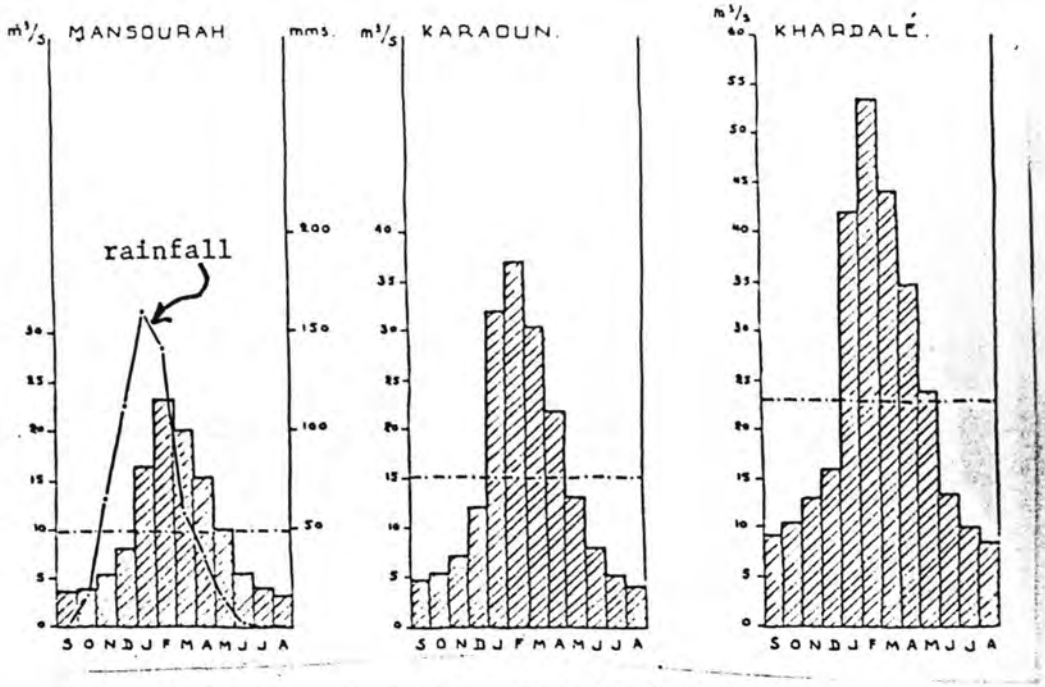
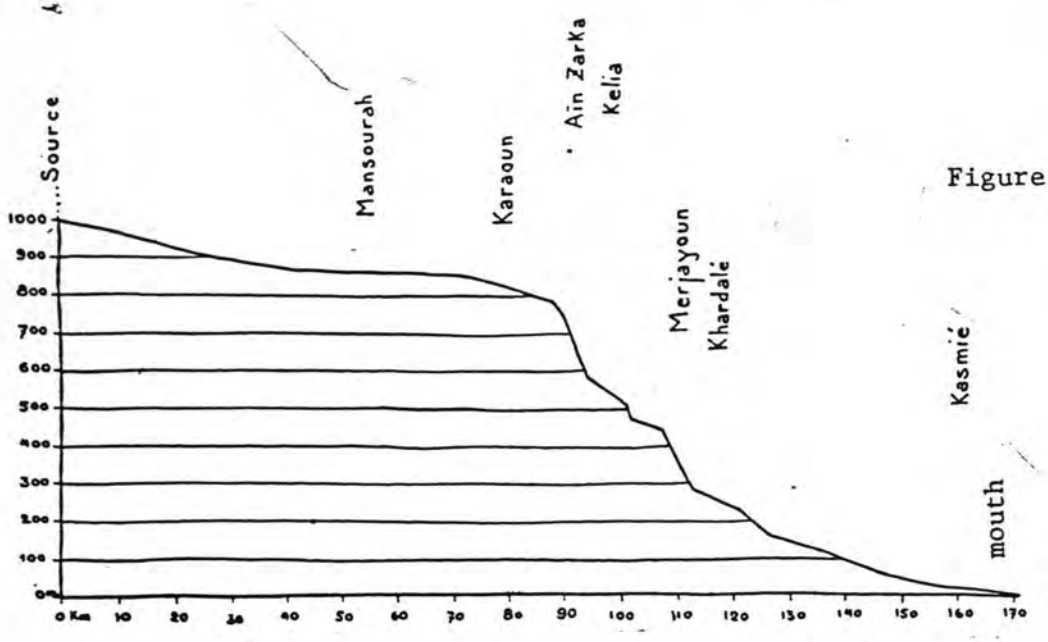
Figure 3



Flow of the Litani at three Gauging Stations

Horizontal lines indicate average flow.

Figure 4

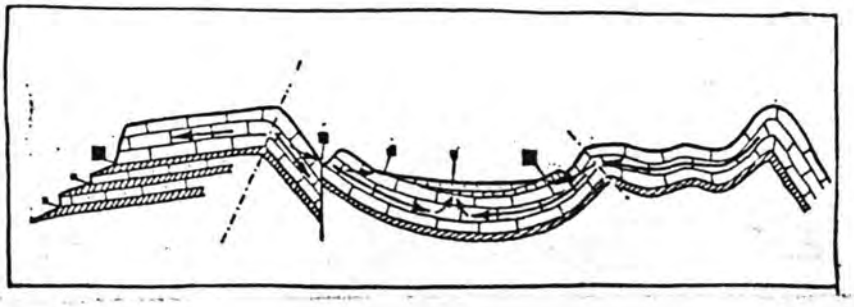


Longitudinal Profile of the Litani River

Source: Both diagrams after Vaumas, pp. 250-51

Figure 5

GEOLOGIC STRUCTURE OF AQUIFERS AND SPRINGS IN THE LITANI BASIN
(Springs shown by square symbols)



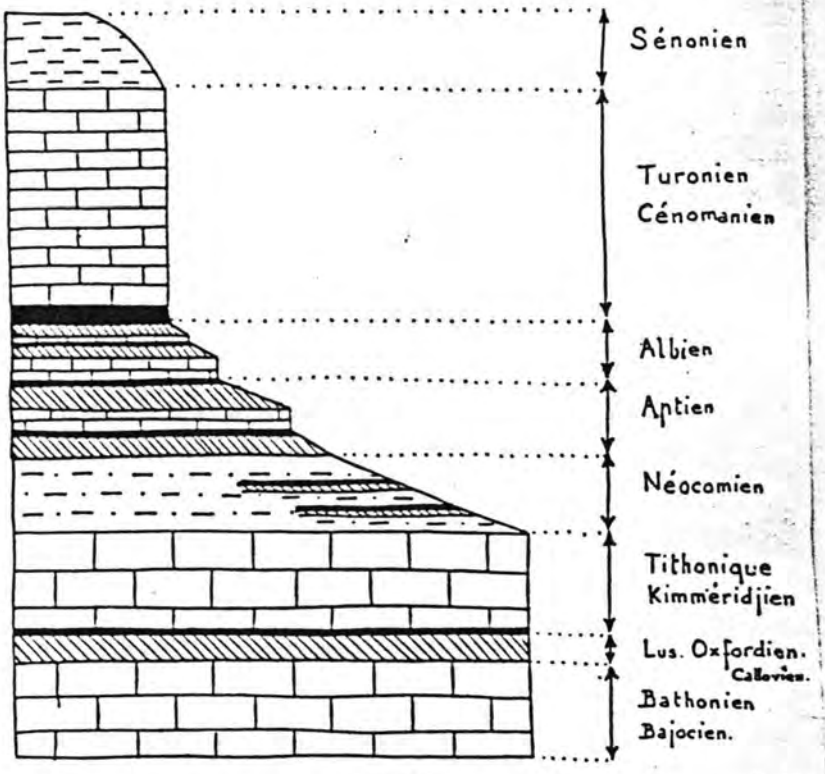


Figure 6

LITHOLOGY OF AQUIFERS AND SPRINGS IN THE LITANI BASIN

(Solid layers represent aquicludes)

After Vaumas, pp. 237 & 239.

Figure 7

GEOLOGIC CROSS-SECTION OF THE UPPER LITANI VALLEY (after Birot and Dresch)

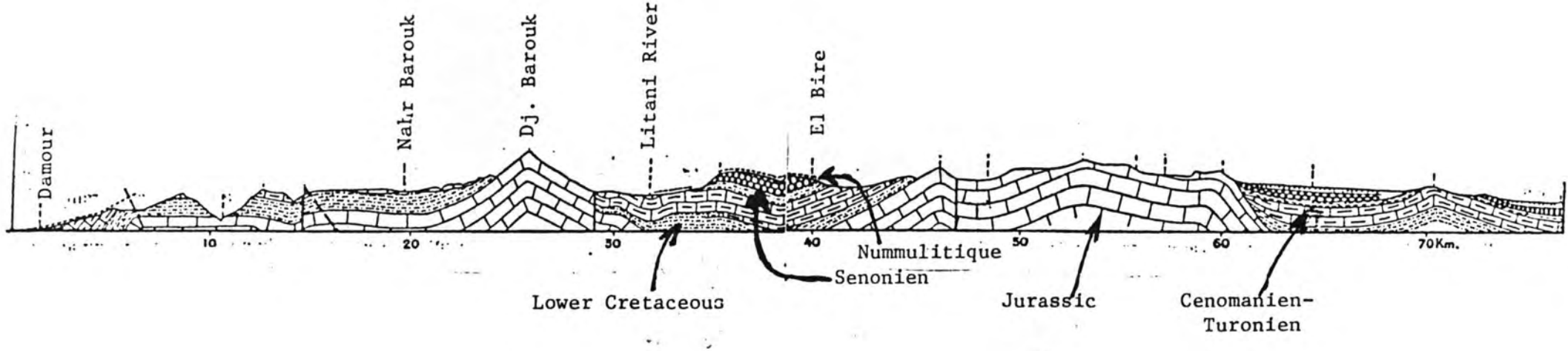


Figure 8

GEOLOGIC CROSS-SECTION OF THE SOUTHERN BEKAA VALLEY (After Birot and Dresch)

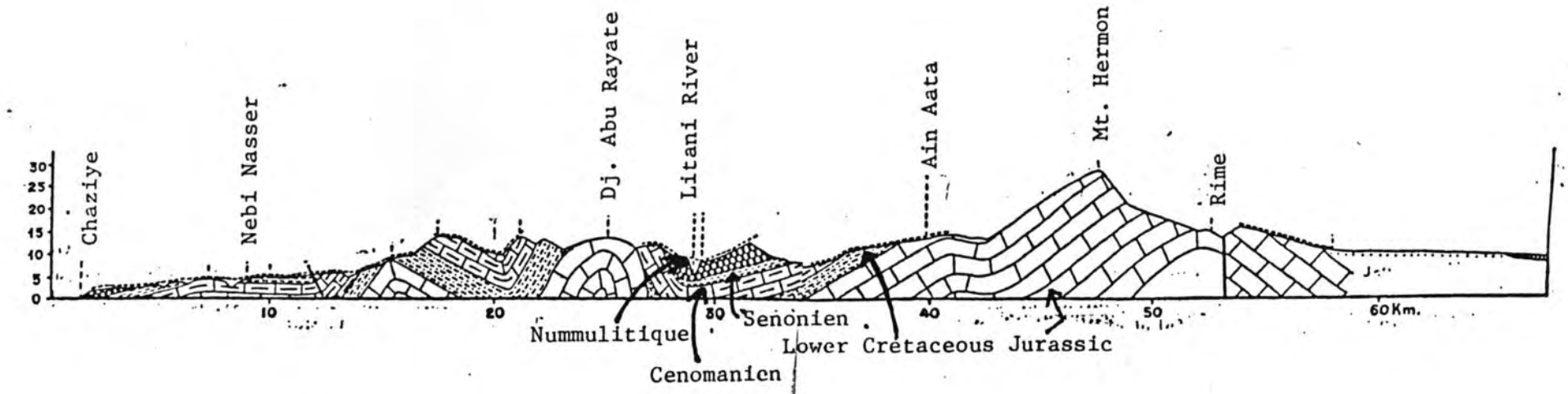
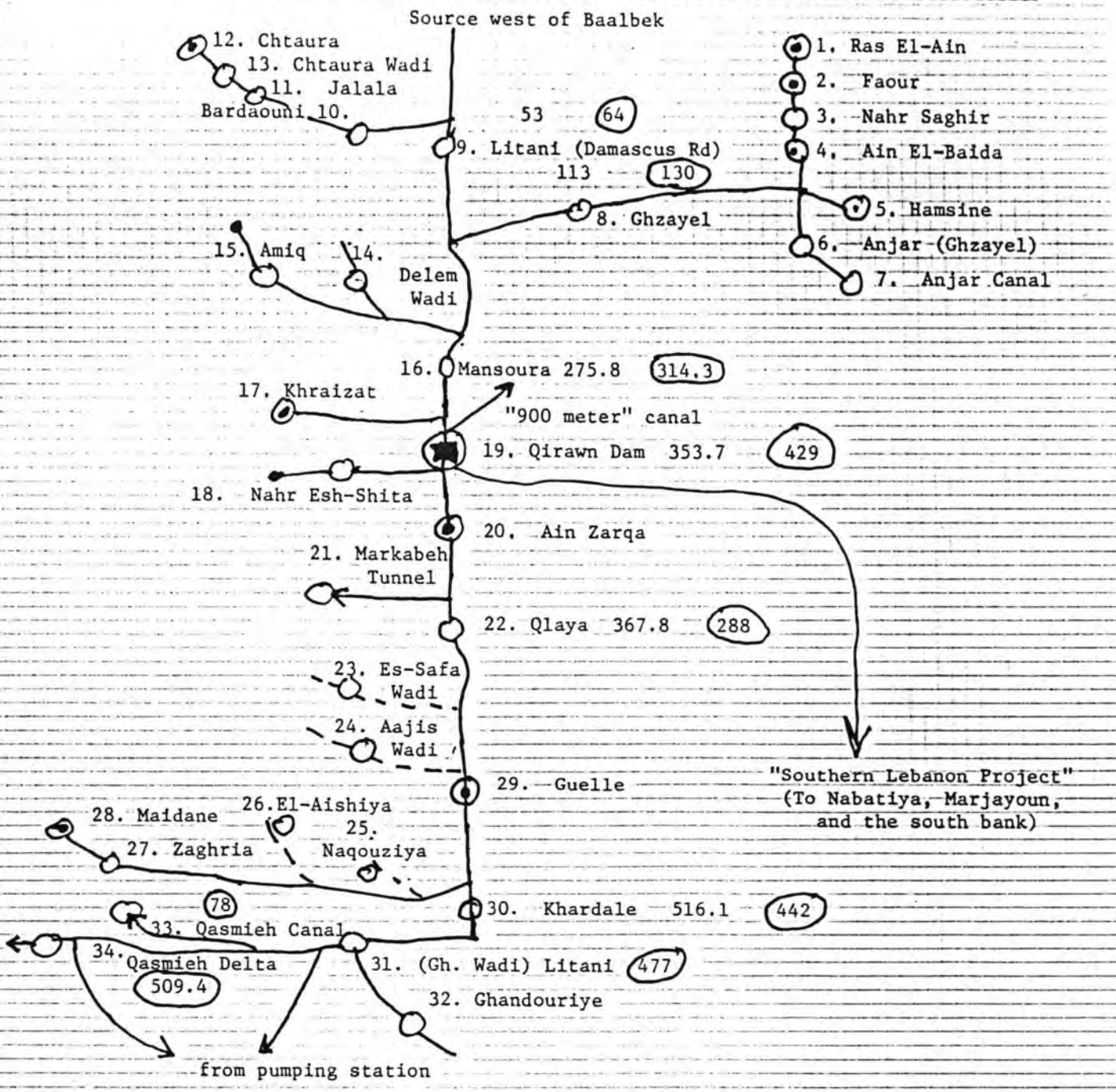


Figure 9

SOURCES, GAUGING STATIONS, AND FLOW OF THE LITANI
Uncircled figures = 1952-53/1972-73
Circled figures = 1967-68/1972-73



Source: Map: "Reseau de Stations Hydrometriques du Sud Liban" Engineering Report (April 1974
All data from Eng. Report.

