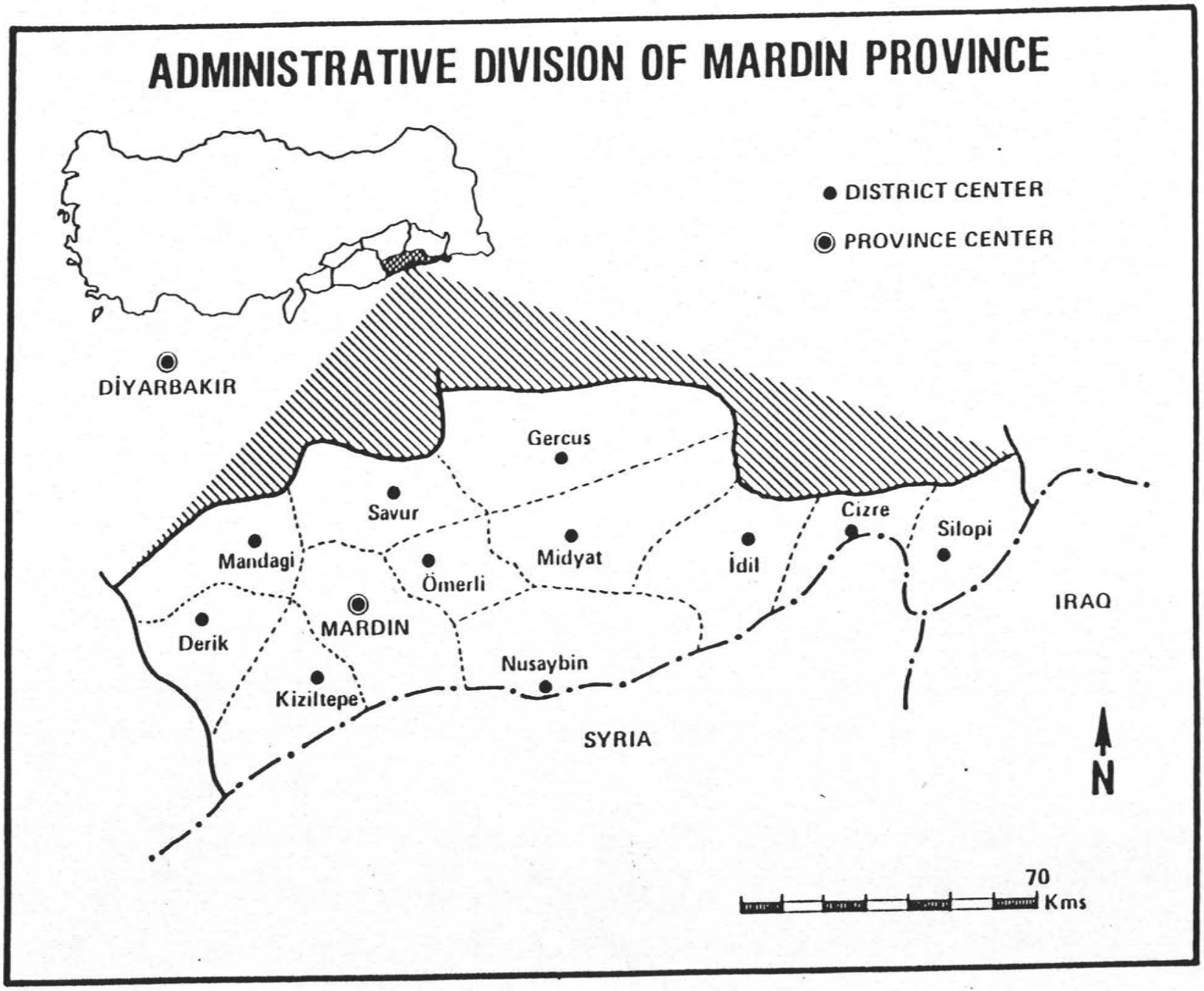
GAZİANTEP
İslahiye
Oğuzeli
Nizip
Kilis
SYRIA
N
70
Kms

FIGURE 5


ADMINISTRATIVE DIVISION OF MARDIN PROVINCE
DISTRICT CENTER
PROVINCE CENTER
DİYARBAKIR
Gercus
Savur
Cizre
Silopi
Mandagi
Midyat
İdil
Ömerli
IRAQ
MARDIN
Derik
Nusaybin
Kiziltepe
SYRIA
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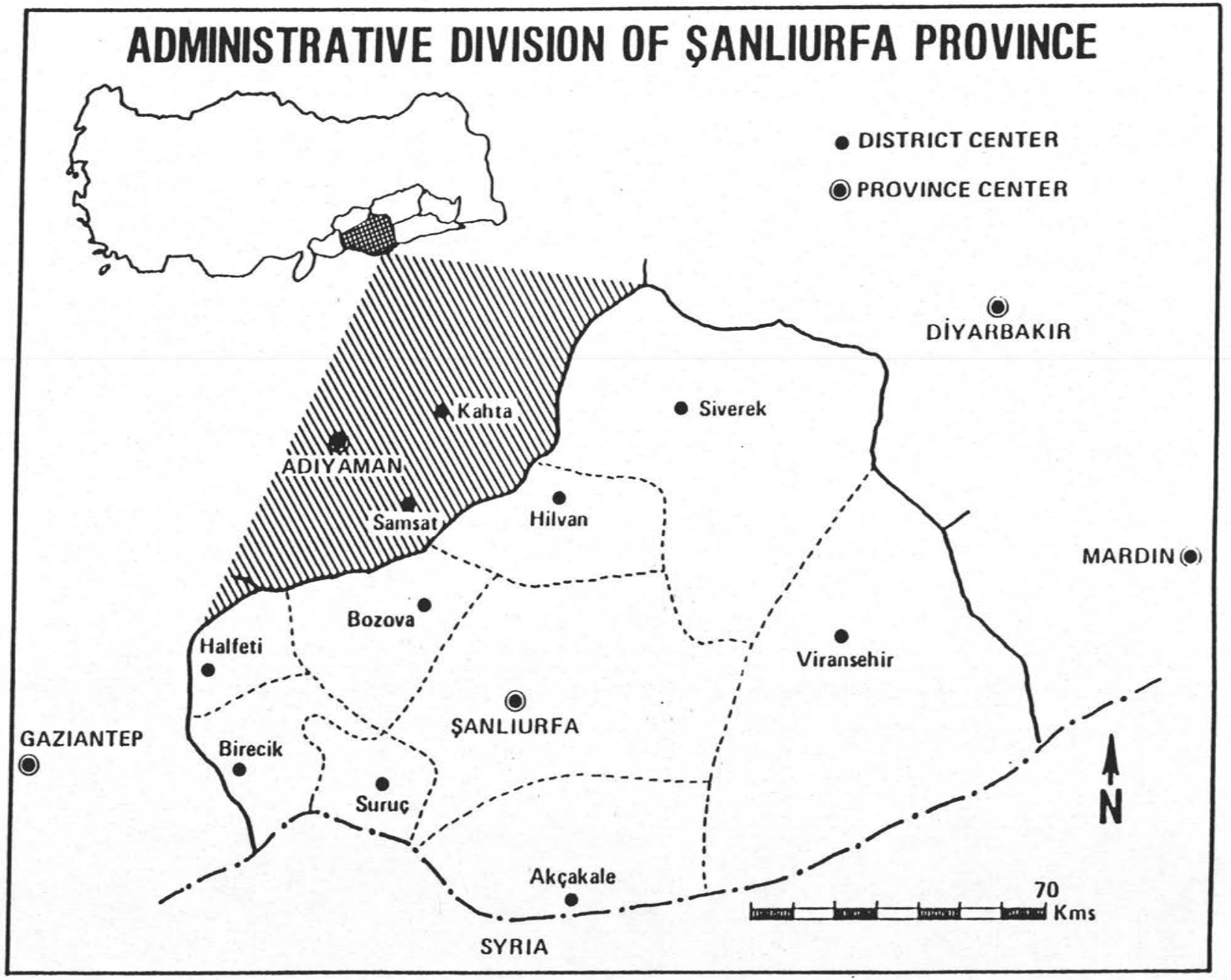
Kms

FIGURE 6


ADMINISTRATIVE DIVISION OF ŞANLIURFA PROVINCE
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PROVINCE CENTER
DİYARBAKIR
Siverek
Kahta
ADIYAMAN
Samsat
Hilvan
MARDIN
Bozova
Halfeti
Viransehir
ŞANLIURFA
GAZIANTEP
Birecik
Suruç
Akçakale
SYRIA
N
70
Kms

FIGURE 7

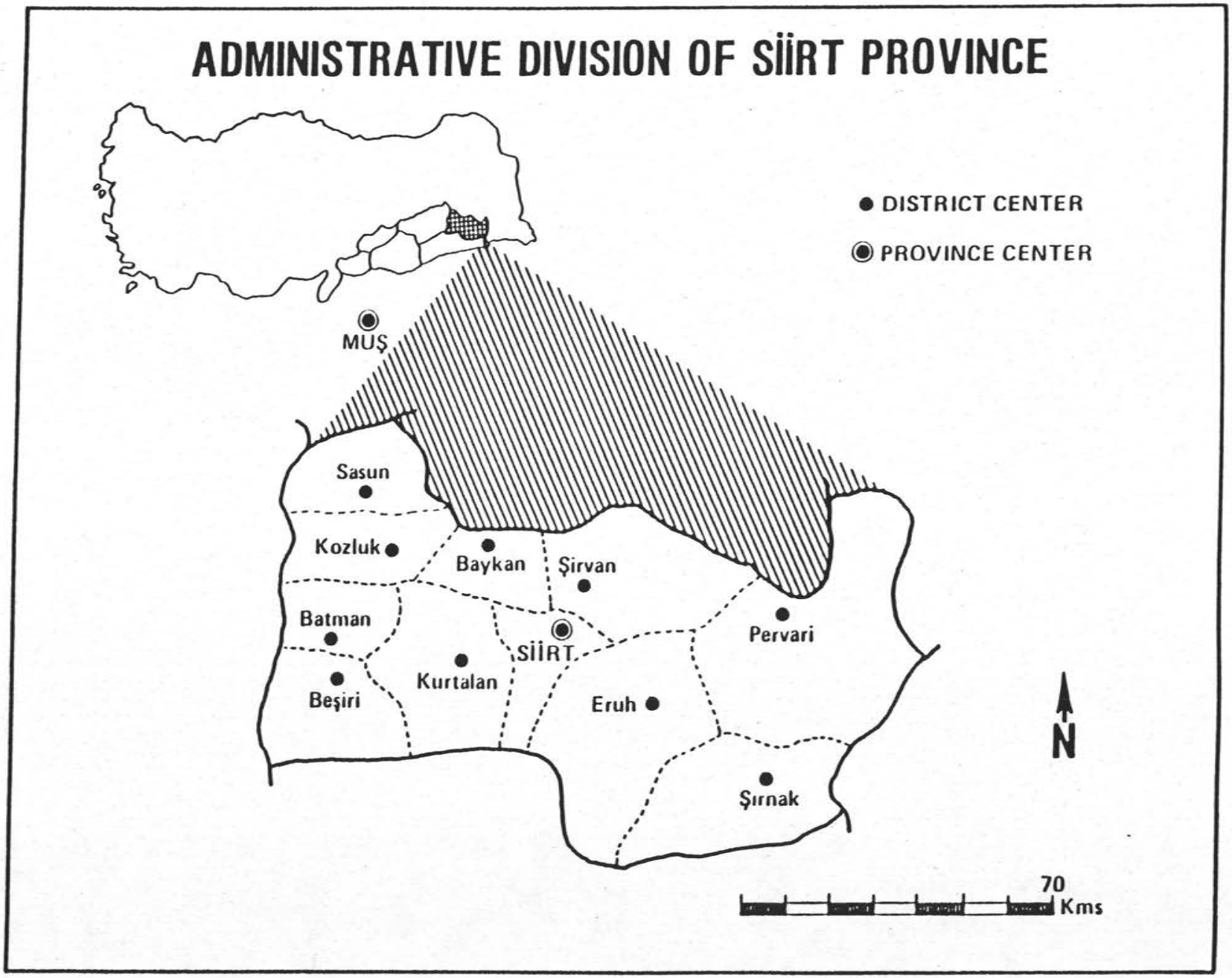

ADMINISTRATIVE DIVISION OF SİİRT PROVINCE
● DISTRICT CENTER
◉ PROVINCE CENTER
MUŞ
Sasun
Kozluk
Baykan
Şirvan
Batman
SİİRT
Pervari
Kurtalan
Beşiri
Eruh
Şırnak
N
70
Kms

FIGURE 8

THE TIGRIS EUPHRATES RIVER SYSTEM WITHIN TURKEY

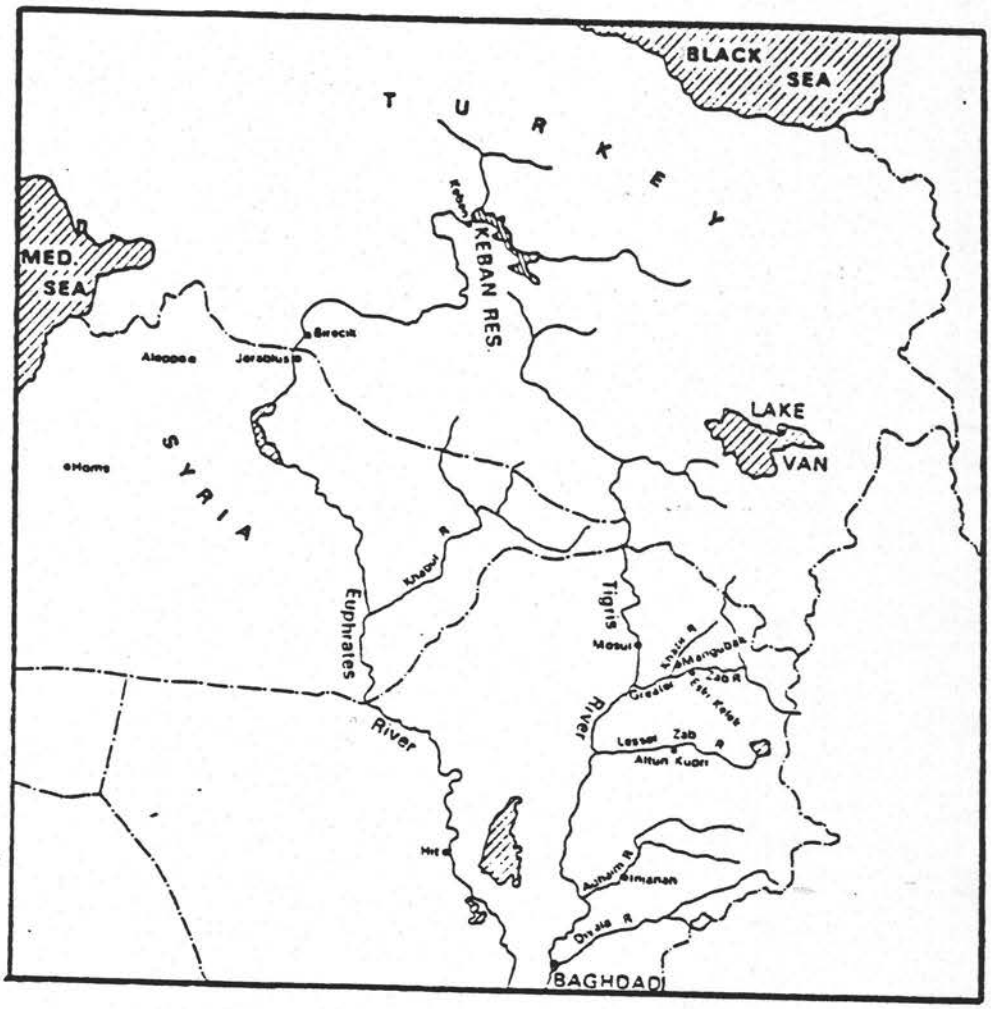
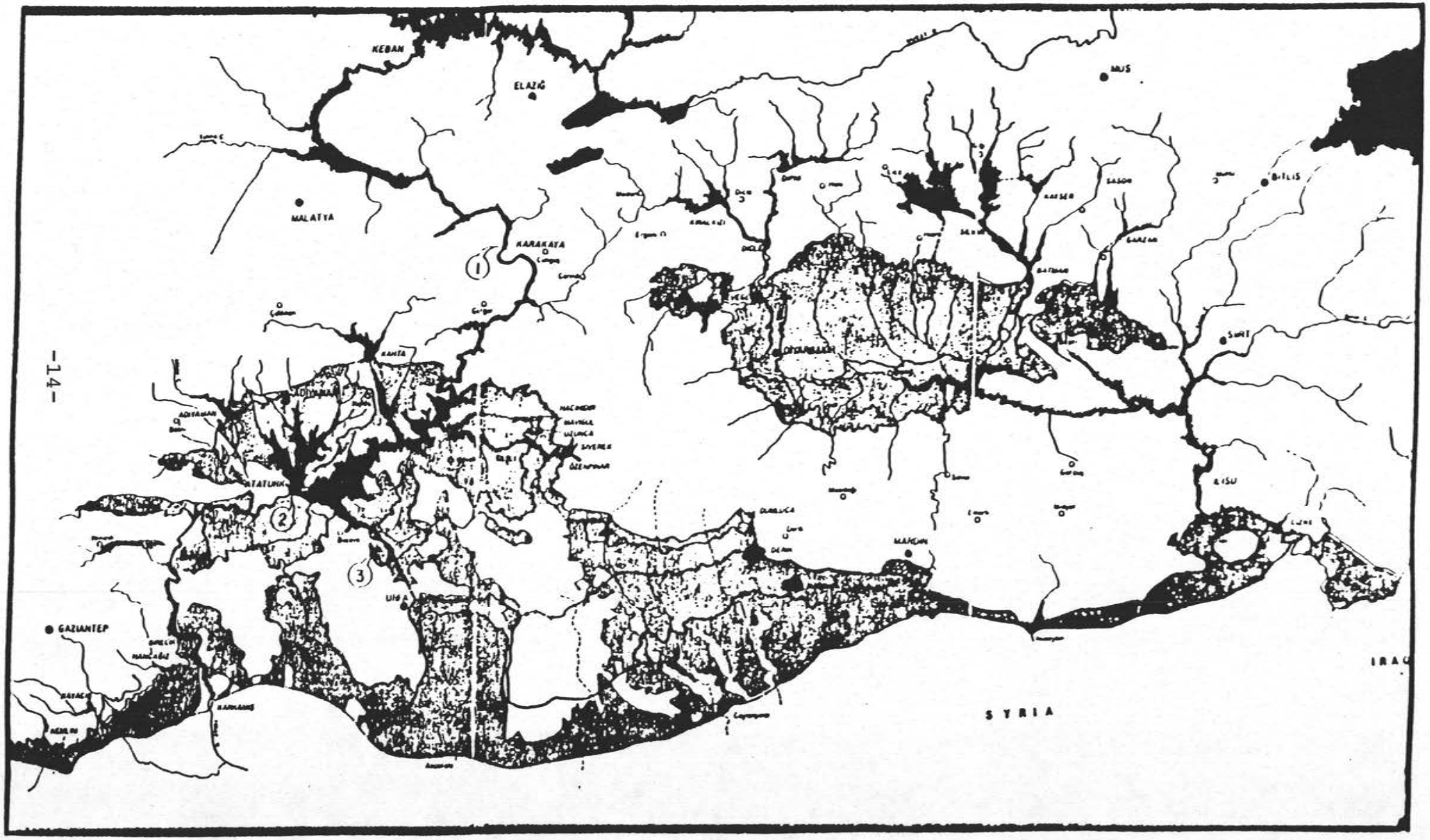


FIGURE 9

THE SOUTHEASTERN ANATOLIAN PROJECT (GAP)



Source: Guneydogu Anadolu Projesi, 1980. (3081)

Chapter 2

FINANCING AND CRITICISM

As in all vast development projects, as was the case of the Colorado River and the U.S. Man in Space Program, there is concern both nationally and internationally about the feasibility, practicability, and competency for GAP.

Syria and Iraq are obviously interested and concerned about construction activities that could reduce the Euphrates' and Tigris' annual flow through their countries(3233). Turkish officials have requested from the World Bank $1.5 billion for the Ataturk Dam, $150 million for the tunnel projects, and $200 million for equipment(3233). Because of Syrian and Iraqi reservations about Turkey controlling the Euphrates' flow, the World Bank is still hesitant in providing hard currency (Table 4). Syria's and Iraq's objections about GAP have influenced some international lending institutions to refuse support(1760). Consequently, tenders for the civils and electrical and mechanical contracts were delayed. Contracts are now being awarded to Turkish firms, and international firms such as Bechtel appear to have lost out(3229).

Syria and Iraq both have important dam schemes and are very reluctant to remove a sizeable portion of the annual river flow for Turkey's irrigation(0907). The World Bank, and most international funding agencies, are not prepared to lend on water projects involving international riparian rights unless all affected countries agree on the water use. Turkey realizes this and argues that the GAP is for everyone's benefit (Syria and Iraq)(0907). The head of Turkey's State Water Works, Mr. Akarun, states, "The annual flow levels of the Euphrates varies from 162 and 700 cubic meters per second, depending on the season. Once the GAP is completed, there should be a steady flow of 500-600 cubic meters per second"(0907). In July 1984, Iraq agreed with Turkey to accept a minimum flow of 500 cubic meters per second, but Syria still refused to negotiate(3227)(3252). Discussions between Turkish and Syrian leaders took place in early 1986 and are continuing. The potential for conflict or cooperation has been analyzed by many, recently by Naff and Matson(3235), and Kolars (part II, this report).

There are additional problems beyond financing. The dam sites are in remote, mountainous areas. Even with international financing, the Keban Dam was completed four years late and the Karakaya is about three years behind schedule(0907). But financing has caused most of the delays.

Although Karakaya's civil works contracts were let to an Italian firm in September 1976, Turkey could not contribute the foreign currency because of serious foreign currency shortages(0907).

As in most dam projects, the government must resettle some of the population. Estimates on dislocated settlements vary. For example, one source estimates about 70,000 people from 57 villages must be relocated from the reservoir of areas of the Karakaya and Ataturk Dams (3226)(0973)). A more recent television report (TRT, December 1985) mentioned 94 villages would be moved for the Karakaya Dam, and 138 for the Ataturk Dam. Consequently, 232 villages would be affected. An accurate figure for the villagers is not available but a reasonable guess is 64,000 people in the 232 villages.

Regardless of financing difficulties, GAP officials are optimistically proceeding with development and construction. In 1983 a contract to build the Ataturk Dam was awarded to the companies of Palet Insaat, Seri Insaat, and Enerji-Su; it was renamed as the ATA-Insaat Consortium. European banks are providing $460 million for equipment purchases, and the first of eight 300 MW generators is scheduled to start operation in May 1991(3250). The seven others are scheduled to be on line by 1994. Swiss banks and the World Bank, although reluctantly, have lent toward the Karakaya dam which was originally scheduled for completion in 1989.

The government of Turkey is considering raising a bond issue for the dam, as it did with the Ataturk bridge across the Bosphorous(3230). Turgut Ozal, the Prime Prime Minister of Turkey and architect of Turkey's economic recovery since the 1980 military government, believes the GAP will "produce enough food, clothes, and other articles for an additional 20 million people"(3231). Ozal believes electricity from the Ataturk project, will pay for itself, including the tunnels for irrigation, in four years(3231). His projection is based on selling electro-power at 1984 prices and does not include increased GNP through boosted agriculture production. There still remains concern about losses of skilled workers, from laborers to engineers, which could affect GAP completion(0373).

The award of the Ataturk Dam project to Turkish contractors initially created scepticism in both local and international construction circles, but ATA-Insaat does have the resources and technical competence to complete the project (3227). Exclusively Turkish contractors built the 179 m high Hasan Ugurlu in Samsun between 1972 and 1979.

In March 1985, The Export-Import Bank of New York and the Manufacturers Hanover Bank loaned Turkey $111 million for the Ataturk Dam(3248). In August 1985, the Turkish State Directorate General of Water Works put out tenders for the

17.5 billion TL Kralkizi Dam, hydro-electric station, and two associated tunnels. This Tigris project alone will consist of 5.5 Mcm of digging and filling, 11,000 tons of steel, and 75,000 cu m of concrete work(3251).