○ Gauging Station (Number refers to Table in text)

• Spring

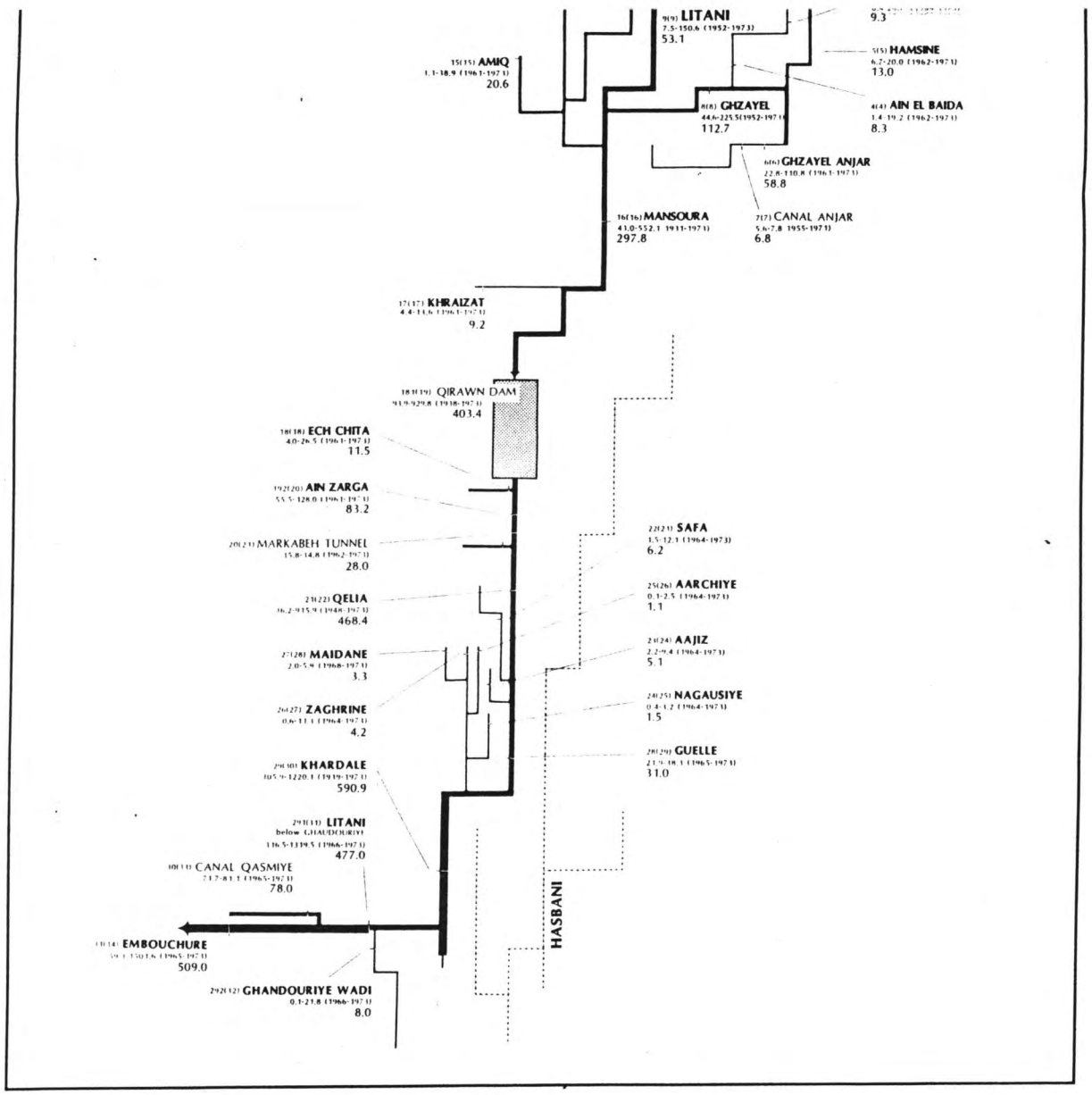
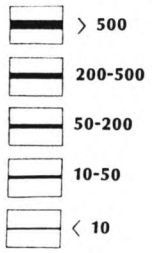
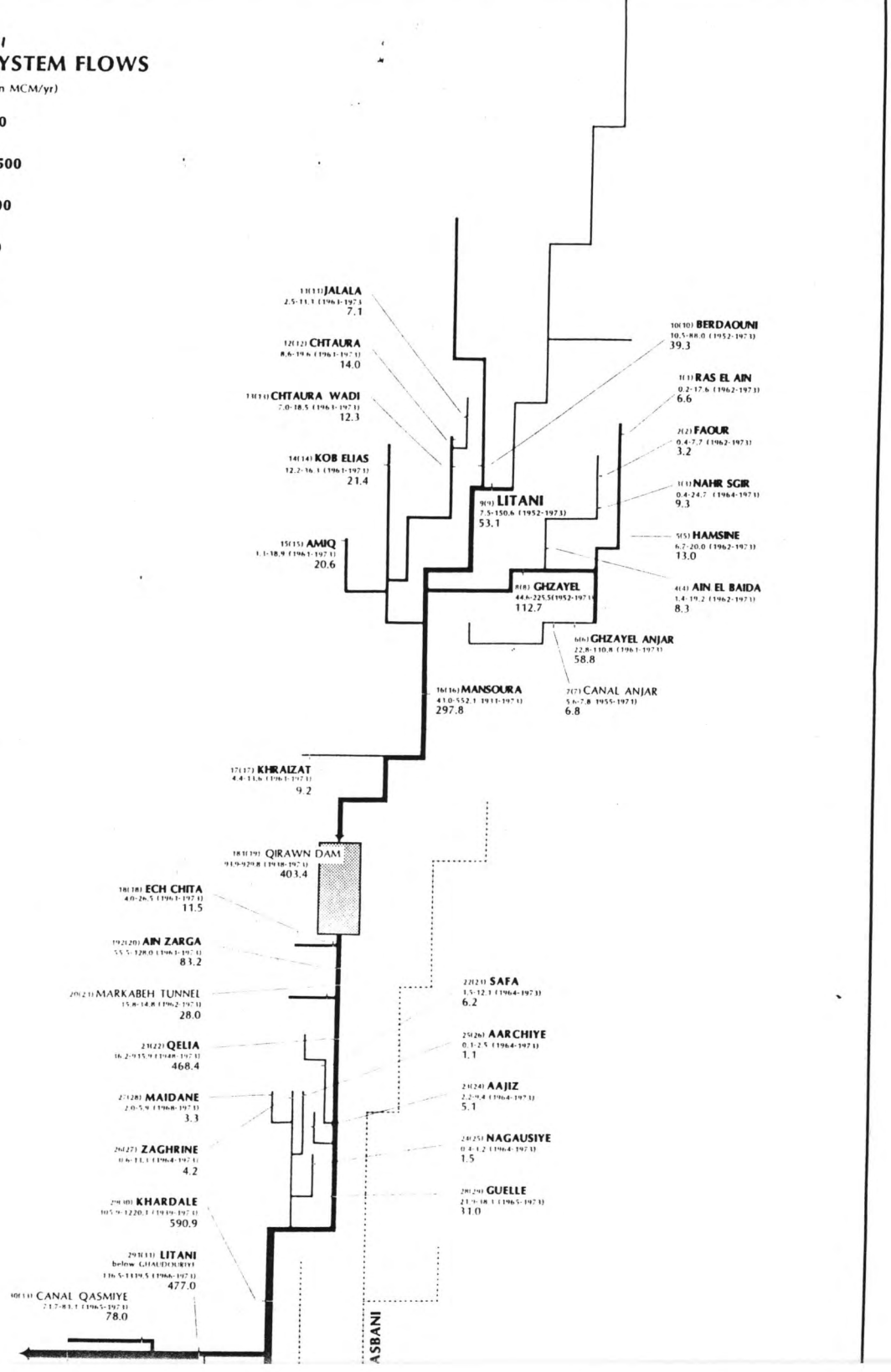

9(9) LITANI
7.5-150.6 (1952-1973)
53.1
9.3
15(15) AMIQ
1.1-38.9 (1961-1973)
20.6
5(5) HAMSINE
6.7-20.0 (1962-1973)
13.0
8(8) GHZAYEL
44.6-225.5(1952-1973)
112.7
4(4) AIN EL BAIDA
1.4-19.2 (1962-1973)
8.3
6(6) GHZAYEL ANJAR
22.8-110.8 (1961-1973)
58.8
16(16) MANSOURA
41.0-552.1 1933-1973)
297.8
7(7) CANAL ANJAR
5.6-7.8 1955-1973)
6.8
17(17) KHRAIZAT
4.4-11.6 (1961-1973)
9.2
18(19) QIRAWN DAM
913.9-929.8 (1938-1973)
403.4
19(20) AIN ZARGA
55.5-128.0 (1961-1973)
83.2
18(18) ECH CHITA
4.0-26.5 (1961-1973)
11.5
20(21) MARKABEH TUNNEL
15.8-14.8 (1962-1973)
28.0
23(22) QELIA
36.2-935.9 (1948-1973)
468.4
22(23) SAFA
3.5-12.1 (1964-1973)
6.2
25(26) AARCHIYE
0.1-2.5 (1964-1973)
1.1
24(24) AAJIZ
2.2-9.4 (1964-1973)
5.1
27(28) MAIDANE
2.0-5.9 (1968-1973)
3.3
24(25) NAGAUSIYE
0.4-3.2 (1964-1973)
1.5
26(27) ZAGHRINE
0.6-11.1 (1964-1973)
4.2
28(29) GUELLE
21.9-38.1 (1965-1973)
31.0
29(30) KHARDALE
105.9-1220.1 (1919-1973)
590.9
29(33) LITANI
below GHAUDOURIYE
136.5-1339.5 (1966-1973)
477.0
10(33) CANAL QASMIYE
21.7-83.1 (1965-1973)
78.0
HASBANI
11(34) EMBOUCHURE
59.1-150.6 (1965-1973)
509.0
29(32) GHANDOURIYE WADI
0.1-21.8 (1966-1973)
8.0

FIG. 41

LITANI SYSTEM FLOWS

(Measurements in MCM/yr)