Table 4

EUPHRATES DRAINAGE BASIN WITHIN TURKEY

River or Stream/ Station Number	Location of Gauge Station	Drainage Area (km^2)	Elev. (m)	Measure Began	Average (cu m/s)	1982 (cu m/s)
Euphrates at Bagistas/2156	38°26'55"E - 39°25'57"N	15,562	865	1968	148.026(14 yr)	170.091
Euphrates at D.D. Yollari Kup/2153	35 km from Old Malataya	77,740	640	1967	796.374(2 yr)	891.279
Euphrates at Keban/2103	38°45'33"E - 38°48'42"N	63,873	688	1936	--	--
Euphrates at Kemahbogazi/2119	39°23'36"E - 39°41'60"N	10,356	1123	1953	81.892(29 yr)	90.297
Euphrates at Sanya D.D.Y./2151	41°10'08"E - 39°34'42"N	8185.6	1355	1963	59.625(12 yr)	71.191
Beyderesi at Kilayik/2131	38°12'36"E - 38°19'21"N	277.6	925	1956	1.952(26 yr)	1.645
Bingol Cayi at Abdurcahmanpara/2158	41°29'10"E - 39°06'29"N	1577.6	1310	1968	18.823(13 yr)	22.507
Bulam Cayi at Fatopasa/2135	38°14'49"E - 37°59'24"N	166.4	1345	1962	4.415(16 yr)	4.469
Calti Suya at Kazlak/2167	38°15'33"E - 39°20'52"N	4288.0	890	1967	25.651(14 yr)	25.021
Cam Deresi at Haci Kamil/2159	39°04'57"E - 37°39'21"N	1036	525	1968	3.284(14 yr)	2.758
Culap Suyu at Incirli/2132	39°02'02"E - 37°09'50"N	525	467	1956	0.339(13 yr)	0.382
Gagcag Suyn at Cinarkoy/2123	41°19'23"E - 37°12'55"N	836	560	1953	10.666(13 yr)	9.814
Dumlu Cayi at Yesildere/2168	28 km from Erzurum	52	2000	1972	0.795(10 yr)	0.991
Goksu Nehri at Malpinar/2115	38°09'26"E - 37°29'36"N	3990.4	397	1953	63.197(15 yr)	55.536
Goynuk Cayi at Cayagizi/2164	40°33'32"E - 38°48'06"N	2332	998	1968	33.202(13 yr)	45.960
Karasu at Asagi Kagdanic/2154	40°45'33"E - 39°56'16"N	2886	1675	1968	19.542(14 yr)	20.426
Karasu at Karakopru/2157	41°29'58"E - 38°46'58"N	2098.4	1250	1968	25.400(14 yr)	39.761
Manzur Cayi at Dedikusagi/2147	39°17'38"E - 39°20'39"N	807.6	1250	1962	35.497(18 yr)	38.482
Manzur Cayi at Melekbahce/2133	39°31'35"E - 39°02'39"N	3248.8	875	1967	87.951(14 yr)	96.869
Manzur Cayi at Miskisag/2149	39°30'29"E - 39°07'15"N	1622.4	925	1963	51.995(19 yr)	58.717
Murat Nehri at Mus/2152	41°30'41"E - 35°51'47"N	17,773.6	1245	1967	128.665(13 yr)	170.730
Murat Nehri at Palu/2102	39°56'51"E - 38°41'57"N	25,447.2	859	1967	261.013(15 yr)	283.685
Murat Nehri at Tutak/2122	42°46'23"E - 39°32'17"N	5822.4	1552	1953	48.615(14 yr)	53.913
Nizip Cayi at Danaoglo/2160	--	1020	365	1968	2.177(14 yr)	1.079
Peri Suyu at Korudibi/2141	40°06'49"E - 39°09'41"N	3604.4	1100	1961	67.449(12 yr)	81.556
Peri Suyu at Logmar/2166	39°48'47"E - 38°51'31"N	5446	5446	1968	77.846(13 yr)	96.842
Pulumur Cayi at Batman Kop/2171	--	1374	890	1977	37.200(3 yr)	36.065
Sultan Cayi at Dedekoy/2173	--	486	935	1976	5.584(6 yr)	4.167
Tohma Suyu at Hisarcik/2145	37°41'08"E - 38°28'32"N	5822	935	1962	25.975(20 yr)	22.765
Tohma Suyu at Yazikoy/2124	37°26'36"E - 38°40'30"N	1336.4	1100	1954	9.079(20 yr)	9.385
Tuzla Deresi at Tercan Kop/2155	40°21'48"E - 39°46'55"N	2144	1415	1968	22.582(14 yr)	25.450
Uludere at Hasancelebi/2171	37°52'56"E - 38°55'38"N	411.2	1188	1976	2.054(6 yr)	1.879
Zerkan Suyu at Hocakoy/2165	40°30'03"E - 37°08'32"N	490	445	1968	1.341(13 yr)	1.644

Source: Elektrik Isl. Etud Id., 1983 Water Year Discharge, Ankara, Turkey.

Chapter 3

THE EUPHRATES PORTION OF GAP

The Euphrates project will eventually have a capacity of 5440 MW and will have a planned potential to irrigate 1,400,000 ha (4.9 million acres). It has been compared in scope with the Tennessee Valley Authority. The project includes three large dam stages: The Keban Project, the Karakaya Project, and the Ataturk Project[3249] (see Table 5.)

3.1. The Keban Project

The Keban Project is a series of dams which includes small upstream dams. The main Keban Dam and power plant began operation in 1974. It was built by SCI-Impreglio, a French-Italian joint venture, and was financed by the European Investment Bank, USAID, and the French, German, and Italian government[0373]. Total cost in 1974 dollars was about TL 8,000 million or $85 million dollars[0907].

The Keban Dam is a compacted, rock-fill dam with a clay core and a total embankment volume of 15.5 million cubic meters. Reservoir surface area is 675 km^2. The foundation height is 210 m, with a crest length of 1,125 m. A major seepage occurred in 1974 but the cavern has been filled and the dam is producing power. It has 8 x 160 MW generators capacity[3249][0907]. The reservoir covered 680 km^2 in 1982[3249]. With the completion of the Keban, the government established flow at a minimum of 450 cu m/s and a maximum of 1,000 cu cm/s[0765]. The final installed capacity of Keban will be 1,240,000 kW[0765]. When full production is reached, the average annual electricity generated is expected to be 6.0 billion kW[3242]. Production from 1974 through 1978 was 17 billion kW[0765].

In July 1981, the Keban Dam was producing electricity on four of its turbines. The fifth turbine was planned on line by December, and at each three-month interval, starting in March 1982, the remainder were to come on line[0907]. The last four units, resulting in 1420 MW capacity, came on line in 1983[3228].

3.2 The Karakaya Project

The Karakaya Dam is being built about 166 km downstream from the Keban near Cungus in the Diyarbakir region. The Karakaya is well underway, and its planned 1800 MWe capacity will be greater than the Keban. Total cost was estimated at $500 million in 1981[0907]. The World Bank committed $350 million[0373]. Annual electricity generation will be between 7.3 and 7.5 billion kWh[3249][3242].

The Karakaya is a concrete arch-type dam with a height of 187 m and crest length of 462 m. The impoundment will be about 9500 Mcm of water [3245]. The embankment will require about 2 million cu m of concrete. Original plans are to have power production in 1986, but this date[0765].

3.3. The Ataturk Power Station and Irrigation Project

The Ataturk Dam project is by far the largest project on the Euphrates, and the dam will be one of the largest in the world (Table 6). The dam site is already under construction near the town of Bozova, where the Euphrates flows into a mountain pass, 70 km northwest of Urfa, and 181 km downstream of the Karakaya Dam.

The Ataturk Dam project is one of the most ambitious engineering feats ever attempted. This third dam on the Euphrates will have a generating capacity of 2,400 MW to eight Francis Turbines. Plans are for generation to be controlled by the Turkish Electric Company (TEK) in Ankara. The reservoir will provide irrigation for about 730,000 ha, making it the first or second largest irrigation scheme in the world [3228]. The project is expected to open up employment opportunities for three million people[1760].

General Kenan Evren, the Turkish Head of State, formally inaugurated work on the project in October 1981, the centennial of Ataturk's birth. The original plan was for completion in 1990 with the first turbine coming on line in 1987[3249]. Cost of the entire project has been estimated from two to four billion dollars[3249][3231].

This project is one of the key components of the GAP. In 1991, the new scheduled completion date, it will be the largest dam ever built in Turkey and the third or fourth largest rock-filled dam in the world[3226][3231][3229]. The dam's 180 m height, clay core, and rock-filled wall will impound an 817 km^2 lake with a volume of 48.7 Mcm. Unlike the Keban and Karakaya projects, the Ataturk scheme will serve both a

hydro-electric and irrigation role. Surplus food production potential for the region to be irrigated by the Ataturk dam is estimated at $5 billion.(3227)

About 726,000 ha of land in the Harran, Siverek, Mardin, Ceylanpinar, and Hilvan plains will be irrigated. The irrigation system will be the largest in the world, containing a twin-bore 24.6 km main tunnel, 283 km of main canals, 150 km of secondary canals, and 200 km of tertiary distribution canals.

ATA-Insaat Consortium has made significant progress on the Ataturk project. In June 1984, there were about 800 workers stripping the site, building roads, and constructing a work camp of mass facilities, offices, stores, workshops, living areas, and schools for workers' children. The workers' town is near the dam site, where stripping is underway for the spillway tunnel, and excavation has started for the power house. Around 30 km of roads are being built to expedite heavy equipment movement from camp to site. Contracts for the dam's turbines, generators, and electrical equipment were placed in March 1984. The turbines are identical to those for Karakaya, and are supported by credits for 458 million dollars(3227). The work force will eventually increase to 3,000.

Completion of the Ataturk project was delayed from 1990 to 1993 because of credit difficulties. In 1984, a new date of 1991 was projected for the dam completion. Consequently, the first turbine should be operating in 1991, with the others on line by 1993. Recent government decisions may advance the dam completion to the end of 1990(0896).

The most difficult part of the dam construction will be the 1200 km of drilling and grouting. Grouting will take about six years after the river diversion is completed. The grouting will be in galleries driven under the dam's foundation and in the walls of the valley. About 11 galleries totalling 12 km will be driven under the foundation(3227).

3.3.1. Geological Conditions

The Turkish Surveying Administration began investigating possible sites for the Ataturk project in 1964(0765). The actual dam site on the Euphrates was located at an area where the Euphrates enters a mountain pass. The site is located in a wide valley at the beginning of the mountain pass, rather than in the pass, because drilling and excavation revealed unsuitable geological instability farther down the canyon. The geological structure at the dam site is limestone rock in

various forms. Farther downstream in the right abutment dolomitic limestone dips under plicated limestone. The pass bottom is covered with abutment rubble, worn rock waste, and river alluvium. Terrace deposits of sandy gravels, five to 10 m thick, cover the bedrock. The alluvium does not exceed 9 m. The dam body will be set on a foundation of plicated limestone. The dam axis lies entirely within a thin bedded, slightly marly limestone(3228).

The slopes of both abutments are mostly covered by a talus mantle about 1 m thick. The foundation rock is dense, moderately hard, and homogeneous over the dam foundation zone. A main fault runs east to west about one km south of the dam, but does not interfere with the dam. However, the dam site is only 240 km southwest of the 1975 Lice earthquake epicenter and is about 40 km southeast of the East Anatolian fault zone(3234). Since the dam is in an active seismic zone, the dam design allows a maximum horizontal acceleration of 25 percent G forces.(3228) This design should withstand any earthquake magnitude up to the 1 in 500 year occurrence.

3.3.2. The Reservoir

The reservoir surface area will cover an area of 817 km^2 (0765). There are some landslide problems upstream of the dam, but the landslide areas are not expected to constitute a danger to the dam. The seepage discovered with preliminary drilling in a few karstic formations at the dam site will be avoided by extending grout curtains toward the right and left abutments.

3.3.3. The Ataturk Power Plant

The power plant is being built at the foot of the right abutment just downstream of the dam. The main building houses the turbines and generators. Eight 300,000 kw turbine generators are in the plant. The combined output potential of 2,400,000 kW makes it among the largest in the world(3242). The electricity will be distributed by Turkey's Electrical Authority (TEK). The power house will be 258 m long, 53 m wide, and 54 m tall (equivalent to an 18-story building).

3.3.4. Construction Of The Dam

The rock-filled Ataturk Dam will be filled with rock excavation material obtained at the site, from sand and gravel out of the river bed, and from basalt rock transported from a site about four km away. Clay, from fields near the site, will be used as the core. The volume of the Ataturk Dam's embankment will be 82 Mcm, making it about five times larger than Keban.

3.4. The Urfa Tunnel And Hilvan Canal

The Ataturk Dam is designed for electrical energy production and for supplying irrigation water to the Urfa Tunnel and Hilvan Canal. Irrigation from the reservoir involves two separate systems because some irrigated plains are higher and some lower than the reservoir level. The Urfa Tunnel system will take water from a branch of the reservoir near Bozova and will irrigate 300,000 ha of land by gravity flow. The Hilvan Canal system will pump water 107 m up from the reservoir, some distance upstream from the Urfa tunnel point, and will send water to 400,000 ha. A total of 730,000 ha will be irrigated.

The Urfa Tunnel construction began in 1977 and is scheduled for completion in 1986[0765]. Water will pass through the two concrete lined 7.5 m (inside diameter) tunnels for 26.4 km at a rate of 308 cu m/s (Table 7). Then canals, one with a capacity of 53 cu m/s and the second with a 255 cu m/s capacity, will convey water to the Urfa-Harran and Mardin-Ceylanpinar plains.

The Hilvan Pumping Station will pump water from the reservoir to the Hilvan Canal. The canal will extend 150 km eastward and provide water for 64,500 ha in the southern part of the Siverek-Hilvan plains. A large dam is to be built at Golebakan and the reservoir will supply water to secondary canals which will supply water to 79,500 ha in another part of the Siverek-Hilvan plains. The main canal will travel south and go through the 5.7 km Siverek Tunnel. It will also pass the 7.9 km long Mardin Tunnel which conveys water under the Tek-Tek plateau to the Mardin plains. From the Mardin plains, the canal will travel 81 km and irrigate another 140,000 ha. Pumping stations are planned to pump water to the Lake Yenice canal, thus supplying water to another 113,000 ha which are located in the region's highest plains. When completed, the Hilvan System will be the largest single point source for any irrigation system in Turkey[0765].

Table 5

TECHNICAL PARAMETERS FOR MAJOR DAMS ON THE EUPHRATES

CHARACTERISTICS	ATATURK DAM	KARAKAYA DAM	KEBAN DAM
Location	180 km downstream of Karakaya	Elazig (166 km downstream of Keban)	Elazig
Stream	Euphrates River	Euphrates River	Euphrates River
Purpose	Energy, irrigation, and flood control	Power generation	Power generation
Date of Completion	Scheduled for 1989	Began filling in 1986	1974
Catchment Area	92,240 km^2		64,100 km^2
Annual Average Precipitation	750 mm (est.)	825 mm (est.)	925 mm (est.)
Annual Inflow	26,585 Mcm	23,600 Mcm	19,999 Mcm
RESERVOIR			
Maximum Water Level	542 m	693 m	845 m
Total Reservoir Volume	49 x 10^9 cu m	9.54 x 10^9 cu m	30.60 x 10^9 cu m
Reservoir Surface Area	817 km^2	298 km^2	675 km^2
DAM EMBANKMENT			
Type	Rock, rock fill	Concrete, archgravity	Compacted rockfill with clay core
Height from Foundation	179 m	187 m	211 m
Height from Riverbed	169 m	137 m	167 m
Crest Length	1664 m	462 m	1125.72 m
Embankment Volume	85 Mcm	2 Mcm	15.5 Mcm
SPILLWAY			
Type Gravity	Radial gate (Dimensions 16 m x 17 m)	Radial gate	Ogee type, concrete
Number	6	10	6
Discharge Capacity	24,000 cu m/s	17,000 cu m/s	12,000 cu m/s

Table 5 continued

CHARACTERITICS	ATATURK DAM	KARAKAYA DAM	KEBAN DAM
DIVERSION TUNNELS			
Type	Horse-shoe	Circular, concrete lined	Horse-shoe section
Number of Tunnels	3	2	2
Tunnel Lengths	1326 m, 1367.20 m, 1396.40 m	568 m and 698 m	708 m each
POWERHOUSE			
Installations Turbine Type	Vertical Axis Francis	Vertical Axis Francis	Vertical Axis Francis
Number of Turbines	8	6	8
Discharge Capacity of Each Turbine	218.3 cu m/s	233 cu m/s	180 cu m/s
Installed Capacity	8 x 300 = 2400 MW	6 x 300 = 1800 MW	8 x 155 = 1240 MW
Average Annual Power Production	8.1×10^9 kWh	7.5×10^9 kWh	5.9×10^9 kWh

Source: Government of Turkey, State Hydraulic Works, Ankara, Turkey, and various other sources.

Table 6

TECHNICAL PARAMETERS OF THE ATATURK DAM AND POWER PLANT

Location	180 km downstream of Karakaya Dam
Drainage Area	92,240 km^2
Average Flow	1026 cu m/s
Highest Recorded Flow	6160 cu m/s
Riverbed Elevation	380 m
Maximum Reservoir Elevation	542 m
Reservoir Area	817 km^2
Reservoir Capacity	49 x 10^9 cu m
Active Reservoir Volume	19,300 Mcm
Dam Type	Rock fill
Dam Peak Elevation	594 m
Height of Dam from Foundation	179 m
Volume of Dam Embankment	85 Mcm
Crest Length	1664 m
Diversion Tunnels	3 x 8 m diameter horseshoe cross section
Diversion Capacity	2100 cu m/s
Average Length of Tunnels	1367 m
Bottom Outlet	2 x 3 sliding gates
Bottom Outlet Capacity	1500 cu m/s
Spillway	Controlled sill and canal
Gates	6 radial (16 m x 17 m)
Spillway Capacity	16,800 cu m/s
Auxiliary Gates	2 (5 m x 8.1 m) radial
Auxiliary Spillway Capacity	1000 cu m/s
Intake Structure	Concrete gravity 8 entrances
Intake Elevation	593.6 m
Intake Gates	8 sliding (4.8 m x 7.7 m)
Penstocks	8 in the right abutment
Diameter of Penstock	Approximately 7 m
Length of Penstock	Approximately 600 m
Powerhouse	Closed type
Number of Units	8
Installed Capacity	300 MW x 8 = 2400 MW
Average Yearly Electric Production	8.1 billion KWh
Turbines	Francis type vertical axis
Turbine Capacity	400,000 horsepower
Generators	Vertical axis
Generators Capacity	315 MVA
Frequency	50 Hz
Speed	150 rpm
Transformers	3 x 8 = 24 single phase
Switchyard	Open type

Source: Devlet Su Isleri, Ankara, Turkey.

Table 7

URFA IRRIGATION TUNNEL

The Urfa tunnel system consists of two concrete lined tunnels, about 26 kilometers long, through which water will be discharged from the Ataturk Dam. The water will be conveyed to a canal system at the beginning of the Urfa-Harran plains. The Urfa Tunnel System will maintain the irrigation of approximately 300,000 hectares.

Type	Circular, reinforced concrete lining
Length of Tunnel	26.4 km each, two parallel tunnels
Grade	T_1 - 0.00062802, T_2 - 0.00062948
Excavation Diameter	approximately 9.50 m
Completed Diameter	7.62 m
Concrete Lining	0.95-0.40 m
Amount of Rock Bolt	4,600,000 kg
Amount of Shotcrete	300,000 tons
Amount of Excavation	3,000,000 cu m
Amount of Concrete	1,150,000 cu m
Discharge of Tunnel	328 cu m/s
Area to be Irrigated	300,000 ha
Geological Formation	Calcerous marl
Hydraulic Load	T_1 - 40.25 m, T_2 - 39.74 m

Source: General Directorate of State Hydraulic Works, Ankara, Turkey, 1984.

Chapter 4

THE TIGRIS PORTION OF GAP

The development plan of both the Euphrates basin (within Turkey) and the western Tigris basin (within Turkey) form the GAP. This massive project has been given top priority by the government of Turkey.

The Tigris portion of the GAP will provide irrigation for about 600,000 ha of land and the generation of eight billion $kWha^{-1}$ from an installed capacity of 2,200 MW(0305). The plan is for four large dams on the main Tigris, three on the tributaries, and 12 small pond (*golet*) dams on the tributaries in irrigation areas. There are also to be 3 large, 4 medium size, and 12 small power plants. Additionally, there will be numerous pumping plants.

Plans for the entire Tigris portion have not been completed, but construction on one of the Dicle dams did begin in 1985.

Chapter 5

INDUSTRY IN THE SOUTHEASTERN ANATOLIA PROJECT REGION

Turkey conducted detailed censuses of its industries in 1950, 1963, 1970, and 1980. In addition to these four main industry census years, there have been some in-between years when production establishments with more than ten employees have been surveyed. All of these census and survey results have been published by the State Institute of Statistics. Results clearly show that the GAP region is of minimal significance in terms of Turkey's industrial production. However, Diyarbakir and Gaziantep are important regional centers (Table 8).

The six GAP provinces of Adiyaman, Diyarbakir, Gaziantep, Mardin, Siirt, and Sanliurfa combined account for only 1.85% of Turkey's 9,693 industrial establishments (over 10 employees), 1.92% of Turkey's industrial employees, and only 1.98% of the value added by manufacturing at the large scale establishments (10 or more employees).

At the other extreme, the most developed region of Turkey is Marmara. About 58% of all large scale industries, 47.4% of workers employed in industry, and 44.6% of value added by large scale establishments are in the Marmara region.

Within the GAP region, the two provinces of Gaziantep and Siirt rank in higher importance for industry at the province scale. Gaziantep is 9th out of 67 provinces in numbers of establishments, 17th in terms of employees, and 18th in value added by manufacturing. Gaziantep's active population employed in manufacturing industries, at 13.2%, is higher than Turkey's average of 10.7%. While Siirt is not ranked in terms of establishments and workers, it ranks 12th of 67 in terms of value added. Siirt is in this favorable position because of oil and oil related production. Oil fields in Batman have accelerated population increases in this area. Batman's population increased from 443 in 1945 to 86,172 in 1980.

Manufacturing industries in Turkey, except some heavy industries and some State Economic Enterprises developed in response to market conditions. Consequently, industrial activities serving the undeveloped regions of Eastern and Southeastern Anatolia agglomerated in the "functional service centers" of surrounding areas. Thus, Gaziantep became the functional center of the GAP region.

As the GAP region service center, Gaziantep, along with Izmir, Ankara, and Adana, is one of only four 6th grade industrial centers in Turkey. Only Istanbul is a 7th grade center (as well as exerting a considerable sphere of influence as a 6th grade center). Gaziantep influences a vast area both directly and indirectly while sharing its influence with the Adana functional center (Tables 9, 10).

The city of Diyarbakir has fewer large scale manufacturing establishments than Gaziantep and is classified as a 5th grade functional center. Diyarbakir city serves the surrounding area as a center of health services, higher education, and administrative facilities (Tables 11, 12).

In the six provinces of the GAP region, similar to the general character throughout Turkey, "small scale establishments" dominate manufacturing. Although there are variations by provinces, the "one person employed" small scale establishments dominate in the GAP region (Tables 13, 14, 15, 16, 17, 18).

These small scale establishments produce daily consumer goods, such as bakeries, and also vary from small scale printing houses, to brick makers, to tailors. Most simply supply the local demand and are located in province and district centers, with a few in rural settlements.

Only Gaziantep, out of the six GAP provinces, had significant numbers of "large-scale manufacturing establishments" (employing 10 or more) (Table 19). This class of industry in Gaziantep is mostly processing of agricultural products. Such agro-industries are textiles (dependent on cotton), olive oil and soap production (dependent on olives), a wine and *raki* factory (dependent on grapes). There are also other plants in Gaziantep city which produce foodstuffs, beverages, and consumer goods for local demand.

The basic structure of industry in the other provinces of Adiyaman, Diyarbakir, Mardin, Siirt, and Sanliurfa is similar, but not of Gaziantep's quantity. All of the province centers are dependent on local agricultural processing such as the tobacco factory in Adiyaman.

With the exception of Gaziantep, industry in the GAP provinces improved very slightly over the past two decades.

The goals of the Southeastern Anatolian Project parallel those of the national Five-Year Development Plans. Since 1963, the government has encouraged development of the GAP region (and other parts of Eastern Turkey). Goals to stop internal migration, to increase population in the region, and to improve the standard of living are well documented in each of the subsequent Five-Year Development Plans. As a result of

government actions to emphasize industrial investments which use the local agricultural products as raw materials, there are today manufacturing plants in the region which are state investments. These investments create high amounts of value added although they are few in number and employ few workers. In 1982, two of the three large-scale establishments in Siirt were state owned factories, employing 3,525 people, and creating value added of 20.2 billion Turkish lira. As a result, Siirt ranks twentieth in Turkey (Table 19).

Again, in the most recent and Fifth Five Year Development Plan, the Southeastern and Eastern regions of Turkey are considered privileged regions and incentives are offered which encourage establishing large-scale manufacturing plants, while at the same time, small-scale labor intensive establishments, particularly those highly sensitive to transport costs (such as dairy products) are also encouraged. The market region is considered to be the entire Middle East.

Table 8

FUNCTIONAL REGIONS OF TURKEY

Regional Center	Provinces within the Functional Region
Adana	Adana, Hatay, Icel
Ankara	Ankara, Cankiri, Corum, Kirsehir
Bursa	Bursa
Diyarbakir*	Diyarbakir, Bitlis, Hakkari, Mardin, Siirt, Van
Elazig	Elazig, Bingol Tunceli
Erzurum	Erzurum, Erzincan, Agri, Kars, Mus
Eskisehir	Eskisehir, Bilecik, Kutahya
Gaziantep*	Gaziantep, Adiyaman, Urfa, Kahramanmaras
Istanbul	Istanbul, Bolu, Canakkale, Edirne, Kirklareli, Kocaeli, Sakarya, Tekirdag, Zonguldak, Kastamonu
Izmir	Izmir, Afyon, Antalya, Aydin, Burdur, Denizli, Isparta, Manisa, Mugla, Usak, Balikesir
Kayseri	Kayseri, Nevsehir, Yozgat
Konya	Konya, Nigde
Malatya	Malatya
Samsun	Samsun, Amasya, Giresun, Ordu, Sinop, Tokat
Sivas	Sivas
Trabzon	Trabzon, Artvin, Rize, Gumushane

Source: *Turkiye'de Yerlesme Merkezlerinin Kademelenmesi Cilt I*, 1982, Ankara, Turkey.

* Within the GAP region.

Table 9

AREA OF PROVINCES DIRECTLY INFLUENCED BY GAZIANTEP (6TH GRADE REGIONAL CENTER)

Province	District
Gaziantep	Center
Elazig	Karakocan
Bingol	Genc, Solhan, Karliova, Kigi
Mus	Varto, Bulanik, Malazgirt
Agri	Patnos
Van	Ercis
Bitlis	All Districts
Siirt	Kozluk, Sirnak
Mardin	Cizre, Silopi
Hakkari	All Except Yuksekova

Source: *Turkiye'de Yerlesme Merkezlerinin Kademelenmesi*, Devlet Planlama Teskilat, Ankara, Turkey, 1982, Vol. I, pp. 159-160.