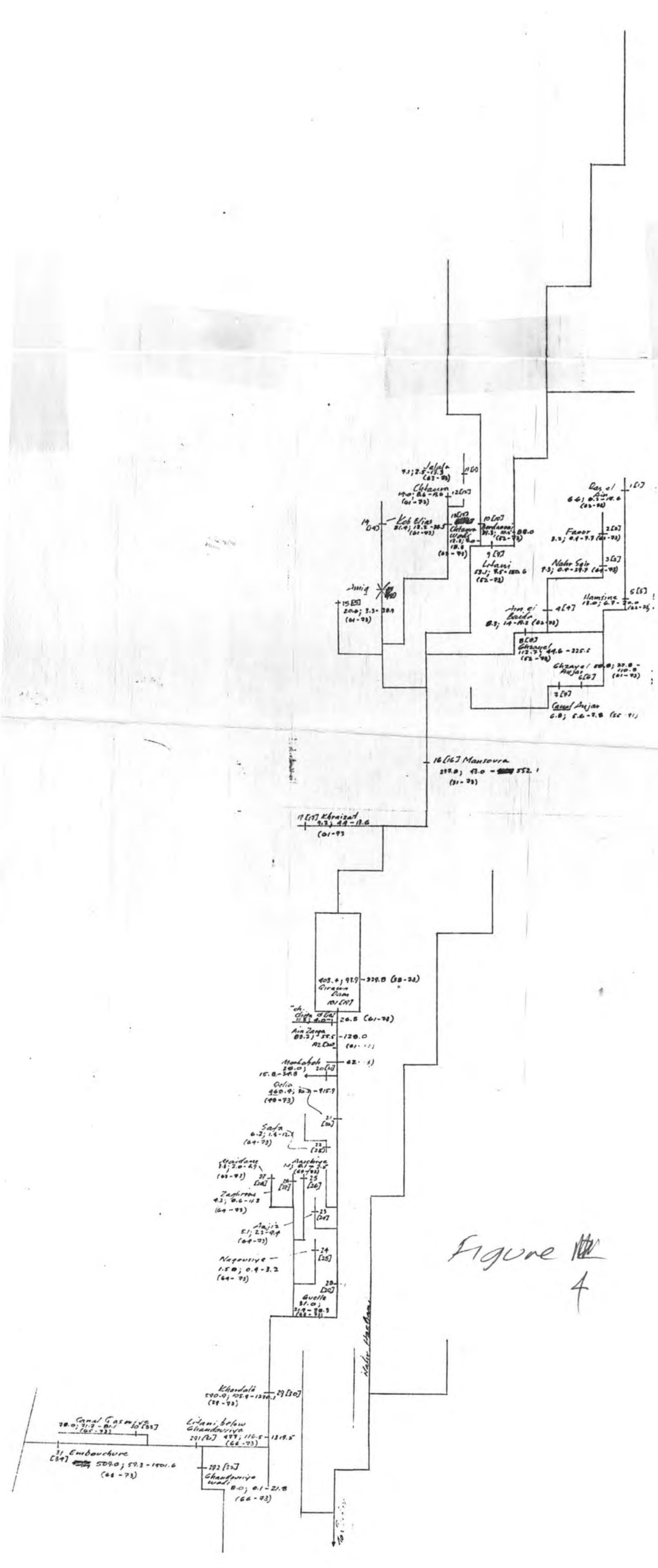
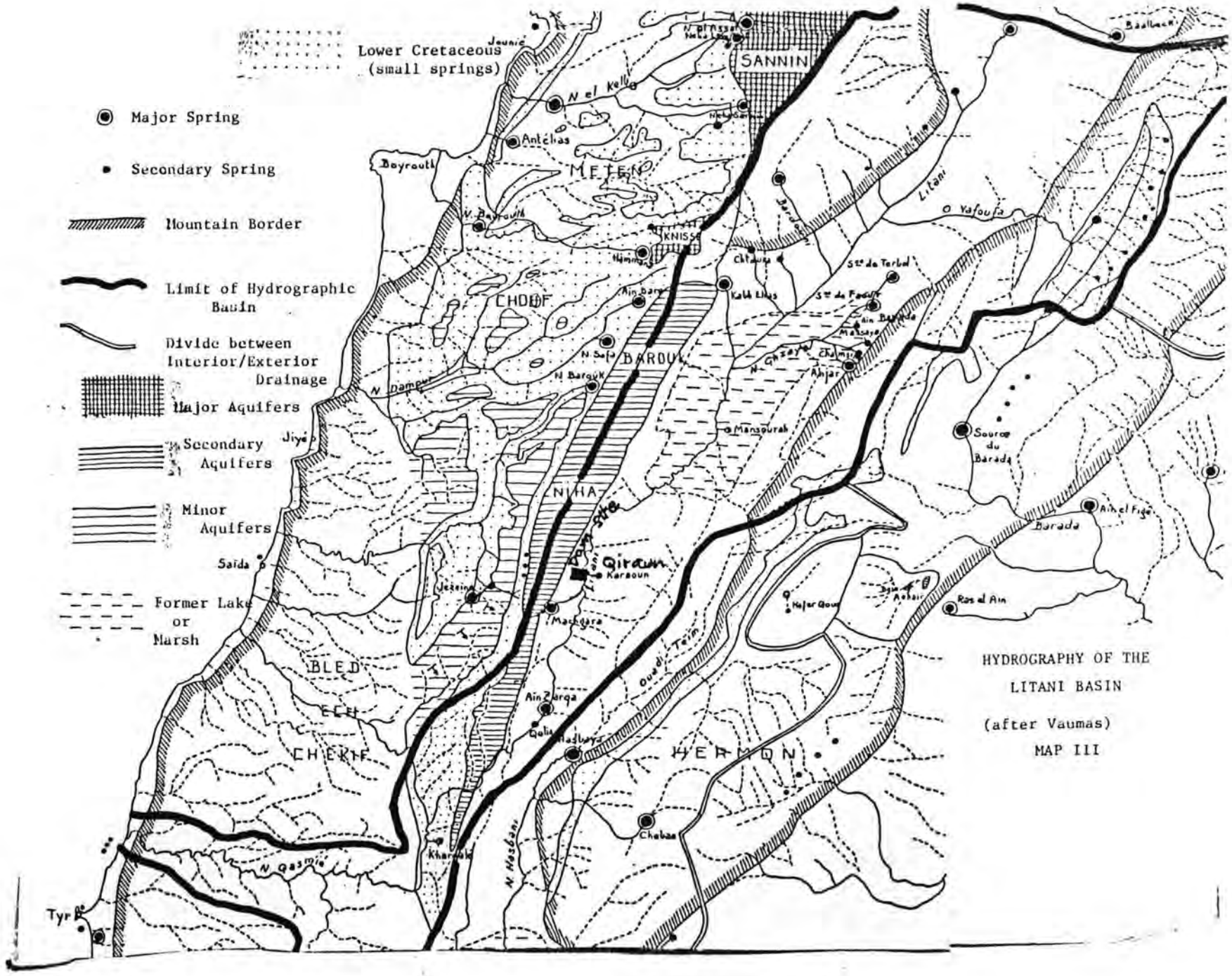
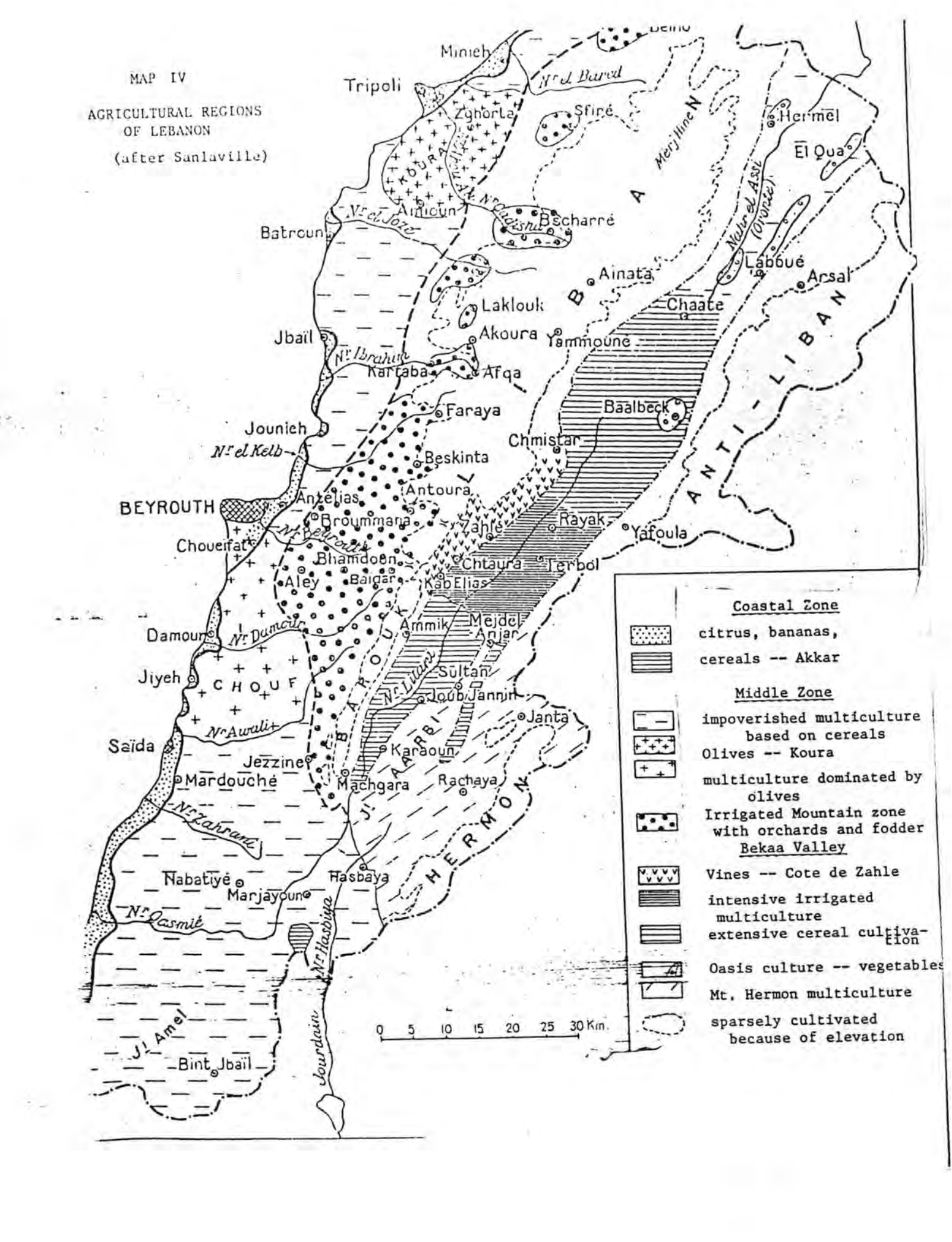
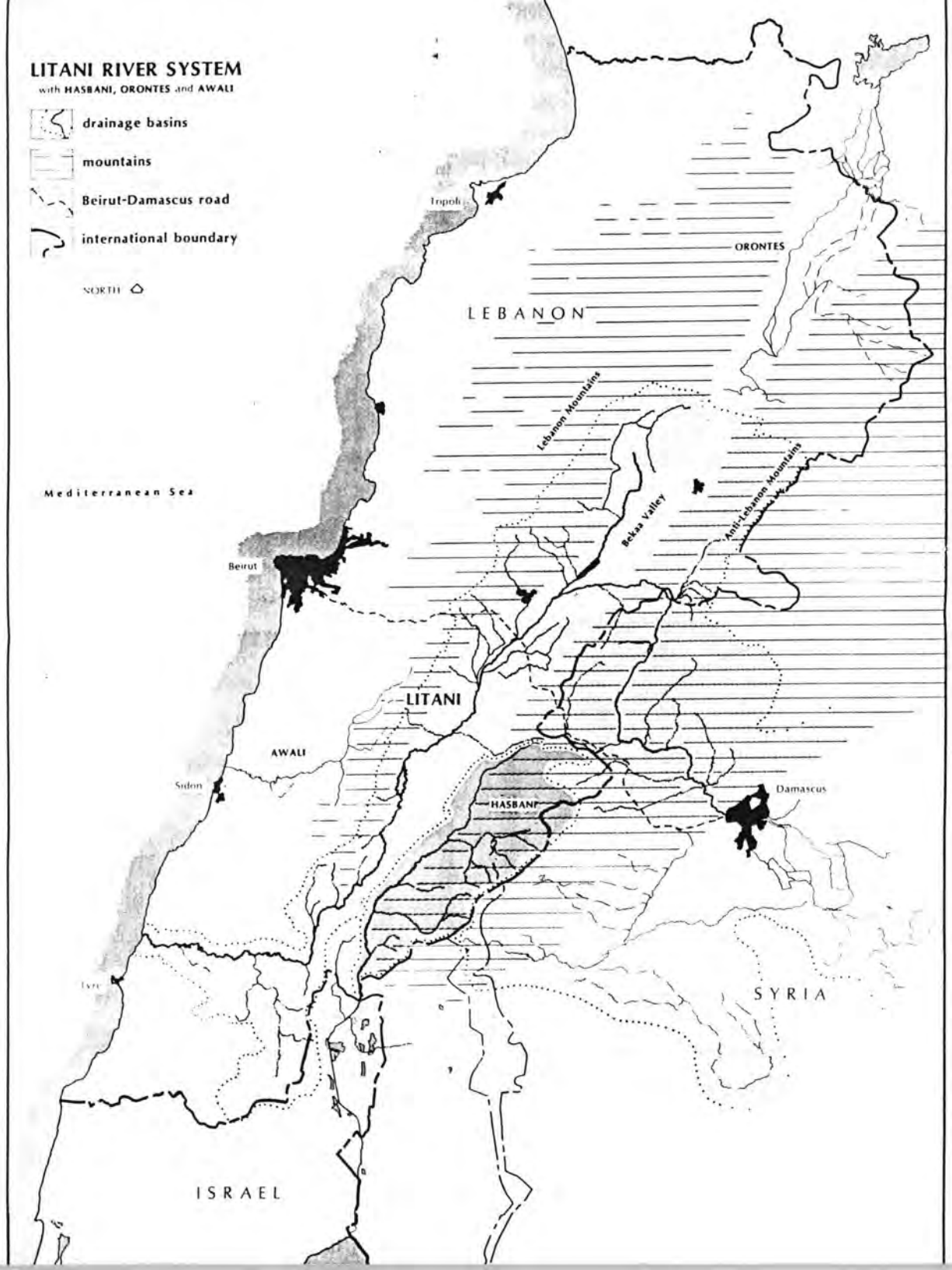
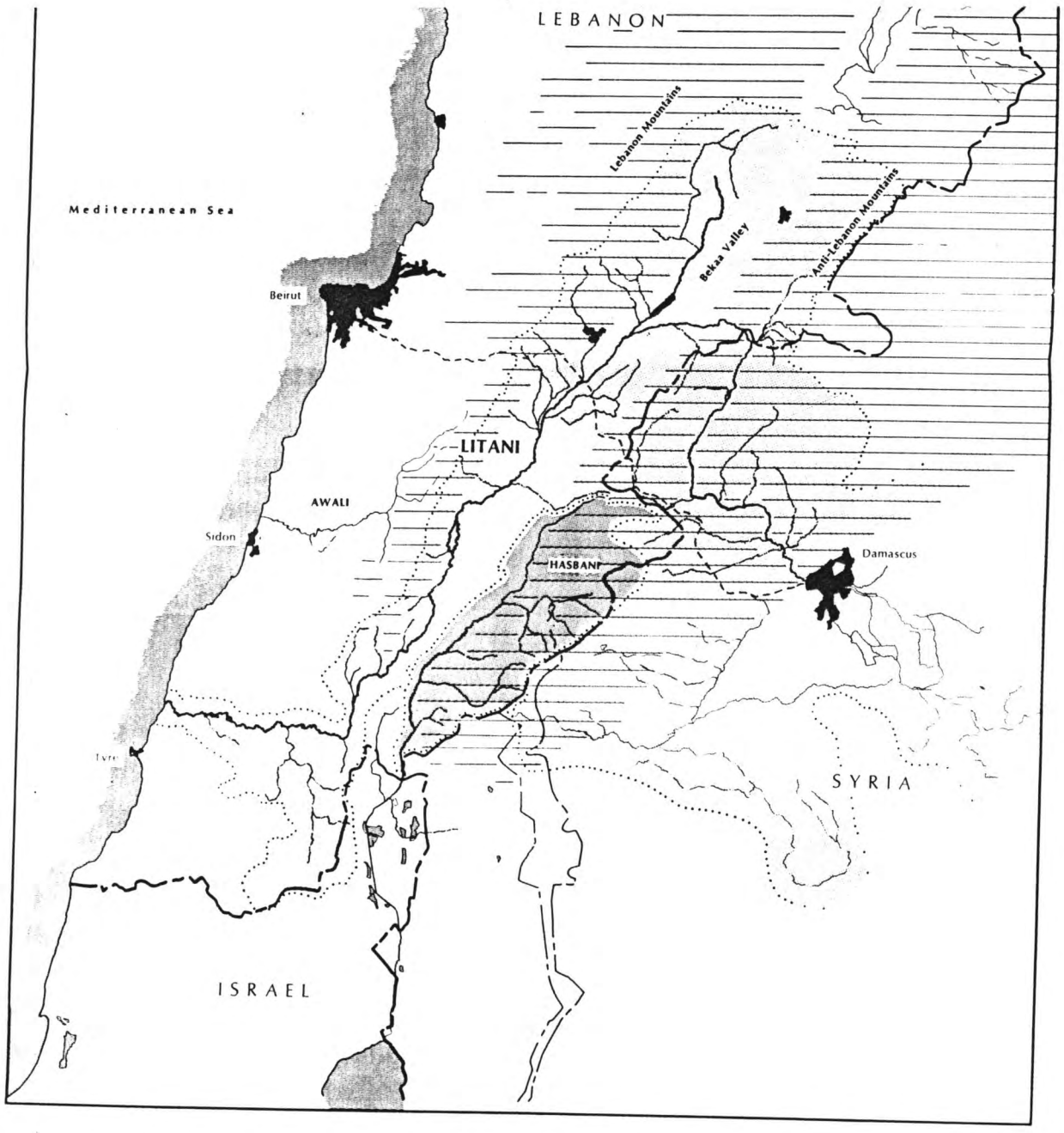

Jalfa
7.1; 2.5-13.3 (63-73)
Chtaura
14.0; 8.6-19.0 (61-73)
Kob Elias
21.4; 12.5-38.5 (61-73)
Chtaura wadi
13.1; 5.0-18.6 (61-73)
Berdaouni
20.3; 11.5-38.0 (62-73)
Litani
53.1; 9.5-180.6 (62-73)
Qar el Ain
6.6; 0.3-17.6 (62-73)
Faour
3.2; 0.4-9.7 (62-73)
Nahr Safa
7.3; 0.9-29.9 (62-73)
Hamsine
18.0; 6.7-20.0 (62-73)
Jwaya
20.0; 3.3-38.9 (61-73)
Jwaya el Baida
8.3; 1.4-19.2 (62-73)
Ghzayel
112.7; 44.6-225.5 (62-73)
Ghzayel Anjar
6.8; 5.6-9.8 (66-73)
Mansoura
298.0; 43.0-552.1 (31-73)
Khraizat
9.2; 4.4-13.6 (61-73)
Girayan Dam
403.4; 93.9-939.8 (58-73)
Aita Zarqa
88.2; 38.5-128.0 (61-73)
Markaboh
29.0; 16.8-34.8 (62-73)
Qelia
460.9; 99.7-915.9 (49-73)
Safa
6.2; 1.6-12.1 (64-73)
Qraidane
3.1; 2.0-4.9 (63-73)
Marchaya
10; 0.1-2.5 (64-73)
Zarkoma
4.3; 0.6-11.8 (64-73)
Majra
5.1; 2.1-9.9 (64-73)
Naqoura
1.5 m; 0.4-3.2 (64-73)
Guella
87.0; 31.9-89.3 (62-73)
Khandala
590.9; 105.9-1220.1 (59-73)
Canal Qasmiye
78.0; 21.9-81.1 (62-73)
Litani before Ghandouriya
201 [32] 497; 116.5-1319.5 (66-73)
Embouchure
509.0; 59.3-1501.6 (66-73)
Ghandouriya wadi
8.0; 0.1-21.8 (66-73)