Table 10

AREAS OF INFLUENCE GAZIANTEP SHARES WITH OTHER PROVINCE CENTERS

Province	District
Adana (6th Grade Center)	All Districts Except Gaziantep District Center
Kahramanmaras	All Except Andirin
Adiyaman	All
Urfa	All
Malatya	Hekimhan, Akcadag, Yesilyurt, D. Sehir, Poturge
Diyarbakir	Cengus, Cermik, Ergani, Dicle, Hani, Lice, Bisml
Mardin	All Except Idil, Cizre, Silopi
Siirt	Eruh

Source: *Turkiye'de Yerlesme Merkezlerinin Kademelenmesi*, Devlet Planlama Teskilat, Ankara, Turkey, 1982, Vol. I, pp. 159-160.

Table 11

AREAS OF PROVINCES DIRECTLY INFLUENCED BY DIYARBAKIR (5TH GRADE REGIONAL CENTER)

Province	District
Diyarbakir	All Districts
Siirt	All Districts
Bitlis	All Districts
Van	All Districts
Hakkari	All Districts
Mardin	Kiziltepe, Nusaybin

Source: *Turkiye'de Yerlesme Merkezlerinin Kademelenmesi*, Devlet Planlama Teskilat, Ankara, Turkey, 1982, Vol. I, pp. 145-146.

Table 12

AREAS OF PROVINCES DIYARBAKIR SHARES WITH OTHER PROVINCE CENTERS

Province	Districts
Gaziantep	Kiziltepe and Nusaybin Districts of Mardin Province
	Hilvan and Siverek Districts of Sanliurfa
Elazig	Bingol Central District, Genc and Solhan

Source: *Turkiye'de Yerlesme Merkezlerinin Kademelenmesi*, Devlet Planlama Teskilat, Ankara, Turkey, 1982, Vol. I, pp. 145-146.

Table 13

SMALL-SCALE MANUFACTURING ESTABLISHMENTS IN ADIYAMAN PROVINCE (1980)

Province and Districts	Total	Size of Annual Average of Workers 1	2	3-4	5-6	7-9
ADIYAMAN	577	272	167	114	19	5
Central District	278	112	87	61	14	4
Besni	92	41	31	18	1	1
Celikhan	15	9	2	4	--	--
Gerger	18	13	4	1	--	--
Golbasi	67	36	19	12	--	--
Kahta	107	61	24	18	4	--
TURKEY	173,337	55,590	50,152	46,587	14,435	6573

Source: D.I.E., *1980 Genel Sanayi ve Isyerlen Sayimi-II, Kucuk Imalat Sanayi*, Ankara, Turkey, 1982. (*1980 Census of Industry and Business Establishments*).

Table 14

SMALL-SCALE MANUFACTURING ESTABLISHMENTS IN DIYARBAKIR PROVINCE (1980)

Province and Districts	Total	Size of Annual Average of Workers 1	2	3-4	5-6	7-9
DIYARBAKIR	1049	309	298	299	107	38
Central District	654	161	180	190	80	32
Bismil	72	22	22	25	2	1
Cermik	47	12	9	19	7	--
Cinar	22	8	9	5	6	--
Cungus	13	2	9	2	--	--
Dicle	8	2	3	3	--	--
Ergani	101	32	37	25	6	1
Hani	33	30	--	2	1	--
Hazro	20	6	10	4	--	--
Kulp	25	14	5	4	2	--
Lice	10	2	3	5	--	--
Silvan	55	16	11	15	9	4
TURKEY	173,337	55,590	50,152	46,587	14,435	6573

Source: D.I.E., *1980 Genel Sanayi ve Isyerlen Samimi-II, Kucuk Imalat Sanayi*, Ankara, Turkey, 1982. *(1980 Census of Industry and Business Establishments)*.

Table 15

SMALL-SCALE MANUFACTURING ESTABLISHMENTS IN GAZIANTEP PROVINCE (1980)

Province and Districts	Total	Size of Annual Average of Workers 1	2	3-4	5-6	7-9
GAZIANTEP	4696	827	1140	1736	664	329
Central District	3418	554	814	1270	502	278
Araban	19	2	5	9	2	1
Islahiye	193	66	71	49	5	2
Kilis	614	135	128	212	106	33
Nizip	390	55	103	176	42	14
Oguzeli	47	14	14	17	1	1
Yavuzeli	15	1	5	3	6	--
TURKEY	173,337	55,590	50,152	46,587	14,435	6573

Source: D.I.E., *1980 Genel Sanayi ve Isyerlen Sayimi-II, Kucuk Imalat Sanayi*, Ankara, Turkey, 1982. *(1980 Census of Industry and Business Establishments)*.

Table 16

SMALL-SCALE MANUFACTURING ESTABLISHMENTS IN MARDIN PROVINCE (1980)

Province and Districts	Total	Size of Annual Average of Workers 1	2	3-4	5-6	7-9
MARDIN	878	389	227	218	37	7
Central District	262	78	88	80	14	2
Cizre	129	65	31	30	3	--
Derik	10	2	5	2	1	--
Gercus	33	17	9	6	1	--
Idil	11	6	3	1	--	1
Kiziltepe	174	59	41	59	11	4
Mazidagi	12	5	4	3	--	--
Midyat	85	55	20	10	--	--
Nusaybin	101	80	10	6	5	--
Omerli	12	6	6	--	--	--
Savur	23	12	3	7	1	--
Silopi	26	4	7	14	1	--
TURKEY	173,337	55,590	50,152	46,587	14,435	6573

Source: D.I.E., *1980 Genel Sanayi ve Isyerlen Sayimi-II, Kucuk Imalat Sanayi*, Ankara, Turkey, 1982. *(1980 Census of Industry and Business Establishments)*.

Table 17

SMALL-SCALE MANUFACTURING ESTABLISHMENTS IN SANLIURFA PROVINCE (1980)

Province and Districts	Total	Size of Annual Average of Workers 1	2	3-4	5-6	7-9
SANLIURFA	1642	504	466	439	161	72
Central District	949	326	277	221	78	47
Akoakale	33	13	6	9	3	2
Birecik	138	19	44	55	17	3
Bozova	21	4	7	6	2	2
Halfeti	26	16	4	4	2	--
Hilvan	17	4	7	2	2	2
Siverek	164	58	39	43	21	3
Suruc	147	36	41	39	22	9
Viransehir	147	28	41	60	14	4
TURKEY	173,337	55,590	50,152	46,587	14,435	6573

Source: D.I.E., *1980 Genel Sanayi ve Isyerlen Sayimi-II, Kucuk Imalat Sanayi*, Ankara, Turkey, 1982. *(1980 Census of Industry and Business Establishments)*.

Table 18

SMALL-SCALE MANUFACTURING ESTABLISHMENTS IN SIIRT PROVINCE (1980)

Province and Districts	Total	Size of Annual Average of Workers 1	2	3-4	5-6	7-9
SIIRT	564	201	189	140	28	12
Central District	226	96	83	40	6	1
Batman	226	55	61	78	21	11
Baykan	13	4	5	4	--	--
Besiri	13	6	6	1	--	--
Eruh	9	5	2	1	1	--
Kozluk	23	11	9	3	--	--
Kurtalan	33	26	12	5	--	--
Pervari	5	1	2	2	--	--
Sason	2	--	1	1	--	--
Sirnak	13	6	2	5	--	--
Sirvan	1	1	--	--	--	--
TURKEY	173,337	55,590	50,152	46,587	14,435	6573

Source: D.I.E., *1980 Genel Sanayi ve Isyerlen Sayimi-II, Kucuk Imalat Sanayi*, Ankara, Turkey, 1982. *(1980 Census of Industry and Business Establishments)*.

Table 19

PROVINCES RANK ORDERED BY LARGE-SCALE ESTABLISHMENTS, NUMBER OF EMPLOYEES, AND VALUE-ADDED (1982)

	Number of Establishments		Average Number of Workers		Value-Added (Billion TL)	
1.	Istanbul	4596	Istanbul	275,038	Istanbul	540
2.	Izmir	840	Izmir	72,168	Izmir	203
3.	Ankara	636	Kocaeli	51,245	Icel	171
4.	Bursa	437	Ankara	46,203	Kocaeli	168
5.	Kocaeli	270	Adana	40,143	Ankara	71
6.	Adana	233	Bursa	40,049	Bursa	66
7.	Manisa	180	Zonguldak	24,123	Adana	60
8.	Konya	156	Hatay	19,461	Zonguldak	52
9.	Gaziantep	149	Konya	18,797	Tekirdag	21
10.	Denizli	128	Samsun	16,195	Samsun	21
11.	Eskisehir	122	Kayseri	14,561	Eskisehir	21
12.	Samsun	111	Eskisehir	14,311	Siirt	20
13.	Kayseri	110	Rize	14,285	Kayseri	19
14.	Aydin	107	Icel	14,135	Konya	18
15.	Zonguldak	105	Manisa	10,858	Balikesir	18
16.	Balikesir	105	Tekirdag	10,538	Samsun	13
17.	Icel	76	Sakarya	10,013	Manisa	11
18.	Sakarya	72	Gaziantep	9133	Gaziantep	10
19.	Tekirdag	69	Balikesir	8517	Antalya	9
20.	Antlaya	60	Denizli	8204	Edirne	9

Table 20

LARGE SCALE INDUSTRIAL ESTABLISHMENTS IN GAP PROVINCES (1964 AND 1982)

	NUMBER OF ESTABLISHMENTS		NUMBER OF WORKERS		VALUE ADDED (1000 TL)
	1964[a]	1982[b]	1964	1982	1982
Adiyaman	0	3	6	1227	1,546,671
Diyarbakir	6	14	766	1537	1,546,734
Gaziantep	43	149	2392	9133	10,184,734
Mardin	0	2	0	32	14,378
Siirt	3	3	375	3525	20,200,370
Sanliurfa	0	9	0	764	515,751
Region's Total	52	180	3533	16,218	33,554,373
Region's Share	1.72%	1.85%	1.16%	1.92%	1.98%
TURKEY'S TOTAL	3012	9693	304,604	845,074	1,687,891,818

[a] Republic of Turkey, *1964 Census of Manufacturing and Service Industries*, State Institute of Statistics, Ankara, 1964.

[b] *1982 Annual Manufacturing Industry Statistics*, State Institute of Statistics, Ankara, 1984.

Chapter 6

POTABLE WATER FOR DOMESTIC USE

There is a serious domestic water deficiency in the GAP region. This deficiency is a result of people having to transport water over long distances for both human and animal consumption. Water is obtained from different sources throughout the region.

Adiyaman's water requirement is supplied from the Kirkgoz springs, about 10 km from the city. Although more water could be obtained from this spring, due to poor transferring system, only 220,000 cu m water is transferred annually.

Diyarbakir's potable water comes from the Gozelli springs, east of the city and has a capacity of 340 lt/s. Diyarbakir receives approximately 11 Mcm water annually.

The city of Gaziantep obtains its water from the wells of the Pancarli spring which has a capacity of 250-300 lt/s. The city receives 8.3 Mcm water annually.

In Mardin, the water is obtained 13 km from the city, from Ayinsebab springs. The capacity of the spring is above 50 lt/s. However, due to a poor transferring system, the city receives only a small part of it (300,000 cu m per year).

In Urfa the water is obtained from three different sources. The Kehriz spring with a capacity of 15 lt/s, the water from Fish Lake, with a capacity of 145 lt/s, and the Direkli spring and wells which supply the city with 6.24 Mcm of water annually.

Throughout the GAP region, various springs and wells are used for potable water supplies.

Chapter 7

AGRICULTURE IN THE SOUTHEASTERN ANATOLIA PROJECT REGION

All six of the provinces of the GAP region will benefit from the results of increased irrigation. All of the areas in Urfa, Mardin, and Diyarbakir will benefit while only parts of Adiyaman, Gaziantep, and Siirt will be affected by GAP irrigation. Since Turkish statistics are published by provinces, this analysis of agriculture in the GAP region also will be presented at the provincial level. It is not possible to segregate the actual and exact region of the GAP program.

With the exception of Gaziantep, the economics of all GAP provinces depend largely on agriculture. The region is distant from the more developed western part of Turkey and has a much lower population density than Turkey as a whole. Gaziantep is an exception with a density of 98 per square km compared to 56 per square km for the entire nation. The population density increases from Sanliurfa (31) to Siirt (36), to Mardin (44), to Adiyaman (47), to Diyarbakir (51). Diyarbakir's population density is close to the national norm, but Gaziantep's is almost twice the national average Tables (21-32).

The agricultural nature of the region shows quite clearly in Table 33. Again, with the exception of Gaziantep, about three-fourths of the active population is employed in agriculture.

The GAP region is an area with a long dry season up to six months. Consequently, because of aridity, traditional dry farming methods, primarily idle fallow, are practiced (Table 34). Consequently, the largest areas are sown in wheat and barley, cereals more resistant to drought and more suitable for dry farming methods. Lentils are also important crops in terms of cultivated area. Irrigated crops of major importance include grapes and a variety of vegetables.

Agriculturally, all the GAP provinces show some common characteristics. But there are some differences. For example, the amount of arable land varies between provinces. The lowest percentage of arable land is in Siirt (9.5%) and the highest is Sanliurfa (50.5%) (Table 35). This is significant because the new GAP irrigation is closely associated with the percentage of Class I, II, III arable land combined with the Class IV arable lands. For Sanliurfa, the 12.9% of Class IV land increases its total arable land to 63.4%. Thus, the Harran Ovasi irrigation project in Sanliurfa province appears

very promising. In fact, except for Siirt and Adiyaman provinces (which will only be partly affected by GAP), all of the GAP region provinces have a higher rate of arable land than Turkey's average (25.2%).

The percentages of potential or arable land actually cultivated also differs by province. For example, in 1982, 97.3% of the arable land in Adiyaman was being cultivated. In the same year, the rate was 92.4% for Diyarbakir, 87.1% for Mardin, 81.6% for Gaziantep, and 75.4% for Sanliurfa. Siirt province pushed beyond the limits of its arable land, and its total culti- vated area included 12.4% of land classified as restricted arable (Class IV).

7.1. Land Ownership in the GAP Region

Well over one half of all agricultural land holdings in the GAP region are between 1 and 5 ha. However, these small plots constitute only 10.5% of all the cultivated land. On the contrary, although only 0.6% of the holdings are considered large (more than 100 ha), 25.1% of the cultivated land falls in this group. This clearly shows an imbalance in terms of landownership (Table 36). Except for Siirt, a high percentage of arable land is cultivated (Table 37).

7.2. Types of Holdings

The two types of agricultural holdings in the GAP region are: 1) those engaged only in crop production, and 2) those engaged in crop production and animal husbandry. Most holdings (91%) are of the latter (Table 38).

7.3. Agricultural Land Use and Crops

Cereals dominate cultivated land in Turkey (80.1%). Wheat alone occupies 53.7% of all the land. This trend also exists in the GAP provinces. Wheat dominates, pulses (mostly lentils) rank second, grapes third, and industrial crops fourth (Table 39). However, there are some differences in productivity of provinces. For example the area devoted to cereals in Siirt (88.5%) are above the national average of 80.1%, but production rates are lower than the national average in all other five provinces. The small area of arable land in Siirt explains its exceptional case. Irrigation prac-

tices in some parts of Gaziantep and Mardin favored other crops over cereals. Cotton (lint and seed) and grape production in Mardin and Gaziantep are competing for land use with cereals.

Wheat is the major cereal crop in Southeastern Anatolia (Tale 40). Except in Diyarbakir province, wheat, as a percentage of all cereals, occupies a higher rate than for Turkey as a whole (Table 41). Barley is the second most important crop in terms of area sown (Table 42).

7.4. Production

Provinces in the GAP region vary in terms of crop yields as well as crop area. For example, wheat represents 59.3 of the total cereal production, but occupies 63.7% of all cereal area. Collectively, the six provinces contribute only 9.5% of Turkey's total cereal production. That is the GAP now provides 10.2% of the wheat and 11.0% of the barley. However, the region is nationally significant in some crops. Lentil is one such example. The six provinces produced 74.6% of Turkey's total lentil production (550,000 tons for Turkey, 410,457 tons from the GAP provinces). Another example is pistaschios. Gaziantep and Sanliurfa are the leading producing provinces (pistaschio also means Gaziantep; Antep-Fistigi means pistaschio of Antep, a historical name of Gaziantep). Pistaschio production is centered in the region, and 88.2% of Turkey's production is found here. Production quantity and shares by province vary each year, but in 1982 Gaziantep had 17.3% of Turkey's total yield, while Sanliurfa contributed 54.6%. Tables 43 through 48 identify the provinces' dominant crops.

The industrial crops of cotton lint, tobacco, and sugar beets are grown mostly in the irrigated areas. Sugar beets and tobacco are produced in Adiyaman, cotton in Mardin, Diyarbakir, Sanliurfa and Gaziantep, and tobacco in Siirt.

Grapes are also important crops in the region. Although the region produces over one-fifth of Turkey's total production, in 1982 Gaziantep alone produced about one-half of the region's 821,424 tons (Gaziantep 405,000 tons; Diyarbakir 117,150 tons; Adiyaman 102,150 tons).

Some other crops, not characteristic of all the GAP region, but ranked in national importance, are found in the provinces. For example, sesame production in Sanliurfa constitutes 9.9% of Turkey's total production (Turkey produces

27,000 tons; Sanliurfa 2,683 tons). Historically, sesame from Harran Ovasi was shipped during the 17th century to Marseilles, France and to Geneva, Switzerland.

Almond production from Mardin is another example. About 14% of Turkey's total production comes from Mardin. Siirt province produces 15.2% of Turkey's pomegranates.

In terms of area in vegetable production, the Southeastern Anatolian Region has 10.4% (64,239 ha) of Turkey's total. Compared to Turkey's total production (12,420,908 tons), the GAP region in 1982 produced 8.5% (1,054,815 tons). It's very difficult to obtain accurate and reliable statistics on vegetable production in Turkey. But it does seem that there is an increasing production trend of vegetables in the GAP region. Yet, annual production does vary depending on uncertainties such as market conditions, local base prices set for some crops (especially for industrial crops, the base of which is determined by the central government), and water available for irrigation. Vegetable as mainly for local consumption, with the exceptions of watermelons, melons, and a few other vegetables (Table 49).

The two "fruit bearing vegetables", melon and watermelon, are important at the national scale. The six GAP provinces produced 15.5% of Turkey's watermelons and 14.0% of Turkey's melon crops in 1982. Although competition is increasing in Thrace, Diyarbakir and Mardin have maintained a positive reputation for quantity of crops. Nationally, Diyarbakir was fourth and Mardin seventh in production of watermelons. In melons, Diyarbakir was ninth and Adiyaman twelfth. With extensive GAP irrigation and mechanization, agricultural productivity should show remarkable improvement. While mechanization will increase crop yields, it also will increase demands for agricultural equipment (Table 50).

7.5. Animal Husbandry

In 1982, 12.3% of Turkey's 85,444,878 livestock were raised in the six GAP provinces. However, because of the low number of consumers, only 7.1% of Turkey's total livestock were slaughtered here. In this region, without extensive irrigation and mechanization, agricultural productivity has traditionally been low. Animal husbandry has been an essential supplement to agriculture. Poor pastures and water deficiency have always negatively influenced husbandry.

Sheep and goats (90.3%), ordinary and angora, are the main animals in the region. Sanliurfa leads the provinces with 2,438,100 animals, followed by Mardin with 2,112,200, and

Siirt with 1,724,390. Diyarbakir province leads the other five provinces in cattle production, while the six provinces together raise 7.1% of Turkey's cattle (Table 51).

Table 21

ADIYAMAN PROVINCE: CITY AND VILLAGE POPULATION

DISTRICTS	TOTAL			CITY POPULATION			VILLAGE POPULATION		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	367,595	185,049	182,546	116,986	60,119	56,867	250,609	124,930	125,679
Province Center	115,262	58,813	56,449	53,219	27,210	26,009	62,043	31,603	30,440
Besni	72,963	36,594	36,369	15,833	7943	7890	57,130	28,651	28,479
Celikhan	18,391	9379	9012	5229	2681	2548	13,162	6698	6464
Gerger	30,380	14,472	15,908	3704	1889	1815	26,676	12,583	14,093
Golbasi	45,546	23,093	22,453	20,390	10,800	9590	25,156	12,293	12,863
Kahta	75,079	37,667	37,412	16,397	8481	7916	58,682	29,186	29,496
Samsat	9974	5031	4943	2214	1115	1099	7760	3916	3844

Source: Republic of Turkey, 1980 Census of Population, Ankara, Turkey, 1983.

Table 22

ADIYAMAN PROVINCE: VILLAGES AND INHABITANTS BY POPULATION GROUPS

Population Group	Number of Villages	POPULATION		
		Total	Male	Female
GRAND TOTAL	346	250,609	124,930	125,679
Total 0 to 2000	336	222,686	110,757	111,929
0 - 50	--	--	--	--
51 - 100	2	192	95	97
101 - 150	2	236	125	111
151 - 200	4	757	370	387
201 - 250	10	2291	1147	1144
251 - 300	12	3395	1744	1651
301 - 400	44	15,498	7824	7674
401 - 500	48	21,808	10,952	10,856
501 - 750	94	58,660	29,208	29,452
751 - 1000	72	61,353	30,424	30,929
1001 - 1250	31	34,728	17,270	17,458
1251 - 1500	15	20,363	9917	10,446
1501 - 1750	1	1546	792	754
1751 - 2000	1	1859	889	970
2001 - 2250	2	4266	2177	1089
2251 - 2500	3	6893	3471	3422
2501 - 2750	1	2505	1306	1199
2751 - 3000	--	--	--	--
3001 - 3250	1	3024	1547	1477
3251 - 4000	3	11,235	5672	5563
4001 - 5000	--	--	--	--
5000 +	--	--	--	--

Source: Republic of Turkey, *1980 Census of Population*, Ankara, Turkey, 1983.

Table 23

DIYARBAKIR PROVINCE: CITY AND VILLAGE POPULATION

DISTRICTS	TOTAL			CITY POPULATION			VILLAGE POPULATION		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
TOTAL	778,150	403,603	374,547	374,264	197,468	176,796	403,886	206,135	197,751
Province Center	323,448	169,282	154,166	235,617	123,454	112,162	87,831	45,828	42,003
Bismil	61,517	31,115	30,402	19,059	9717	9342	42,458	21,398	21,060
Cermik	36,893	18,510	18,383	9798	5021	4777	27,095	13,489	13,606
Cinar	35,668	18,288	17,380	6115	3175	2940	29,553	15,113	14,440
Cungus	17,955	8910	9045	3684	1880	1804	14,271	7030	7241
Dicle	35,170	17,940	17,230	5729	3019	2710	29,441	14,921	14,520
Ergani	59,359	30,325	29,034	24,218	12,548	11,670	35,141	17,777	17,364
Hani	23,018	11,734	11,284	8077	4261	3816	14,941	7473	7468
Hazro	18,974	9817	9157	4426	2294	2132	14,548	7523	7025
Kulp	42,047	21,692	30,355	5619	3098	2521	36,428	18,594	17,834
Lice	41,402	21,146	20,256	8298	4265	4033	33,104	16,881	16,223
Silvan	82,698	44,844	37,855	43,624	24,736	18,888	39,075	20,108	18,967

Source: Republic of Turkey, 1980 Census of Population, Ankara, Turkey, 1983.

Table 24

DIYARBAKIR PROVINCE: VILLAGES AND INHABITANTS BY POPULATION GROUPS

Population Group	Number of Villages	POPULATION		
		Total	Male	Female
GRAND TOTAL	693	403,886	206,135	197,751
Total 0 to 2000	685	383,331	194,939	188,392
0 - 50	7	235	128	107
51 - 100	13	1035	559	476
101 - 150	16	2156	1138	1018
151 - 200	37	6484	3263	3221
201 - 250	57	12,750	6363	6387
251 - 300	41	11,271	5746	5525
301 - 400	85	29,617	14,917	14,700
401 - 500	86	38,586	19,600	18,986
501 - 750	187	114,053	57,632	56,421
751 - 1000	79	67,724	34,345	33,379
1001 - 1250	43	47,982	24,608	23,374
1251 - 1500	21	28,931	14,869	14,062
1501 - 1750	8	13,432	6896	6536
1751 - 2000	5	9075	4875	4200
2001 - 2250	3	6397	3321	3076
2251 - 2500	1	2275	1139	1136
2501 - 2750	1	2545	2026	519
2751 - 3000	2	5794	2929	2865
3001 - 3250	--	--	--	--
3251 - 4000	1	3544	1781	1763
4001 - 5000	--	--	--	--
5001 +	--	--	--	--

Source: Republic of Turkey, *1980 Census of Population*, Ankara, Turkey, 1983.

Table 25

GAZIANTEP PROVINCE: CITY AND VILLAGE POPULATION

DISTRICTS	TOTAL			CITY POPULATION			VILLAGE POPULATION		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
TOTAL	808,697	409,302	399,395	512,745	262,229	250,516	295,952	147,073	148,879
Province Center	449,392	229,476	219,916	374,290	191,892	182,398	75,102	37,584	37,518
Araban	26,868	13,243	13,625	8213	4036	4177	18,655	9207	9448
Islahiye	85,605	43,473	42,132	22,082	11,687	10,395	63,523	31,786	31,737
Kilis	95,419	47,647	47,772	58,335	29,024	29,311	37,084	18,623	18,461
Nizip	96,367	47,985	48,382	38,967	19,779	19,188	57,400	28,206	29,194
Oguzeli	37,903	18,755	19,148	7847	4233	3614	30,056	14,522	15,534
Yavuzeli	17,143	8723	8420	3011	1578	1433	14,132	7145	6987

Source: Republic of Turkey, 1980 Census of Population, Ankara, Turkey, 1983.