Figure 4


Lower Cretaceous (small springs)
Major Spring
Secondary Spring
Mountain Border
Limit of Hydrographic Basin
Divide between Interior/Exterior Drainage
Major Aquifers
Secondary Aquifers
Minor Aquifers
Former Lake or Marsh
SANNIN
METN
CHOUF
BAROUK
NIHA
BLED ECH CHERIF
HERMON
Litani
Qiraoun
Karaoun
Jezzine
Saida
Tyre
Beyrouth
Antélias
Jounié
Baalbeck
Rosel Ain
Source du Barada
Barada
Oued Teim
N Hasbani
N Qasmié
HYDROGRAPHY OF THE LITANI BASIN
(after Vaumas)
MAP III

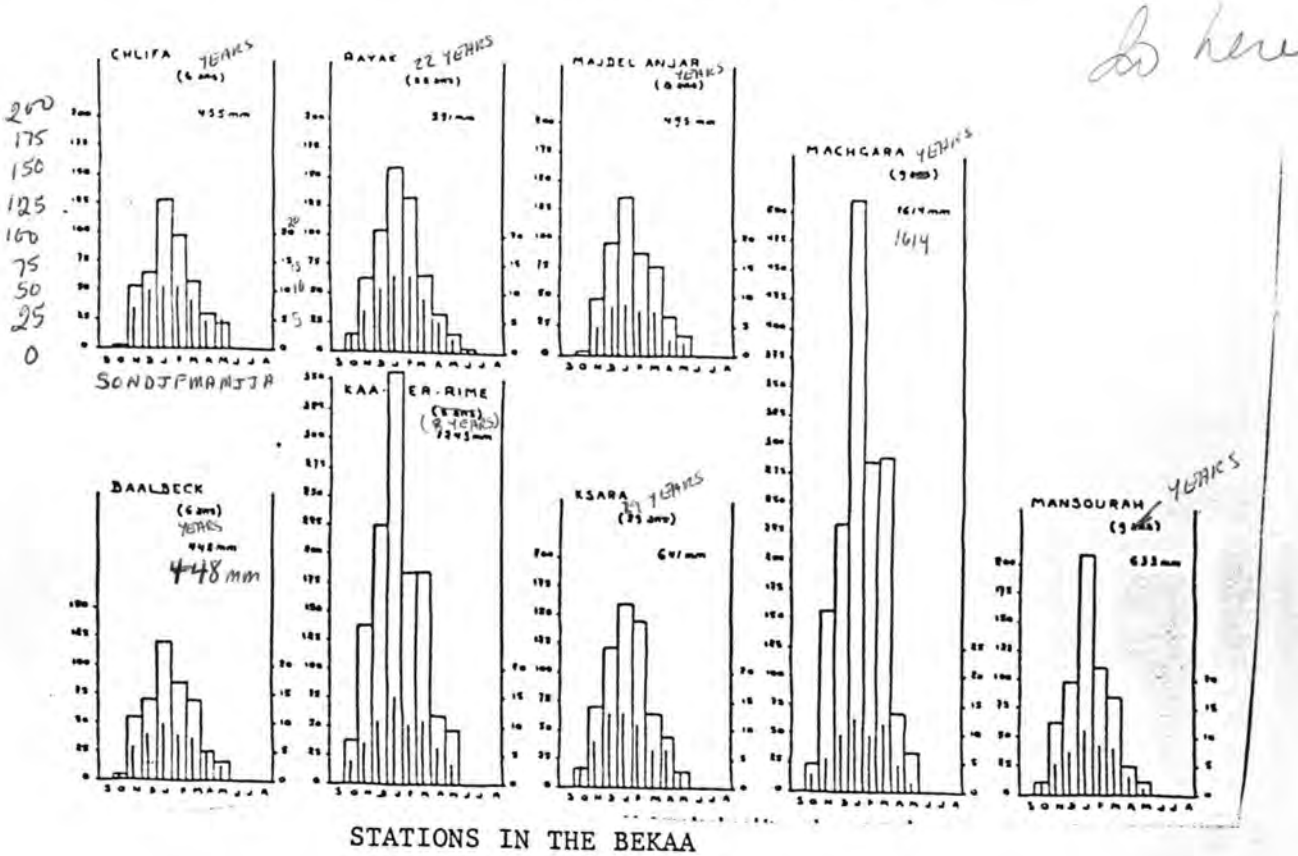

MAP IV
AGRICULTURAL REGIONS OF LEBANON
(after Sanlaville)
Minieh
Tripoli
Nr el Barid
Zghorta
Sfiré
Hermel
El Qua
Merj Hine
Nahr el Assi (Oronte)
Labboué
Arsal
Ainata
Chaate
Aintoura
Nr el Joze
Batroun
Bcharré
Laklouk
Akoura
Yammoune
Jbail
Nr Ibrahim
Kartaba
Afqa
Faraya
Baalbeck
Jounieh
Nr el Kelb
Chmistar
Beskinta
Antoura
Anteliias
BEYROUTH
Broummana
Zahle
Rayak
Yafoula
Nr Beirouth
Choueifat
Bhamdoun
Chtaura
Terbol
Aley
Baidar
Kab Elias
Ammik
Mejdel Anjar
Damour
Nr Damour
Sultan
Joub Jannin
Janta
Jiyeh
CHOUF
Nr Awali
Karaoun
Saïda
Jezzine
Machgara
Rachaya
Mardouché
Nr Zahrani
Nabatiyé
Marjayoun
Hasbaya
Nr Qasmié
Nr Hasbiya
Jourdain
Bint Jbail
0 5 10 15 20 25 30 Km
Coastal Zone
citrus, bananas,
cereals -- Akkar
Middle Zone
impoverished multiculture based on cereals
Olives -- Koura
multiculture dominated by olives
Irrigated Mountain zone with orchards and fodder
Bekaa Valley
Vines -- Cote de Zahle
intensive irrigated multiculture
extensive cereal cultivation
Oasis culture -- vegetables
Mt. Hermon multiculture
sparsely cultivated because of elevation


LITANI RIVER SYSTEM
with HASBANI, ORONTES and AWALI
drainage basins
mountains
Beirut-Damascus road
international boundary
NORTH
Tripoli
ORONTES
LEBANON
Lebanon Mountains
Anti-Lebanon Mountains
Bekaa Valley
Mediterranean Sea
Beirut
LITANI
AWALI
Sidon
HASBANI
Damascus
Tyre
SYRIA
ISRAEL

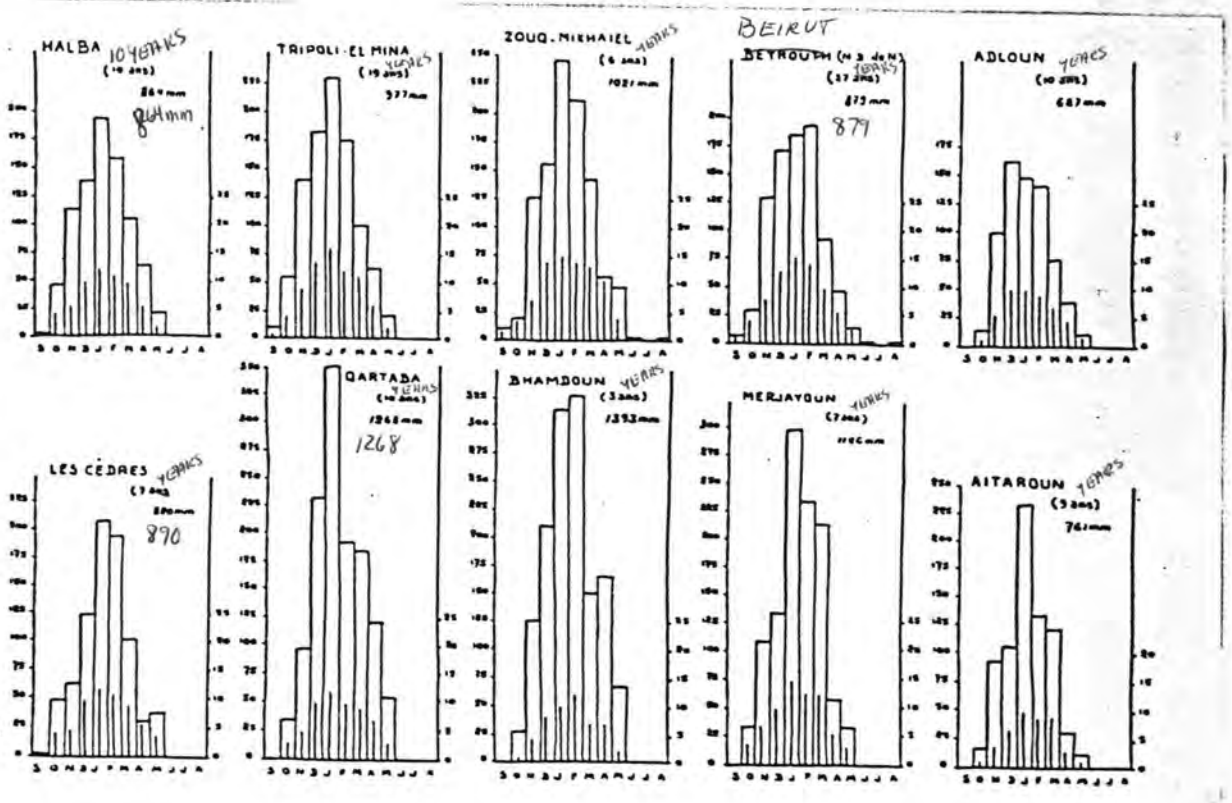

LEBANON
Lebanon Mountains
Anti-Lebanon Mountains
Bekaa Valley
Mediterranean Sea
Beirut
LITANI
AWALI
Sidon
HASBANI
Damascus
Tyre
SYRIA
ISRAEL

MAP 5

Figure 1 ANNUAL RAINFALL AT SELECTED STATIONS IN LEBANON
(after Vaumas, p. 223)



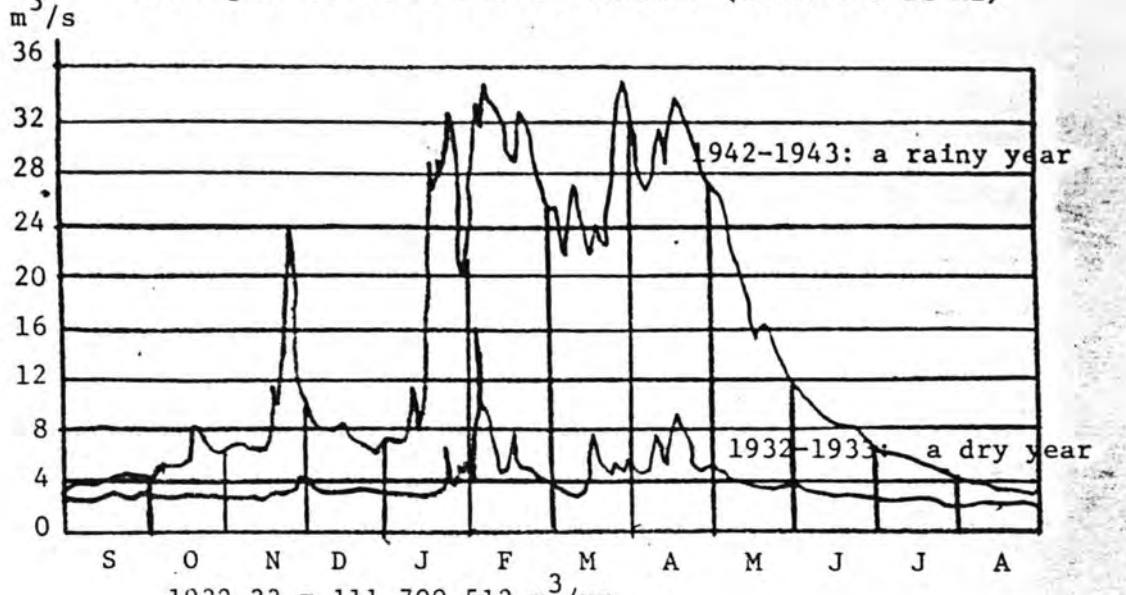
STATIONS IN THE BEKAA



STATIONS THROUGHOUT LEBANON

Figure 2

The Regime of the Litani at Mansura (after Abd El-Al)



1932-33 = 111,700,512 m^3/yr

1942-43 = 449,249,242 m^3/yr

Source: Pierre Birot and Jean Dresch
La Mediterranee et le Moyen-Orient
V.II, p. 274
Presses Universitaires de France (1956)

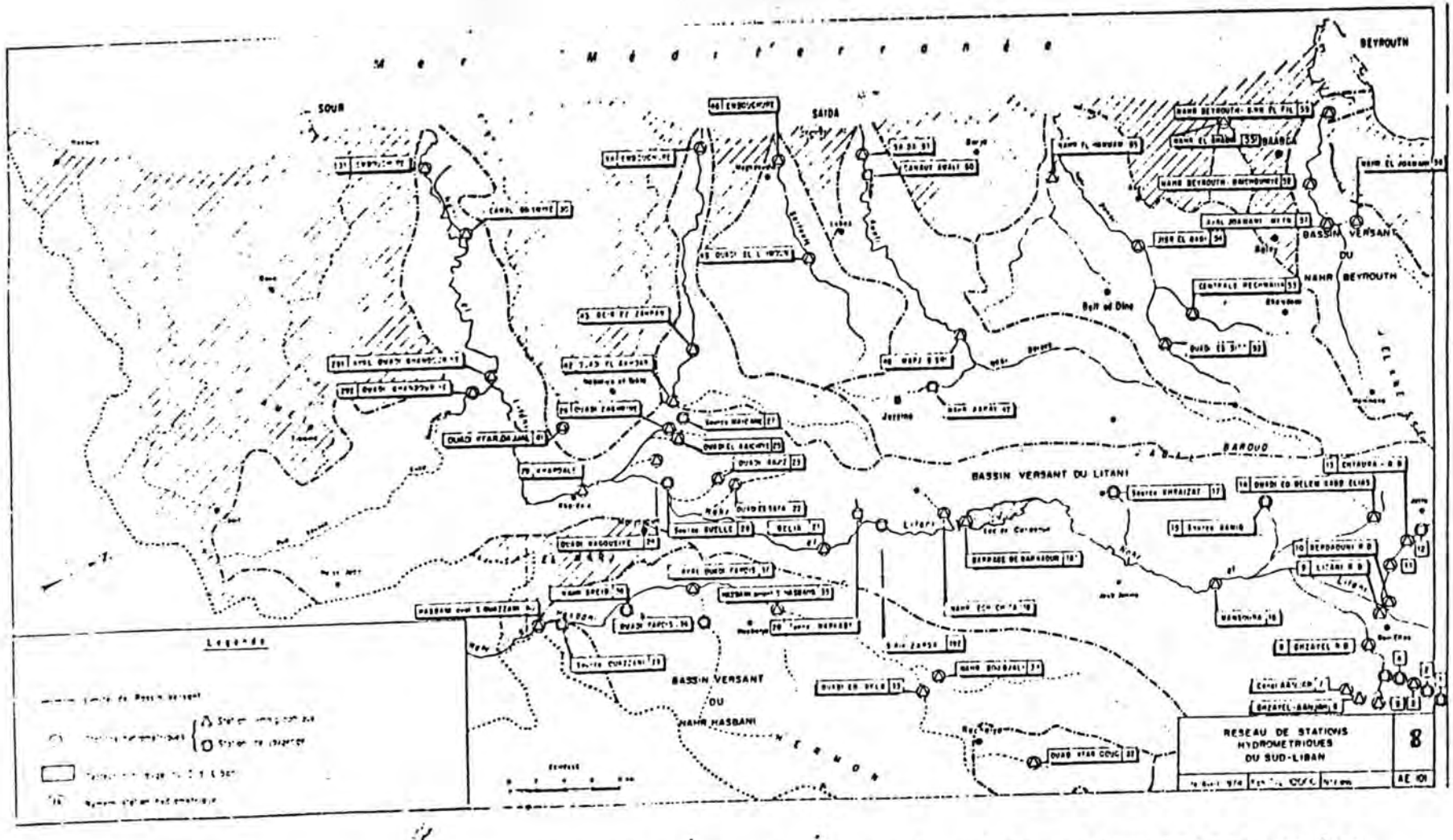


Figure 3: Locations of gaging stations on the Litani and its tributaries; gaging stations in adjacent watersheds also appear on the map.