Table 26

GAZIANTEP PROVINCE:
VILLAGES AND INHABITANTS BY POPULATION GROUPS

Population Group	Number of Villages	POPULATION Total	Male	Female
GRAND TOTAL	600	295,952	147,073	148,879
Total 0 to 2000	587	258,376	128,138	130,238
0 - 50	13	334	177	157
51 - 100	35	2672	1281	1391
101 - 150	48	6052	2977	3075
151 - 200	64	11,304	5611	5693
201 - 250	53	11,960	5977	5983
251 - 300	55	15,205	7548	7657
301 - 400	77	26,608	12,932	13,676
401 - 500	58	25,764	12,716	13,048
501 - 750	100	61,458	30,649	30,809
751 - 1000	37	32,374	15,808	16,566
1001 - 1250	23	25,831	12,837	12,994
1251 - 1500	6	8451	4412	4039
1501 - 1750	14	22,826	11,172	11,654
1751 - 2000	4	7537	4041	3496
2001 - 2250	5	10,609	5330	5279
2251 - 2500	2	4663	2304	2359
2501 - 2750	--	--	--	--
2751 - 3000	2	5789	2901	2888
3001 - 3250	--	--	--	--
3251 - 4000	1	3412	1732	1680
4001 - 5000	3	13,103	6668	6435
5001 +	--	--	--	--

Source: Republic of Turkey, *1980 Census of Population*, Ankara, Turkey, 1983.

Table 27

MARDIN PROVINCE: CITY AND VILLAGE POPULATION

DISTRICTS	TOTAL			CITY POPULATION			VILLAGE POPULATION		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
TOTAL	564,967	288,385	276,582	192,004	103,045	88,959	372,963	185,340	187,623
Province Center	78,020	40,773	37,247	39,137	21,425	17,712	38,883	19,348	19,535
Cizre	32,633	17,007	15,626	20,003	10,661	9342	12,630	6346	6284
Derik	42,887	22,211	20,676	15,288	8163	7125	27,599	14,048	13,551
Gercus	42,080	20,646	21,434	4649	2517	2132	37,431	18,129	19,302
Idil	36,274	18,652	17,622	6202	3519	2683	30,072	15,133	14,939
Kiziltepe	73,972	37,571	36,401	30,445	15,813	14,632	43,527	21,758	21,769
Mazidagi	26,900	14,799	12,101	7938	5284	2654	18,962	9515	9447
Midyat	84,625	42,375	42,250	19,951	10,868	9083	64,674	31,507	33,167
Nusaybin	63,561	31,920	31,641	30,981	15,688	15,293	32,580	16,232	16,348
Omerli	19,004	9183	9821	4499	2225	2274	14,505	6958	7547
Savur	36,372	18,173	18,199	6100	3217	2883	30,272	14,956	15,316
Silopi	28,639	15,075	13,564	6811	3665	3146	21,828	11,410	10,418

Source: Republic of Turkey, 1980 Census of Population, Ankara, Turkey, 1983.

Table 28

MARDIN PROVINCE:
VILLAGES AND INHABITANTS BY POPULATION GROUPS

Population Group	Number of Villages	POPULATION		
		Total	Male	Female
GRAND TOTAL	720	372,963	185,340	187,623
Total 0 to 2000	703	324,796	161,037	163,759
0 - 50	12	317	166	151
51 - 100	32	2612	1334	1278
101 - 150	44	5625	2783	2842
151 - 200	64	11,383	5765	5618
201 - 250	69	15,625	7744	7881
251 - 300	68	18,610	9409	9201
301 - 400	86	29,455	14,670	14,785
401 - 500	103	45,997	22,528	23,469
501 - 750	109	66,583	32,831	33,752
751 - 1000	52	44,338	21,772	22,566
1001 - 1250	29	31,444	15,891	15,553
1251 - 1500	21	28,555	14,048	14,507
1501 - 1750	9	14,758	7360	7398
1751 - 2000	5	9494	7360	7398
2001 - 2250	4	8488	4226	4262
2251 - 2500	2	4767	2417	2350
2501 - 2750	2	5161	2691	2470
2751 - 3000	5	14,269	7354	6915
3001 - 3250	2	6103	3024	3079
3251 - 4000	1	3391	1693	1698
4001 - 5000	--	--	--	--
5001 +	1	5988	2898	3090

Source: Republic of Turkey, *1980 Census of Population*, Ankara, Turkey, 1983.

Table 29

SIIRT PROVINCE: CITY AND VILLAGE POPULATION

DISTRICTS	TOTAL			CITY POPULATION			VILLAGE POPULATION		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
TOTAL	445,483	230,253	215,230	183,804	97,124	86,680	261,679	133,129	128,550
Province Center	61,955	33,553	28,402	42,291	23,752	18,539	19,664	9801	9863
Batman	102,803	52,727	50,076	86,172	44,169	42,003	16,631	8558	8073
Baykan	22,228	11,498	10,730	4465	2470	1995	17,763	9028	8735
Besiri	21,919	11,271	10,648	3443	1810	1633	18,476	9461	9015
Eruh	41,743	20,933	20,810	3852	1970	1882	37,891	18,963	18,928
Kozluk	41,731	21,195	20,536	10,157	5077	5080	31,574	16,118	15,456
Kurtalan	44,193	22,540	21,653	10,442	5556	4486	33,751	16,984	16,767
Pervari	26,045	13,403	12,642	4800	2543	2257	21,245	10,860	10,385
Sason	25,436	13,438	11,998	4163	2220	1943	21,273	11,218	10,055
Sirnak	34,677	18,263	16,414	10,997	6028	4969	23,680	12,235	11,445
Sirvan	22,753	11,432	11,321	3022	1529	1493	19,731	9903	9828

Source: Republic of Turkey, 1980 Census of Population, Ankara, Turkey, 1983.

Table 30

SIIRT PROVINCE:
VILLAGES AND INHABITANTS BY POPULATION GROUPS

Population Group	Number of Villages	POPULATION Total	Male	Female
GRAND TOTAL	499	261,269	133,129	128,550
Total 0 to 2000	495	251,228	127,763	123,465
0 - 50	5	63	30	33
51 - 100	10	876	457	419
101 - 150	20	2599	1326	1273
151 - 200	27	4786	2436	2350
201 - 250	30	6758	3484	3274
251 - 300	46	12,779	6387	6392
301 - 400	91	32,161	16,245	15,916
401 - 500	73	32,879	16,757	16,122
501 - 750	106	64,696	32,754	31,942
751 - 1000	43	37,600	19,388	18,262
1001 - 1250	23	25,361	12,805	12,556
1251 - 1500	16	22,069	11,297	10,722
1501 - 1750	3	4965	2519	2446
1751 - 2000	2	3636	1928	1708
2001 - 2250	1	2119	1074	1045
2251 - 2500	2	4610	2405	2205
2501 - 2750	--	--	--	--
2751 - 3000	--	--	--	--
3001 - 3250	--	--	--	--
3251 - 4000	1	3722	1887	1835
4001 - 5000	--	--	--	--
5000 +	--	--	--	--

Source: Republic of Turkey, *1980 Census of Population*, Ankara, Turkey, 1983.

Table 31

URFA PROVINCE: CITY AND VILLAGE POPULATION

DISTRICTS	TOTAL			CITY POPULATION			VILLAGE POPULATION		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
TOTAL	602,736	311,717	291,019	282,419	149,372	133,047	320,317	162,345	157,972
Province Center	206,508	108,877	97,631	147,488	78,544	68,944	59,020	30,333	28,687
Akcakale	38,460	20,162	18,298	11,184	6387	4797	27,276	13,775	13,501
Birecik	41,048	20,266	20,782	20,081	10,095	9986	20,967	10,171	10,796
Bozova	36,390	18,399	17,991	5597	2995	2602	30,793	15,404	15,389
Halfeti	25,852	12,505	13,347	3258	1658	1600	22,594	10,847	11,747
Hilvan	21,564	10,808	10,756	5635	2725	2910	15,929	8083	7846
Siverek	82,022	41,862	40,160	29,464	14,949	14,515	52,558	26,913	25,645
Suruc	50,664	25,748	24,916	18,892	9743	9149	31,772	16,005	15,767
Viransehir	100,228	53,090	47,138	40,820	22,276	18,544	59,408	30,814	28,594

Source: Republic of Turkey, 1980 Census of Population, Ankara, Turkey, 1983.

Table 32

URFA PROVINCE:
VILLAGES AND INHABITANTS BY POPULATION GROUPS

Population Group	Number of Villages	POPULATION Total	Male	Female
GRAND TOTAL	692	320,317	162,345	157,972
Total 0 to 2000	686	281,499	142,028	139,471
0 - 50	24	827	443	384
51 - 100	37	2857	1510	1347
101 - 150	61	7578	3897	3681
151 - 200	73	12,756	6608	6148
201 - 250	65	14,179	7429	7290
251 - 300	57	15,716	7864	7852
301 - 400	107	37,145	18,692	18,453
401 - 500	75	33,815	16,885	16,930
501 - 750	107	64,578	32,576	32,002
751 - 1000	32	27,667	13,879	13,788
1001 - 1250	22	24,345	12,296	12,049
1251 - 1500	14	18,508	9408	9100
1501 - 1750	6	9828	4940	4888
1751 - 2000	6	11,160	5601	5559
2001 - 2250	3	6344	3076	3268
2251 - 2500	--	--	--	--
2501 - 2750	--	--	--	--
2751 - 3000	--	--	--	--
3001 - 3250	--	--	--	--
3251 - 4000	1	3502	1754	1748
4001 - 5000	--	--	--	--
5000 +	2	28,972	15,487	13,485

Source: Republic of Turkey, *1980 Census of Population*, Ankara, Turkey, 1983.

Table 33

ACTIVE POPULATION EMPLOYED BY MAJOR
ECONOMIC SECTORS IN THE GAP REGION

SECTORS	ADIYAMAN	DIYARBAKIR	GAZIANTEP	MARDIN	SANLIURFA	SIIRT
Agriculture						
% of Active Population	82.7	71.8	53.0	77.6	76.7	70.7
Manufacturing						
% of Active Population	3.7	3.0	13.2	2.1	2.8	3.6
(Social) Services/Administration						
% of Active Population	6.1	13.4	13.6	9.9	2.7	11.3
Commerce						
% of Active Population	2.6	4.4	8.7	2.7	2.7	11.3
Construction and Building						
% of Active Population	2.3	4.4	4.9	2.5	2.4	2.7

Source: 1980 Population Census of Turkey, State Institute of Statistics, Ankara, Turkey, 1983.

Table 34

AGRICULTURAL CROPS IN THE SOUTHEASTERN ANATOLIAN PROJECT REGION

Cereals	Pulses	Industrial Crops	Oil Seeds	Tuber Crops	Fruits	Nuts	Grape-like Fruits	Fodder Crops
Wheat	Chick Peas	Tobacco	Cotton Seed	Dry Onions	Pear	Pistachio	Mulberry	Maize
Barley	Dry Beans	Sugar Beet	Sesame	Dry Garlic	Quince	Walnut	Fig	Cow Vetch
Maize	Lentil	Cotton(Lint)	Flax(Seed)	Potato	Apple	Almond	Pomegranate	Wild Vetch
Millet	Mungi Bean	Flax(Fibre)	Soy Bean		Plum		Grape	Alfalfa
Rice		Dry Pepper	Sunflower		Apricot			Sainfoin
			Groundnut		Cherry			
					Peach			
					Sour Cherry			
					Wild Apricot			
					Olive			

Source: Turkey: Agriculture Structure and Productivity, 1982.

Table 35

LAND CLASSIFICATION IN THE GAP PROVINCES
(in Hectares)

	Arable Land					Restricted Arable	Nonarable	Non-Agricultural Land	
Provinces	Class I	Class II	Class III	Total	I-II-III %	Class IV	V-VI-VII	Class VIII	Total Area
Adiyaman	21,928	58,258	64,432	144,618	18.9	56,733	520,332	36,616	758,299
Diyarbakir	150,765	225,104	180,031	555,900	36.2	140,468	781,150	52,728	1,530,246
Gaziantep	80,753	122,939	76,224	279,916	36.6	86,572	389,717	6910	763,115
Mardin	181,598	137,788	120,367	439,753	34.4	95,518	640,490	55,169	1,230,930
Siirt	22,489	39,698	41,939	104,126	9.5	37,702	870,258	84,163	1,096,249
Sanliurfa	454,219	234,903	249,572	938,694	50.5	239,998	698,737	19,204	1,858,400
Turkey	5,012,537	6,758,702	7,574,330	19,345,569	25.2	7,201,016	46,692,633	3,455,513	76,694,731

Source: Topraksu Genel Mudurlugu, Turkiye Arazi Varligi: Kullanma, Siniflar, Sorunlar, Ankara, 1978, pp. 28-29.

Table 36

DIVISION OF LAND BY LANDOWNERS IN GAP REGION

Farmland Size (Hectares)	Number of Families	Area of the Farms	% of Total Owners	% of Total Farmland
1.0 - 5	141,903	199,075	61.4	10.5
5.1 - 20	74,843	756,291	32.4	40.0
20.1 - 50	12,211	395,559	5.3	20.9
50.1 - 100	603	66,880	0.3	3.5
100 +	1389	473,787	0.6	25.1
TOTAL	230,949	1,891,592	100.0	100.0

Source: *Guneydogu Anadolu Projesi*, Ankara, 1980, p. VIII-5.