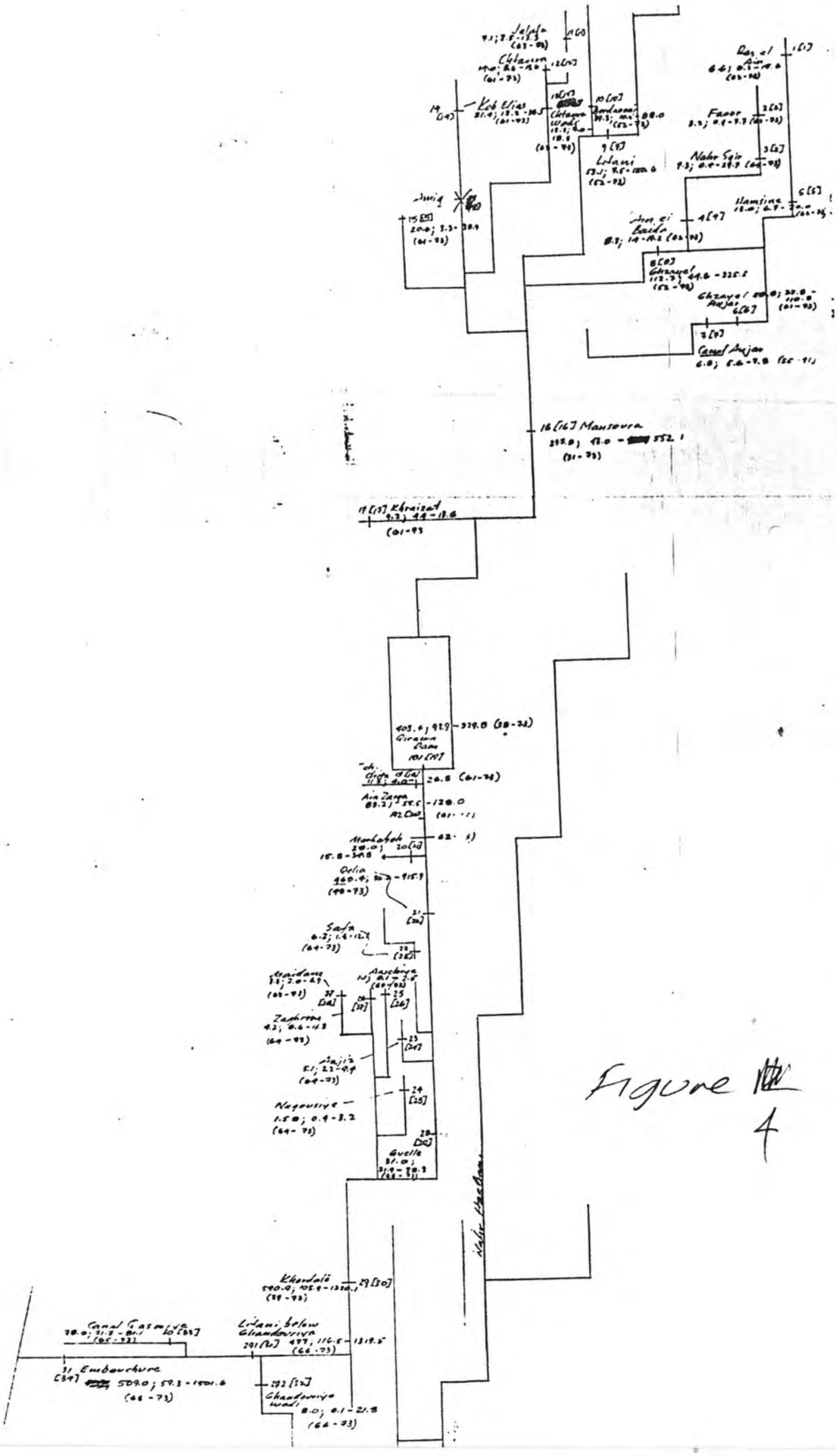

Juniq
Lolani
Mansoura
Khraizat
Girawa Dam
Ain Zarqa
Mahalah
Qelia
Safa
Zahrona
Nagawiya
Guella
Khandalé
Canal Grasmeya
Lolani below Ghandouriya
Ghandouriya wadi
Embouchure

Figure 4

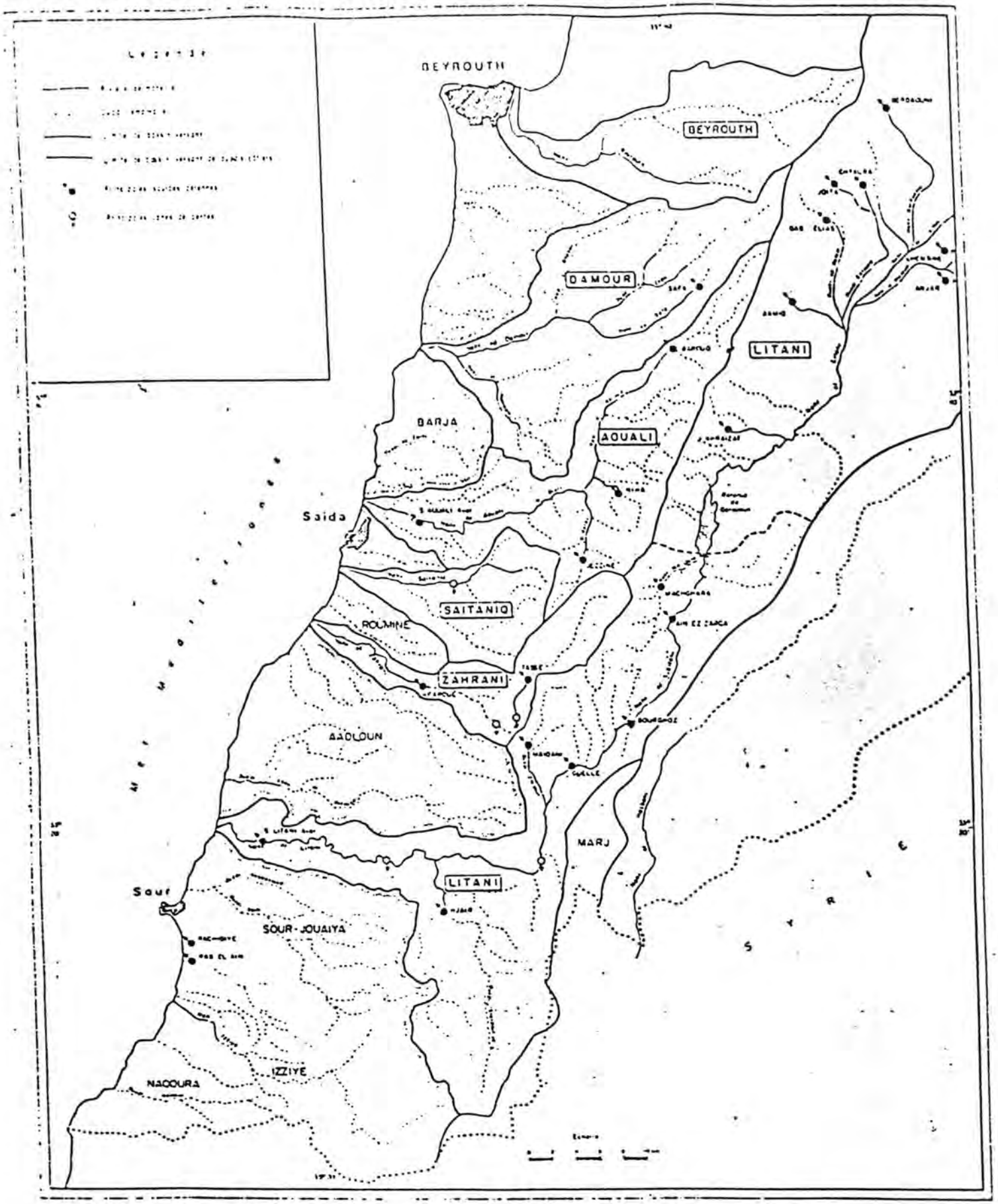


Figure 5: Configuration of drainage basins in the south of Lebanon

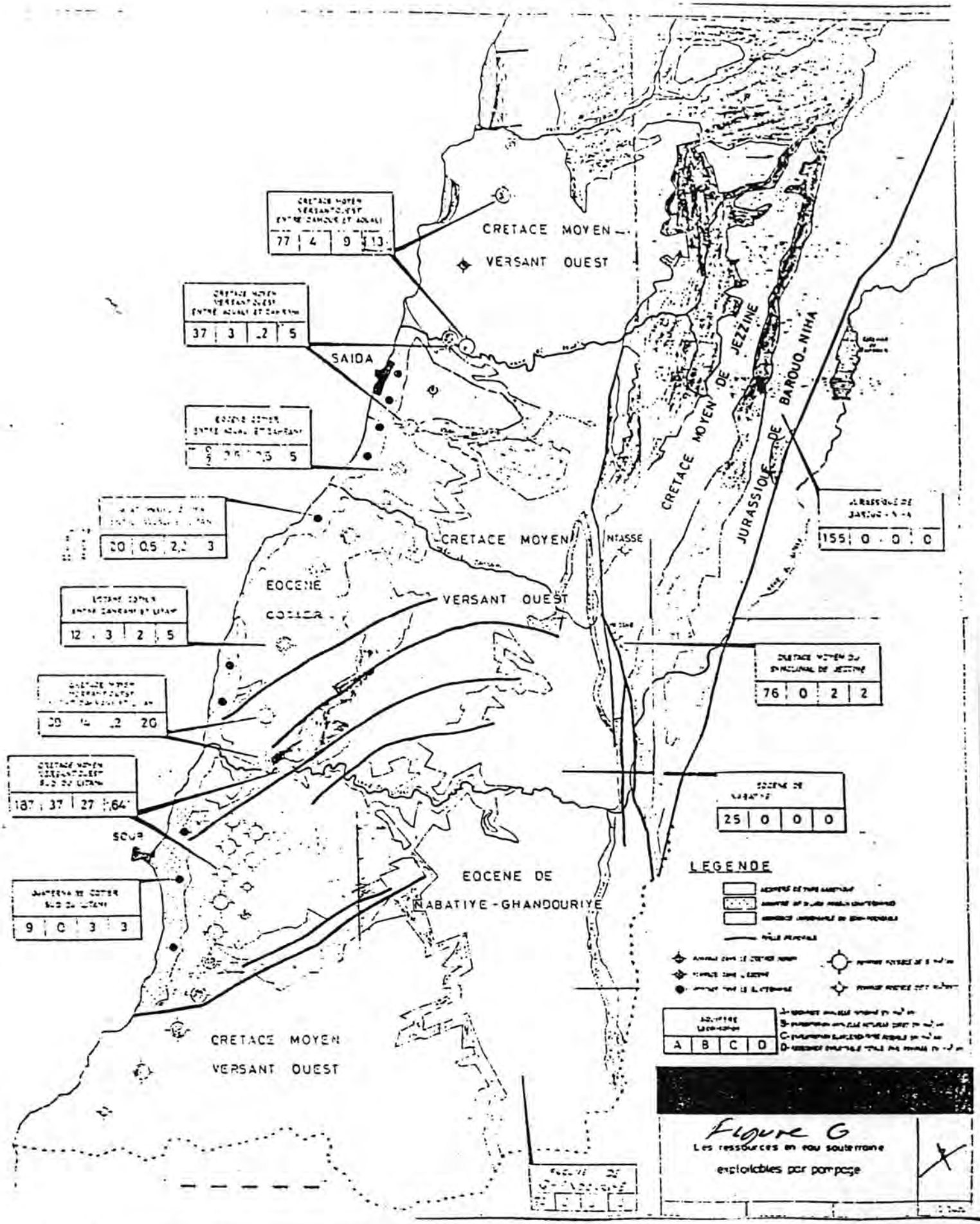


Figure 6

Les ressources en eau souterraine exploitables par pompage

TABLE 1: Rainfall in Lebanon

Station Name	Altitude (m)	Years of Observation	Yearly Avg. (mm)	Avg. for 1939-40 to 1970-71 (mm)
1-North Batroun	20	30	1024	1035
2-Ghazir	390	22	1085	1108
3-Suq Mikayel	70	28	901	901
4- Arbaniya	510	12	1299	1256
5-A.U.B.	34	95	899	926
6-St. Joseph University	45	20	885	887
7-Beirut Airport	15	18	740	757
8-Suq el-Gharb	790	23	1184	1192
9-Jisr el-Qadi	260	22	1108	1132
10-Keter-Maya	380	6	796	788
11-Sidon	5	6	690	678
12-Sfaray pilot section	570	10	1016	940
13-Deir Zahrani	450	6	1089	994
14-Arab Salim	580	6	1020	1010
15-Qasmieh (Litani mouth)	30	24	676	660
16-Ain Ebel	766	12	802	775
17-Aitaroun	680	32	787	787
18-Insariya	160	7	730	656
19-Duweir	380	10	931	860
20-Nabatiya	410	7	928	834
21-Tyre	5	6	704	627
22-Jouaya	300	6	726	719
23-Qana	300	4	631	618
24-Jarmaq	400	6	978	969
25-Qlaya	1050	28	1210	1211
26-Bikfaya	900	22	1308	1336
27-Dahr el-Baydar	1510	19	1361	1381
28-Beit Eddine	880	31	1138	1138
29-Jezzine	945	30	1380	1352
30-Rihan	1090	4	1194	938
31-Hermel Bekaa	700	32	239	239
32-Jamouneh	1370	31	982	995
33-Baalbek	1150	31	406	407
34-Qaa el-Rim	1320	32	1294	1294
35-Tel Amara (agr. research)	905	18	618	632
36-Ksara	920	50	634	650
37-Chtaura	920	19	833	845
38-Taanayel	880	5	879	?
39-Anjar	925	31	531	527
40-Mansura South Bekaa	860	33	632	637
41-Joub Jannin	920	25	720	720
42-Qirawn village	950	16	675	680
43-Mashghara	1070	28	1462	1396
44-Terbol	890	3	804	604
45-Qirawn Dam	950	9	1151	1066
46-Markabeh	670	5	1256	1040
47-Hasbaya	750	27	1030	1037
48-Marjayoun	760	25	894	885
49-Deir el-Ashayeb	1280	5	754	649
50-Rashaya	1235	25	847	847

Source: UNDP, *Annuaire des precipitations mensuelles et annuelles du Liban* (Beirut, 1973).

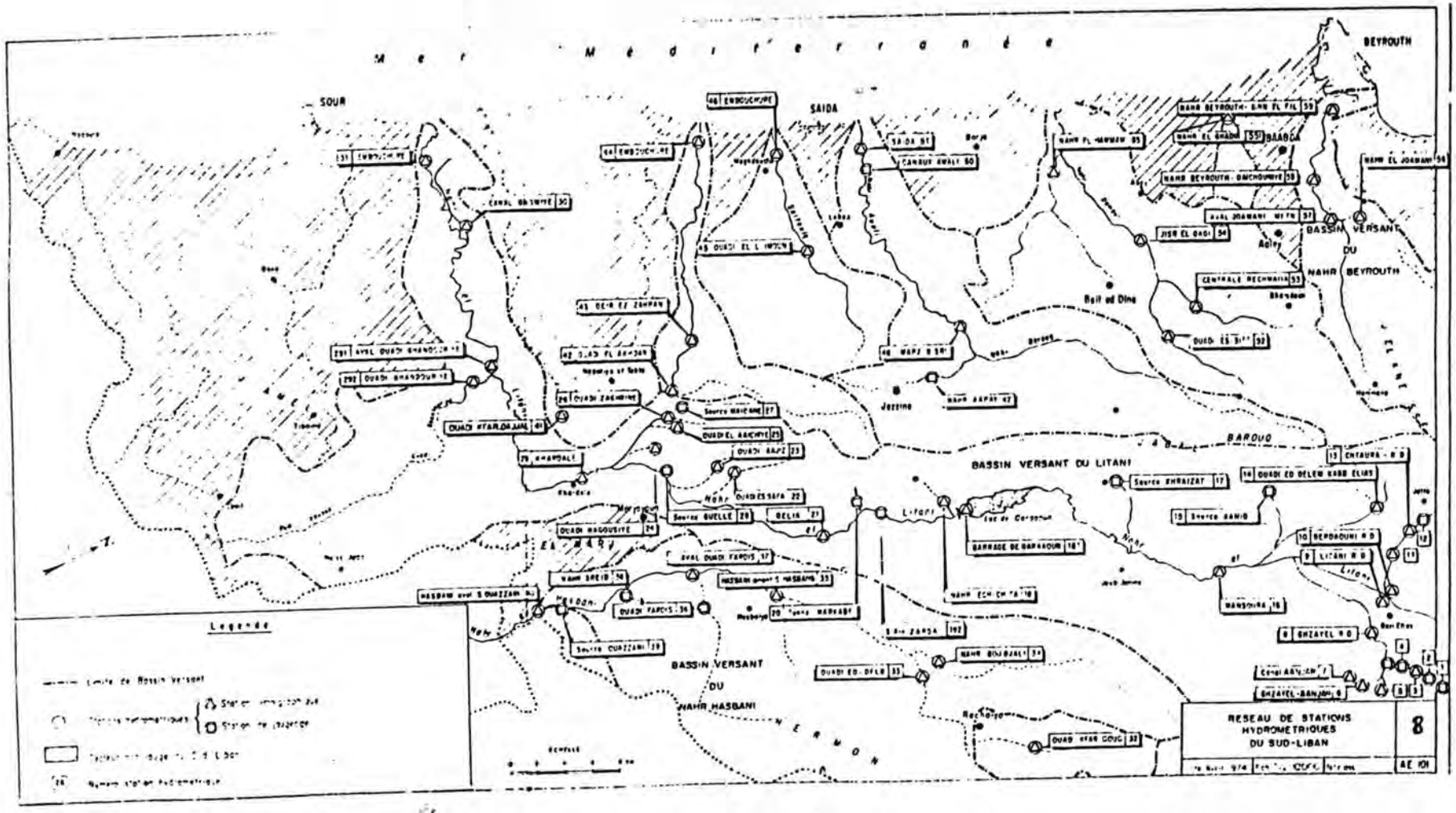


Figure 3: Locations of gaging stations on the Litani and its tributaries; gaging stations in adjacent watersheds also appear on the map.

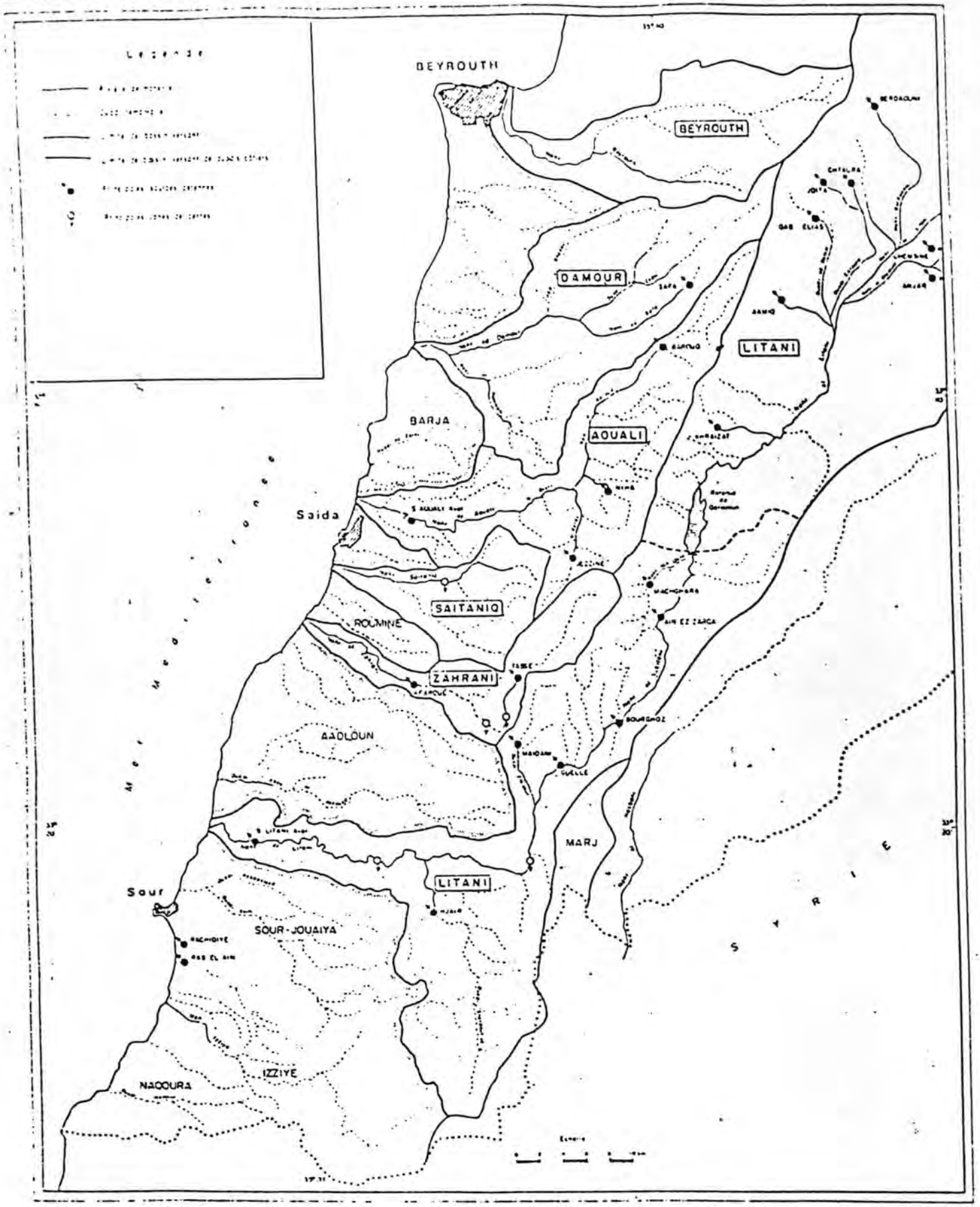
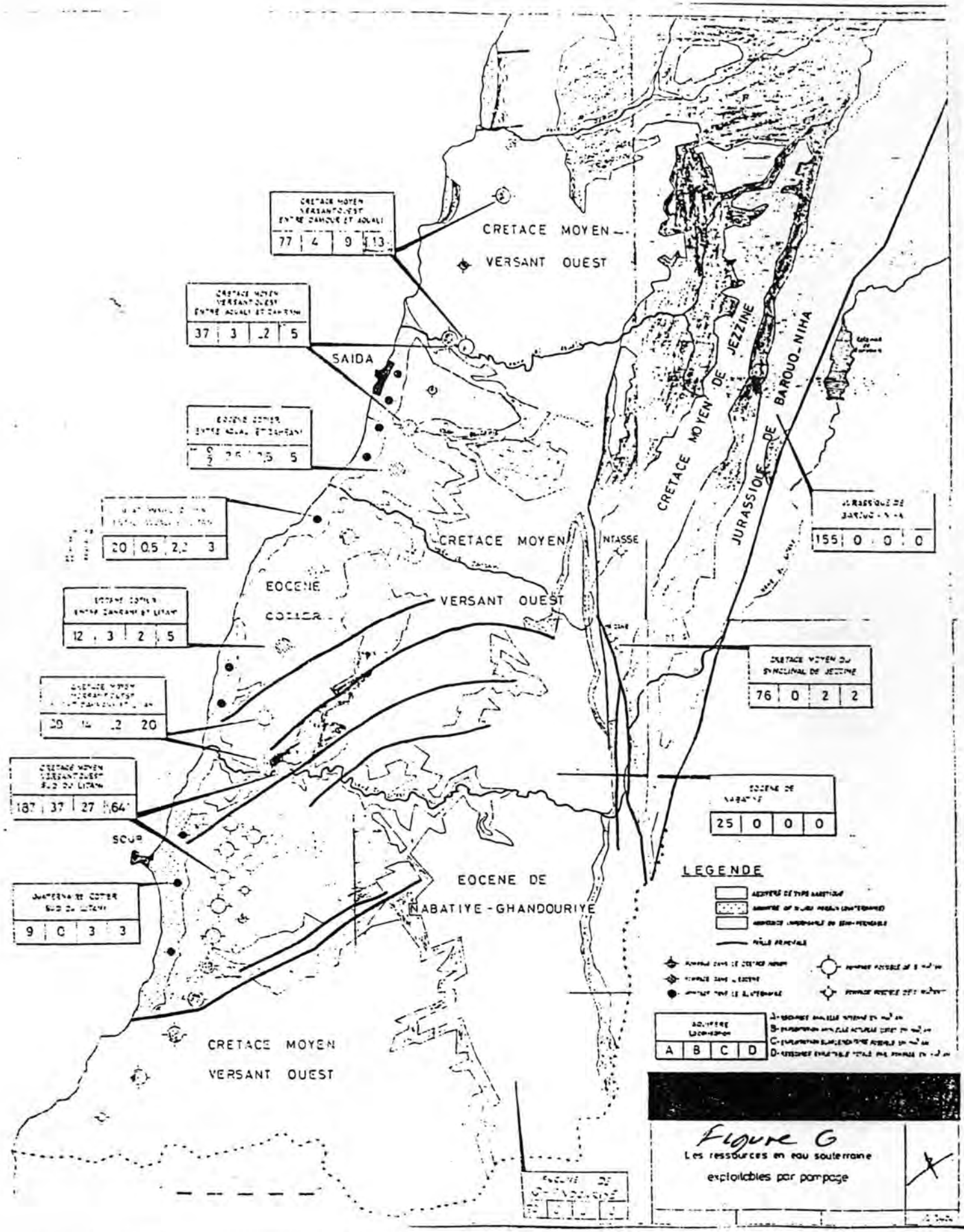
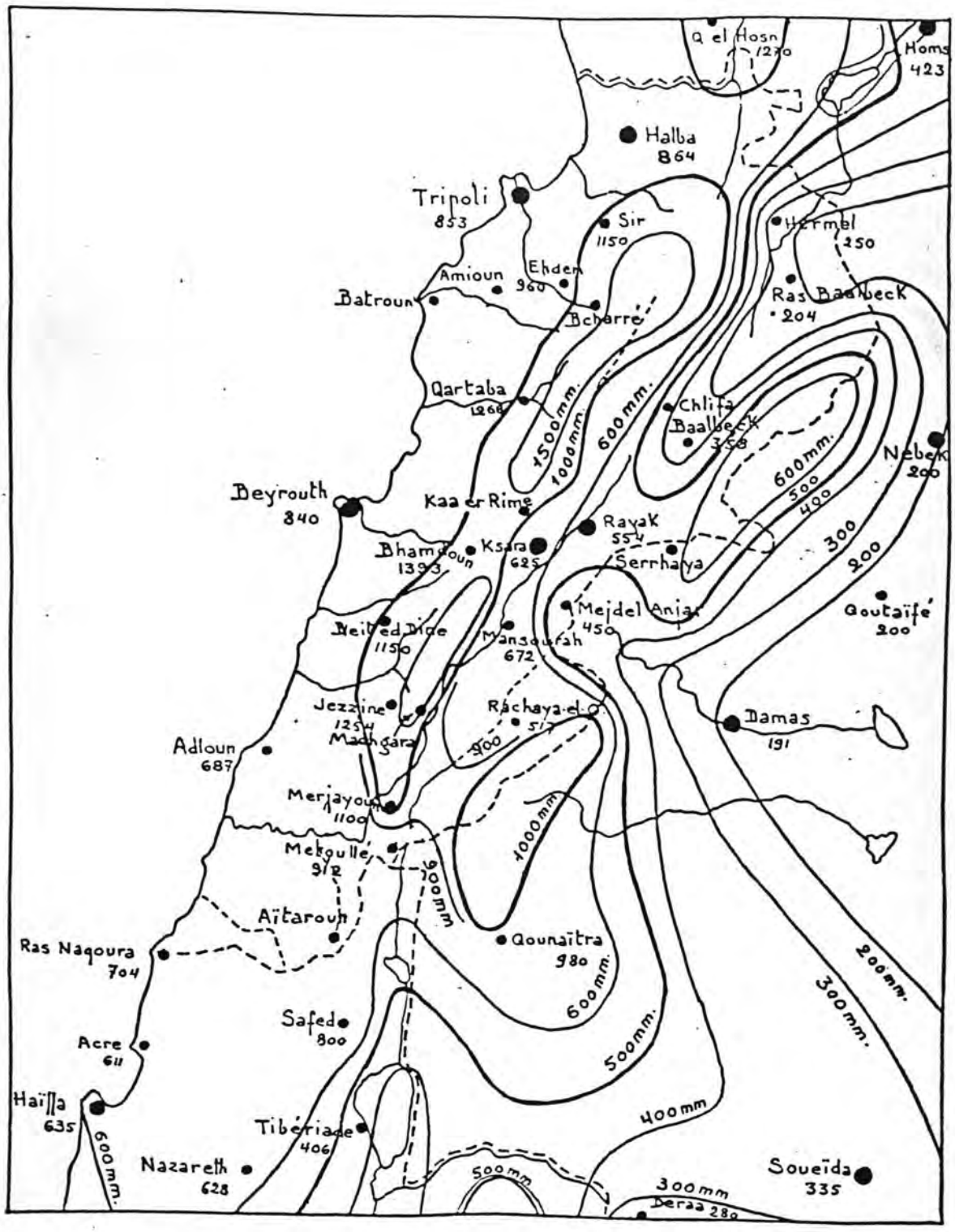