Table 37

ARABLE AND CULTIVATED LAND IN THE GAP REGION

Province	Arable Land	Cultivated Land	Percent[a]
Adiyaman	144,618	140,664	97.3
Diyarbakir	555,900	513,623	92.4
Gaziantep	279,916	228,304	81.6
Mardin	439,753	382,994	87.1
Siirt	104,126	117,079	-12.4
Sanliurfa	938,694	708,047	75.4

Source: *Tarimsal Yapi ve Uretim 1982.*

[a] Percent of cultivated land in arable land.

Table 38

AGRICULTURAL HOLDINGS (FARMS) IN GAP REGION

	Those Engaged Only in Crop Production		Those Engaged in Crop Production and Animal Husbandry		Total
Province	Number	%	Number	%	Number
Adiyaman	2213	7.3	28,055	92.7	30,268
Diyarbakir	1699	4.0	40,267	96.0	41,966
Gaziantep	3933	12.3	27,902	87.7	31,835
Mardin	4239	10.0	37,622	90.0	41,861
Siirt	15,976	9.0	161,179	91.0	177,155
Sanliurfa	3982	12.5	27,333	87.5	31,255
TOTAL	31,982	9.0	322,358	91.0	354,340

Source: *Guneydogu Anadolu Projesi*, Ankara, 1980, p. VII-5.

Table 39

MAJOR PRODUCTION GROUPS IN THE GAP REGION

Province	Cereals	%*	Industrial Crops	%*	Pulses	%*	Tuber Crops	%*	Oil Seeds	%*
Adiyaman	110,303	78.4	11,420	8.1	16,420	11.9	657	0.5	1505	1.1
Diyarbakir	369,642	71.9	7721	1.5	131,145	25.5	1540	0.3	3575	0.8
Gaziantep	145,133	63.5	15,818	6.9	61,743	27.0	3205	1.4	2405	1.2
Mardin	258,041	64.8	9269	2.4	123,494	32.2	1140	0.3	1050	0.3
Siirt	103,701	88.5	5906	5.0	6857	5.9	537	0.5	78	0.1
Sanliurfa	512,834	72.4	11,198	1.5	178,604	25.2	682	0.1	4729	0.8

Source: Tarimsal Yapi ve Uretim 1982.

* Percent of that production group in cultivated land.

Table 40

CEREAL PRODUCTION IN THE GAP REGION
(all cereals)

Provinces	Area (ha)	Production (Tons)
Adiyaman	110,303	179,858
Diyarbakir	369,642	579,210
Gaziantep	145,313	273,749
Mardin	248,041	595,982
Siirt	103,701	145,106
Sanliurfa	512,834	741,729
TURKEY	13,421,685	26,418,000

Source: *Tarimsal Yapi ve Uretim 1982.*

Table 41

WHEAT PRODUCTION IN THE GAP REGION

Province	Area (ha)	%	Production Tons	%	Yield (Kgs)
Adiyaman	79,881	72.4	125,115	69.5	1566
Diyarbakir	235,500	63.7	343,375	59.3	1458
Gaziantep	107,057	73.8	197,362	72.1	1844
Mardin	191,213	77.1	472,396	79.3	2471
Siirt	80,870	78.0	112,203	77.7	1394
Sanliurfa	360,710	70.3	537,880	72.5	1491
TURKEY	9,000,000	67.1	17,500,000	66.2	1944

Source: *Tarimsal Yapi ve Uretim 1982.*

Table 42

BARLEY PRODUCTION IN THE GAP REGION

Province	Area (ha)	%	Production Tons	%	Yield (Kgs)
Adiyaman	29,213	26.5	56,651	29.3	1802
Diyarbakir	123,700	33.5	219,780	37.9	1777
Gaziantep	37,316	25.7	74,252	27.1	1990
Mardin	56,478	22.8	122,935	20.6	2177
Siirt	22,540	21.7	31,794	21.9	1411
Sanliurfa	151,640	29.6	203,290	27.4	1341
TURKEY	3,137,000	23.4	6,400,000	24.2	2040

Source: *Tarimsal Yapi ve Uretim 1982.*

Table 43

DOMINANT CROP TYPES IN ADIYAMAN PROVINCE

By Area (in Hectares)	
Wheat	79,881
Barley	29,213
Lentil	14,143
Grape	13,620
Vegetables	6202
Tobacco	5312

By Production (in Tons)	
Wheat	125,115
Grape	102,150
Barley	52,651
Melon	41,632
Lentil	14,567
Tomato	12,400
Sugar Beet	6990
Dry Onion	6981
Tobacco	6172
Cotton Seed	6073
Watermelon	4445

Table 44

DOMINANT CROP TYPES IN DIYARBAKIR PROVINCE

By Area (in Hectares)	
Wheat	235,500
Barley	123,700
Lentil	120,270
Grape	21,500
Vegetables	19,747
Chick Peas	8050
Cotton	6000
Millet	4977
Rice	4420

By Production (in Tons)	
Wheat	343,375
Barley	219,780
Watermelon	210,280
Grape	117,150
Lentil	106,354
Tomato	62,470
Melon	49,659
Dry Onion	25,580
Aubergine	20,775
Cucumber	20,250
Chick Peas	9554
Rice	9040
Cotton Seed	7104

Table 45

DOMINANT CROP TYPES IN GAZIANTEP PROVINCE

By Area (in Hectares)	
Wheat	107,057
Grape	69,479
Lentil	54,254
Barley	37,316
Cotton	13,762
Vegetables	9816
Chick Peas	4346
Dry Onion	2540

By Production (in Tons)	
Grape	405,500
Wheat	197,362
Barley	74,252
Watermelon	57,750
Tomato	57,000
Lentil	55,618
Dry Onion	48,840
Melon	38,416
Aubergine	29,100
Olive	28,804
Green Pepper	24,295
Squash	13,530
Cotton Seed	12,371
Sugar Beet	9875
Dry Pepper	9315

Table 46

DOMINANT CROP TYPES IN MARDIN PROVINCE

By Area (in Hectares)	
Wheat	191,213
Lentil	117,144
Barley	56,478
Grape	24,047
Vegetables	13,288
Cotton	9166
Chick Peas	5997

By Production (in Tons)	
Wheat	472,396
Lentil	125,844
Barley	122,935
Watermelon	100,420
Grape	96,149
Melon	42,870
Tomato	25,902
Aubergine	13,360
Cotton Seed	10,838
Cotton Lint	6774
Almond	5376

Table 47

DOMINANT CROP TYPES IN SIIRT PROVINCE

By Area (in Hectares)		By Production (in Tons)	
Wheat	80,870	Wheat	112,703
Barley	22,540	Grape	40,135
Grape	7222	Watermelon	32,050
Tobacco	5806	Barley	31,794
Vegetables	3766	Melon	24,673
Lentil	3486	Dry Onion	9260
Chick Peas	3345	Tomato	8909
		Tobacco	7538
		Aubergine	5555
		Pomegranate	5103
		Lentil	3417

Table 48

DOMINANT CROP TYPES IN SANLIURFA PROVINCE

By Area (in Hectares)	
Wheat	360,710
Lentil	170,664
Barley	151,640
Vegetables	11,420
Cotton	10,838
Sesame	3604

By Production (in Tons)	
Wheat	537,880
Barley	203,290
Lentil	104,617
Grape	60,340
Watermelon	28,400
Melon	19,442
Tomato	11,852
Cotton Seed	11,227
Cotton Lint	7017
Pistachio	7103
Aubergine	6825
Chick Peas	6595
Dry Onion	4100
Sesame	2682

Table 49

VEGETABLE PRODUCTION IN GAP REGION (1982)

Provinces	Area (ha)	Production (Tons)	Fruit Bearing Vegetables	%
Adiyaman	6202	78,773	76,912	97.6
Diyarbakir	19,747	384,534	381,014	99.1
Gaziantep	9816	241,353	233,426	96.7
Mardin	13,288	197,658	194,537	98.4
Siirt	3766	78,789	76,425	97.0
Sanliurfa	11,420	73,708	69,651	94.5

Table 50

NUMBER OF TRACTORS IN GAP REGION

Provinces	1976	1978	1982
Adiyaman	1514	1761	2432
Diyarbakir	2784	3517	4585
Gaziantep	2644	3611	6818
Mardin	1288	1869	2150
Siirt	560	974	1227
Sanliurfa	2519	2969	4085
TURKEY	281,802	370,259	491,001

Source: *Guneydogu Anadolu Projesi*, Ankara, 1980, p. VIII-3.

Table 51

ANIMALS IN GAP PROVINCES (1982)

Province	Total Animals	Sheep	Goats	Angora Goats	Cattle	Animals Slaughtered
Adiyaman	840,569	383,460	313,510	0	109,249	67,980
Diyarbakir	1,920,549	837,130	584,700	0	426,119	295,690
Gaziantep	874,091	438,620	340,270	0	63,501	317,990
Mardin	2,341,203	1,221,470	486,110	404,460	165,523	146,050
Siirt	1,930,871	807,250	742,610	174,530	135,561	135,380
Sanliurfa	2,628,384	2,122,380	315,720	0	124,260	151,044
TURKEY	85,444,878	49,636,000	14,655,000	3,558,000	15,273,894	15,724,670

Source: Tarimsal Yapi ve Uretim 1982.

Chapter 8

PROSPECT

It is too early to forecast the probable effects of GAP on the region. The genesis of GAP was the "Lower Euphrates Project" which aimed to construct dams in a region smaller than today's GAP. Consequently, land and soil classification studies have been completed over only a small area of the new GAP region. Soils are presently being classified, but the four year study by TUBITAK has only been in progress one year (in 1986). This study will provide the basis for planners to determine which crops will be grown in the GAP region. In all probability, traditional crops will continue to be grown, but with higher yields due to more efficient methods and a dependable water source. Continuing traditional crops will minimize changes in the social and economic structure.

A considerable amount of land will be inundated by new reservoirs. These alluvial soils are presently some of the region's most fertile lands. These more fertile soils will be replaced by expansion of cultivation into "restricted or marginal arable lands" (Class IV) (See Table 35). High yields in these new lands can only be achieved with intensive irrigation, fertilizer, and new techniques. According to plans, industrial crops will gain in importance with irrigation in the region but this is closely dependent on demands of the new manufacturing plants which are planned for the region.

Market conditions, which are far form stable in Turkey, will affect the crops to be sown in the region. This factor plays an important role in the decision making process. Today, base prices and production quotas are very unpredictable.

When the new irrigation and power supply comes to the region, progress will be interrelated with social factors. For example, farmers have to be trained in irrigation methods, rational use of fertilizer, and use of technology. Institutions such as D.S.I., Topraksu, and the Ministry of Agriculture will have important training roles. New training is planned after completion of the first few sub-projects of GAP.

Mechanization of agriculture will result in increased yields of several crops., But this mechanization also creates increased demands for equipment.. For example, since a tractor plow about 45 ha, a 55% increase in tractors (from 21,297

in 1982 to 33,000) will be needed to cultivate more than 1.5 million ha of irrigated land (Table 50). Improvements in animal husbandry are expected after GAP is completed. Irrigated lands will see increased yields of fodder crops. For example, alfalfa production is expected to reach 1.25 million tons after GAP is completed. This equates to about twice the total of Turkey's present production. Just how much irrigated land will GAP really provide? Estimates vary from 2,032,203 ha (Table 1) to 1.8 million (Table 52). A reasonable estimate, most often quoted by Turkish officials, seems to be 1.8 million ha. This is an area almost equal to Turkey's present public irrigated lands today (1.6 million ha). The six provinces in the GAP region now have only 121,754 ha of both public and privately irrigated lands. The projected 15 fold increase of irrigated lands in the GAP region will offer enormous agricultural and economic opportunities for the region as well as Turkey. According to the D.S.I., cotton, rice, cereals, alfalfa, oil seeds, vegetables, sugar beets, fruit, and grapes will have enormously increased production.

Table 52

IRRIGATED LAND IN GAP PROVINCES

Provinces	Publicly and Privately Irrigated (in ha)
Adiyaman	12,336
Diyarbakir	26,114
Gaziantep	22,294
Mardin	22,256
Siirt	5060
Sanliurfa	33,694
TOTAL FOR GAP	121,754
TURKEY	2,990,080
PROJECTED BY GAP	1,800,000 more

Source: *Guneydogu Anadolu Projesi*, Ankara, 1980.

Chapter 9

CONCLUSION

The disputes between Turkey, Syria, and Iraq over the use of water from the Euphrates and Tigris rivers continues. Turkey realizes that water from both rivers is an important national asset. Given increasing demands for energy and irrigation, Turkey is moving forward to serve her national interest. Regardless of international support, either economically or politically, Turkey will continue the GAP effort. Unlike some critics[2043], I believe that the GAP will proceed, although it may fall behind schedule in the Tigris portion, it will eventually be completed. The target date of early in the 21st century is fast approaching, and with the new century Turkey will strengthen its economy, and residents of Adiyaman, Diyarbakir, Gaziantep, Mardin, Siirt, and Sanliurfa provinces will be an integrated part of one of the world's largest development projects. GAP is no agricultural fantasy. With some limitations, Turkey's goals will be met. The extent of international cooperation between the three affected countries is speculative at best.

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