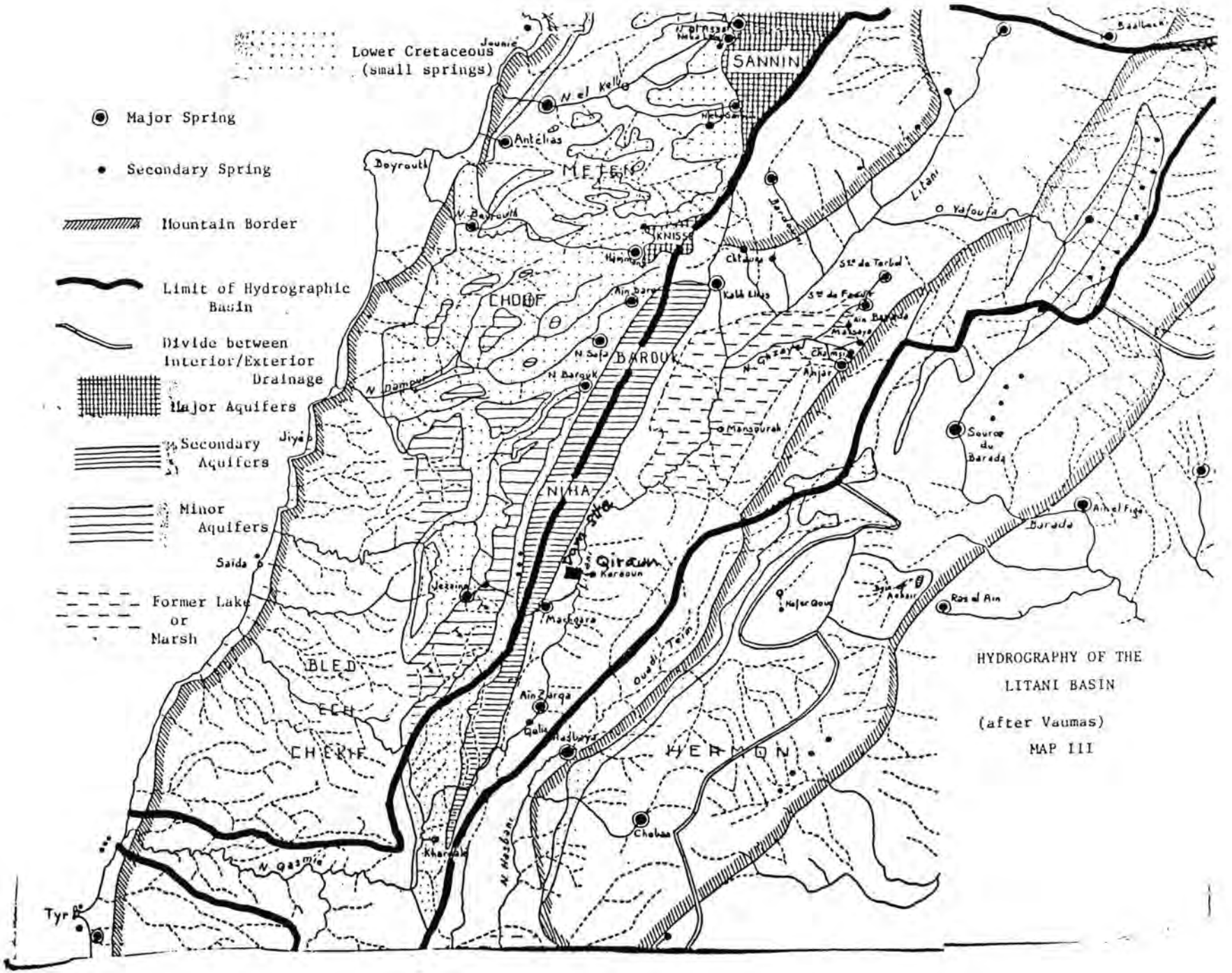
Figure 5: Configuration of drainage basins in the south of Lebanon

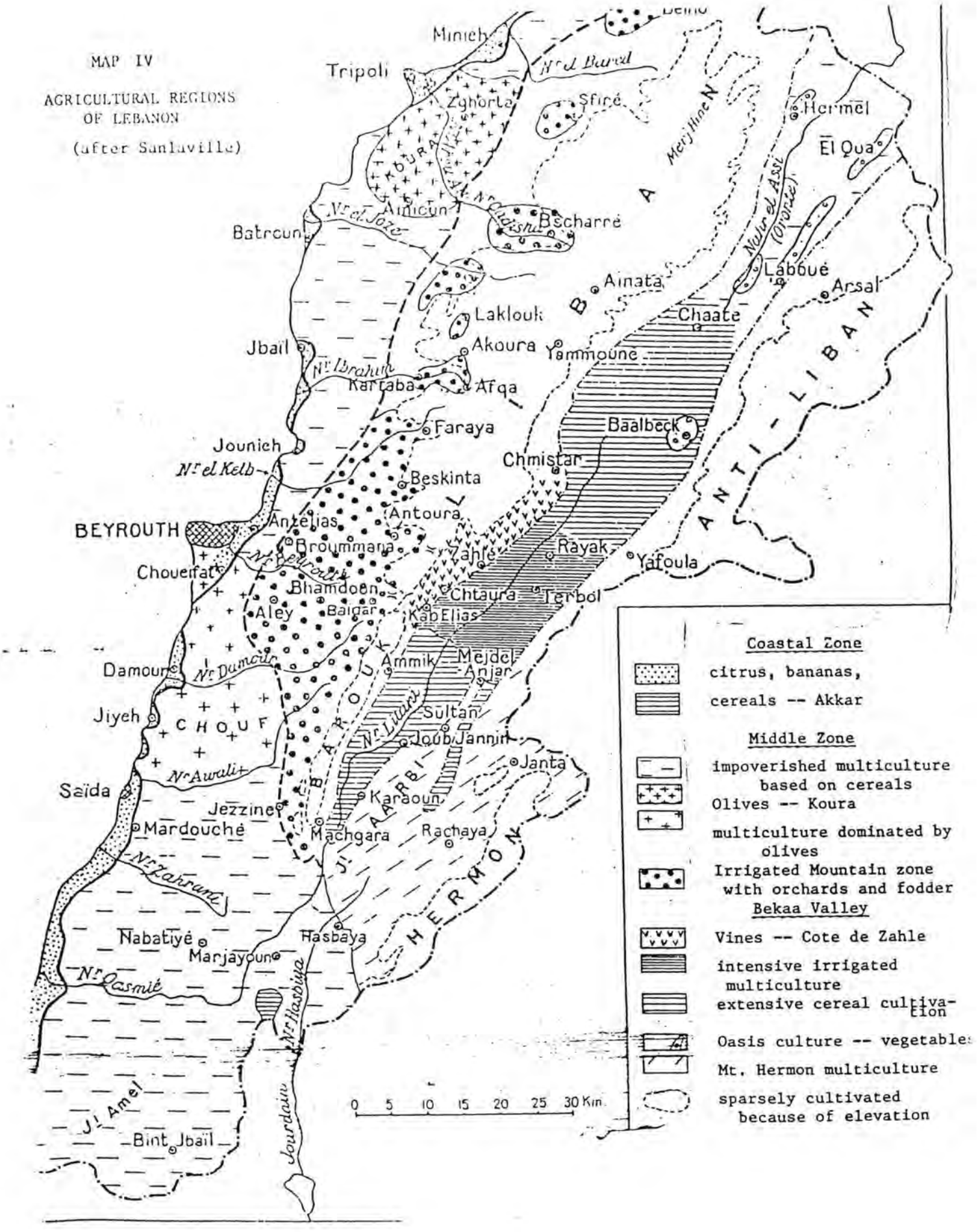

CRETACE MOYEN
VERSANT OUEST
77 | 4 | 9 | 13
37 | 3 | 2 | 5
SAIDA
CRETACE MOYEN DE JEZZINE
JURASSIQUE DE BAROUD-NIHA
155 | 0 | 0 | 0
CRETACE MOYEN
EOCENE
COTIER
VERSANT OUEST
20 | 0.5 | 2,2 | 3
12 | 3 | 2 | 5
76 | 0 | 2 | 2
20 | 14 | 2 | 20
187 | 37 | 27 | 64
SOUR
25 | 0 | 0 | 0
EOCENE DE
NABATIYE - GHANDOURIYE
9 | 0 | 3 | 3
CRETACE MOYEN
VERSANT OUEST
LEGENDE
A | B | C | D
Figure G
Les ressources en eau souterraine
exploitables par pompage

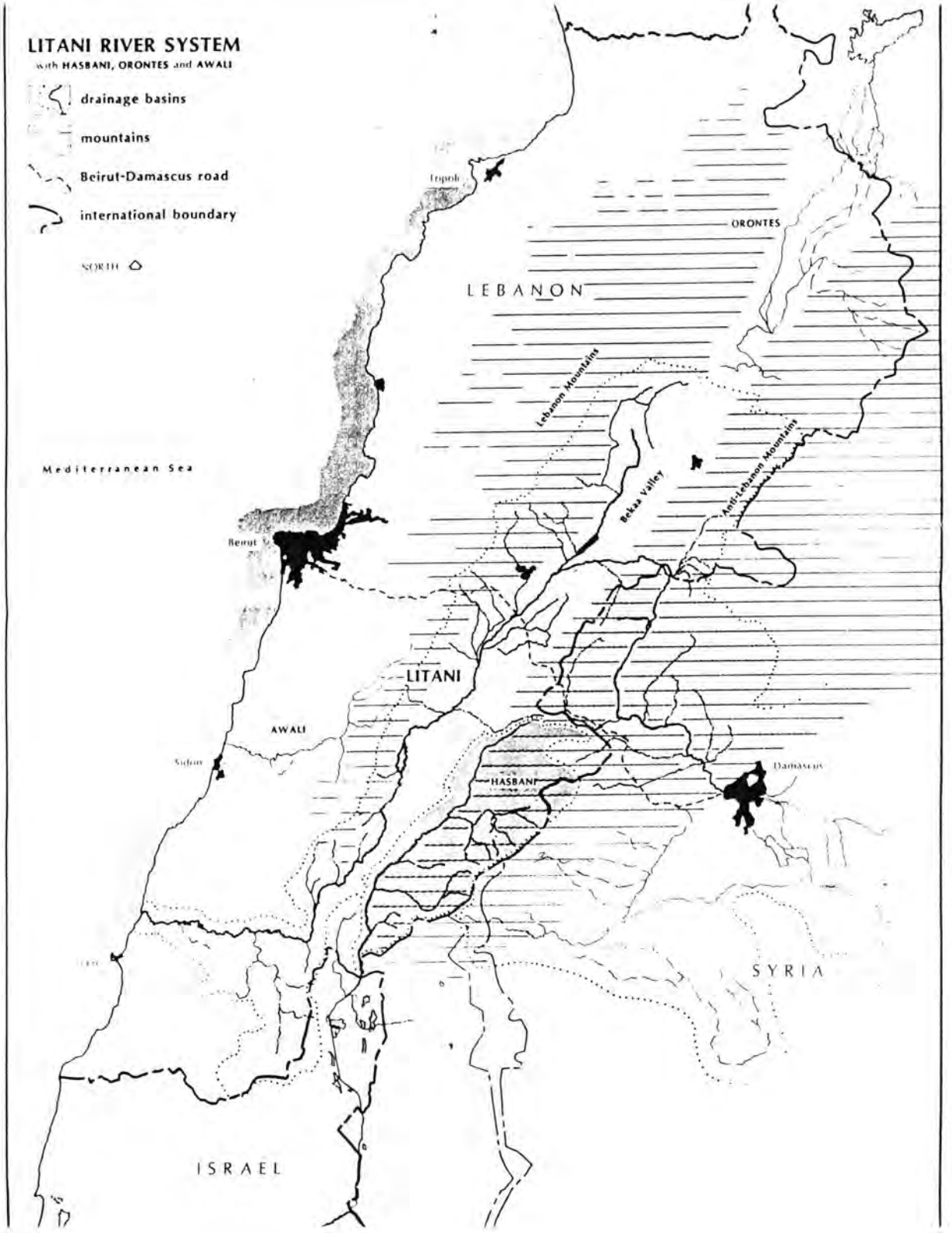
MAP II

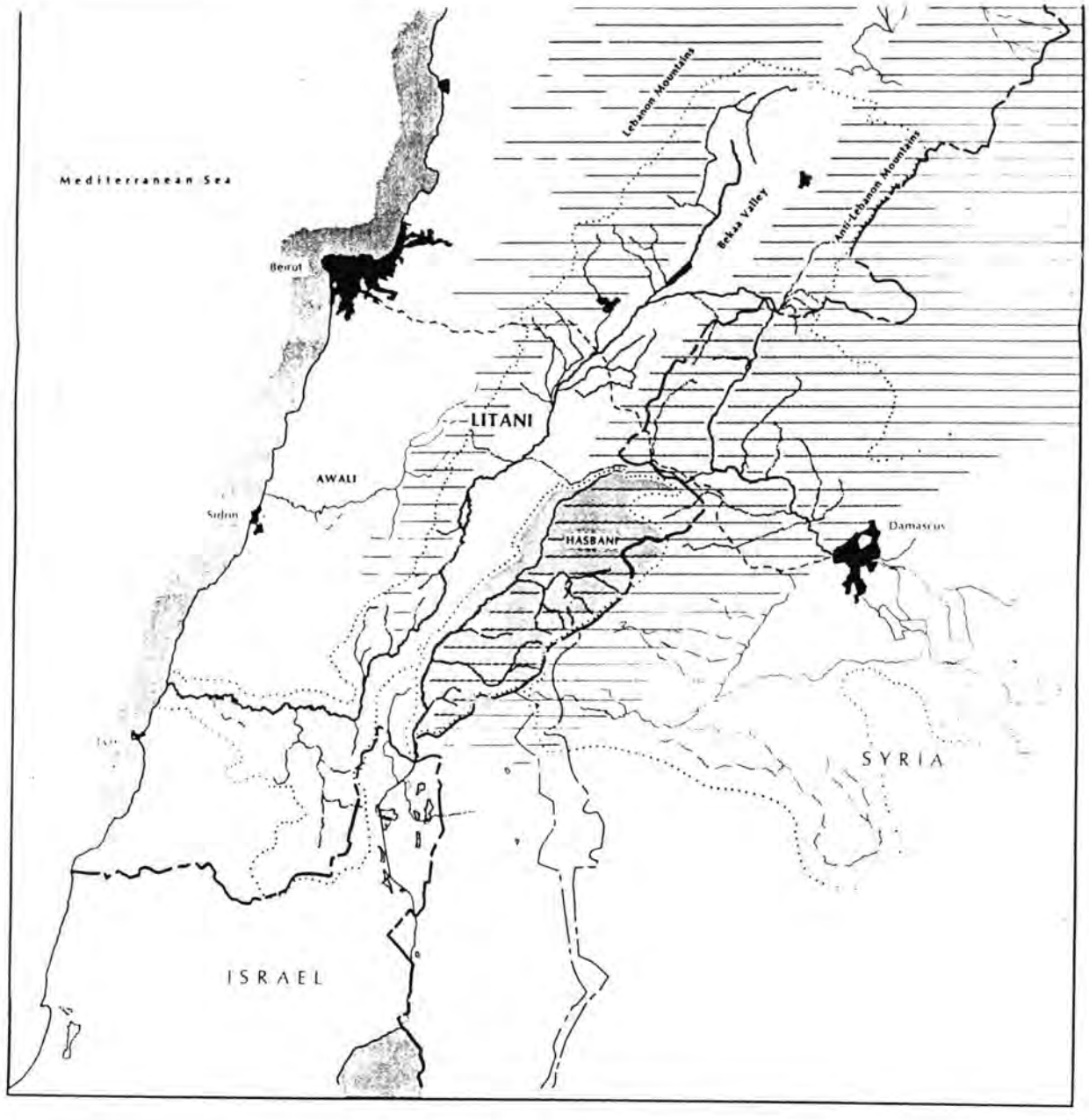
PRECIPITATION IN LEBANON (after Vaumas)




Lower Cretaceous (small springs)
Major Spring
Secondary Spring
Mountain Border
Limit of Hydrographic Basin
Divide between Interior/Exterior Drainage
Major Aquifers
Secondary Aquifers
Minor Aquifers
Former Lake or Marsh
SANNIN
METEIF
CHOUF
BAROUK
NIHA
BLED ECH CHERIF
HERMON
Beyrouth
Antélias
Jounie
Jiye
Saida
Tyr
Qiraun
Litani
Ras el Ain
Baalbeck
Barada
Source du Barada
Ain el Figé
Ain Zarqa
Qalia
Hasbaya
Chebaa
Khardale
N Qasmie
N Hasbani
Oued el Teim
HYDROGRAPHY OF THE LITANI BASIN
(after Vaumas)
MAP III

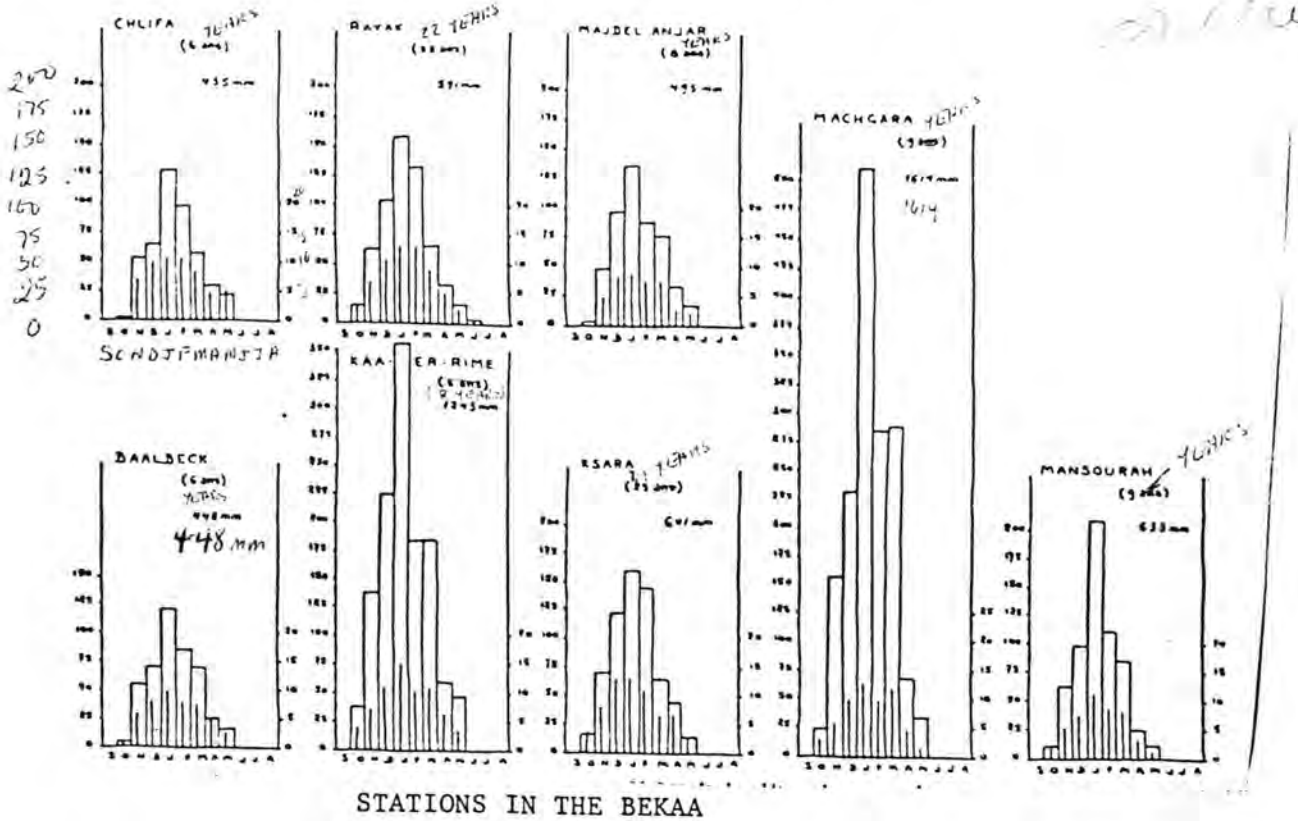

MAP IV
AGRICULTURAL REGIONS OF LEBANON
(after Sanlaville)
Minieh
Tripoli
Nr el Barid
Zghorta
Sfiré
Hermel
El Qua
Merj Hine
Nahr el Assi (Oronte)
Aimicun
Nr el Jaze
Bcharré
Batroun
Ainata
Laboué
Arsal
Laklouk
Chaate
Jbail
Akoura
Yammoune
Nr Ibrahim
Kartaba
Afqa
Faraya
Baalbeck
Jounieh
Nr el Kelb
Chmistar
Beskinta
Antoura
BEYROUTH
Anteliias
Broummana
Rayak
Yafoula
Choueifat
Nr Beyrouth
Zahlé
Bhamdoen
Chtaura
Terbol
Aley
Baigar
Kab Elias
Damour
Nr Damour
Ammik
Mejdel Anjar
Jiyeh
CHOUF
Sultan
Nr Litani
Joub Jannin
Janta
Nr Awali
Saïda
Karaoun
Jezzine
Mardouché
Machgara
Rachaya
Nr Zahrani
Nabatiyé
Hasbaya
Marjayoun
Nr Qasmié
Nr Hasbiya
Jourdain
Bint Jbail
0 5 10 15 20 25 30 Km
Coastal Zone
citrus, bananas,
cereals -- Akkar
Middle Zone
impoverished multiculture based on cereals
Olives -- Koura
multiculture dominated by olives
Irrigated Mountain zone with orchards and fodder
Bekaa Valley
Vines -- Cote de Zahle
intensive irrigated multiculture
extensive cereal cultivation
Oasis culture -- vegetables
Mt. Hermon multiculture
sparsely cultivated because of elevation


LITANI RIVER SYSTEM
with HASBANI, ORONTES and AWALI
drainage basins
mountains
Beirut-Damascus road
international boundary
NORTH
Tripoli
ORONTES
LEBANON
Lebanon Mountains
Anti-Lebanon Mountains
Bekaa Valley
Mediterranean Sea
Beirut
LITANI
AWALI
Sidon
HASBANI
Damascus
SYRIA
ISRAEL

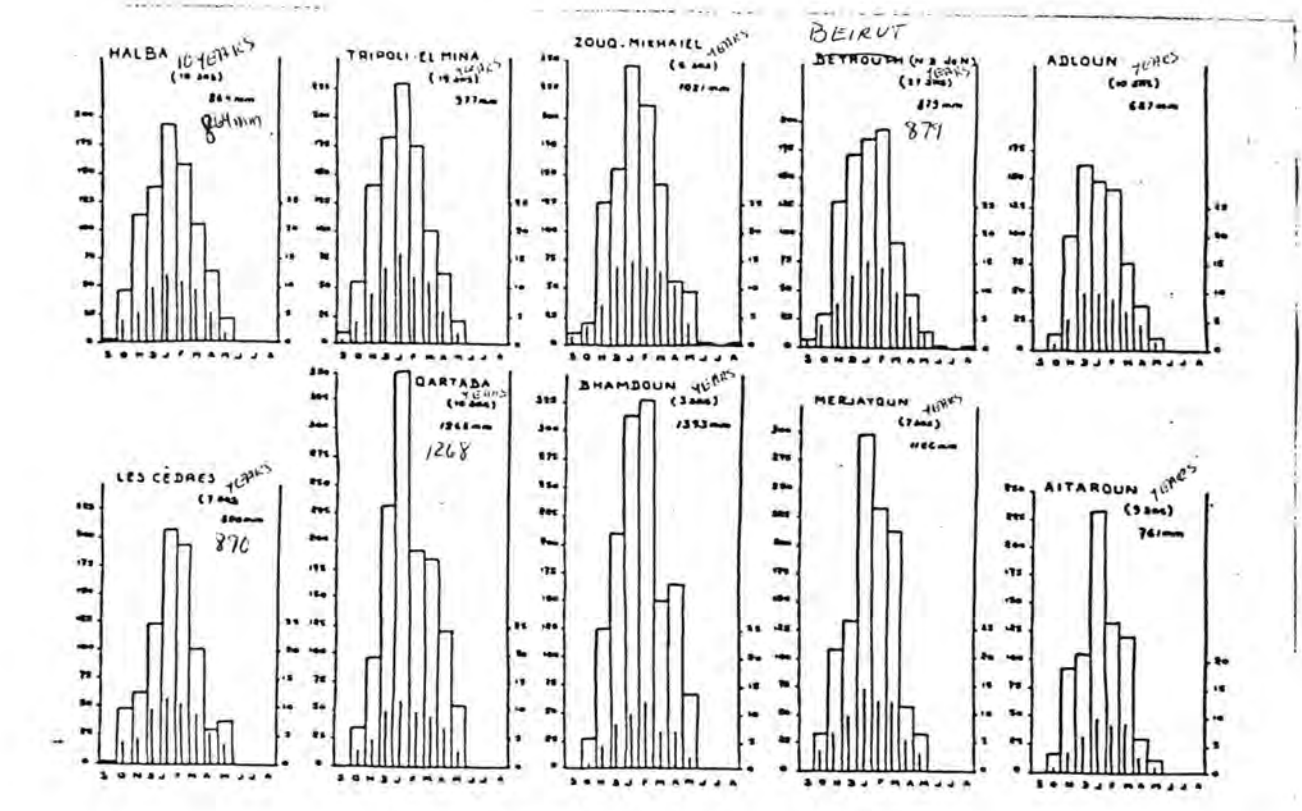

Mediterranean Sea
Lebanon Mountains
Bekaa Valley
Anti-Lebanon Mountains
Beirut
LITANI
AWALI
Sidon
HASBANI
Damascus
Tyre
SYRIA
ISRAEL

MAP 5

Figure 1 ANNUAL RAINFALL AT SELECTED STATIONS IN LEBANON
(after Vaumas, p. 223)



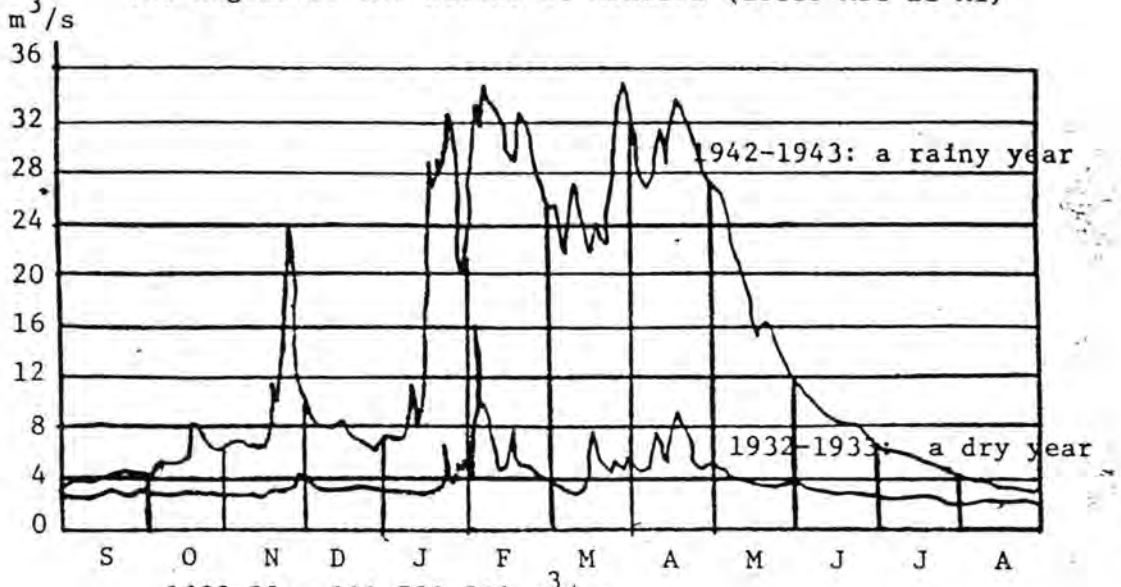
STATIONS IN THE BEKAA



STATIONS THROUGHOUT LEBANON

Figure 2

The Regime of the Litani at Mansura (after Abd El-Al)



1932-33 = 111,700,512 m^3/yr

1942-43 = 449,249,242 m^3/yr

Source: Pierre Birot and Jean Dresch
La Mediterranee et le Moyen-Orient
V.II, p. 274
Presses Universitaires de France (1956)

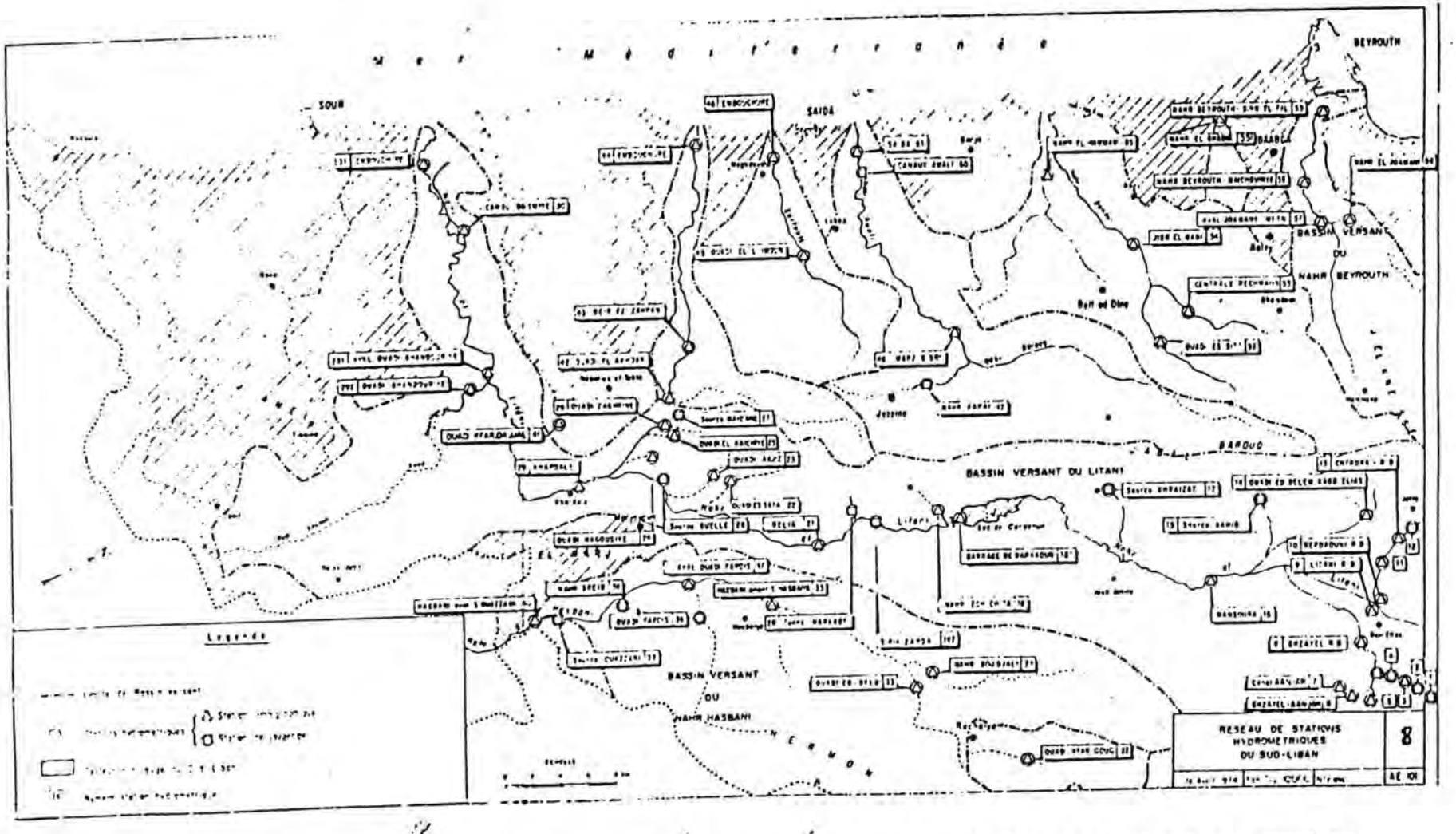
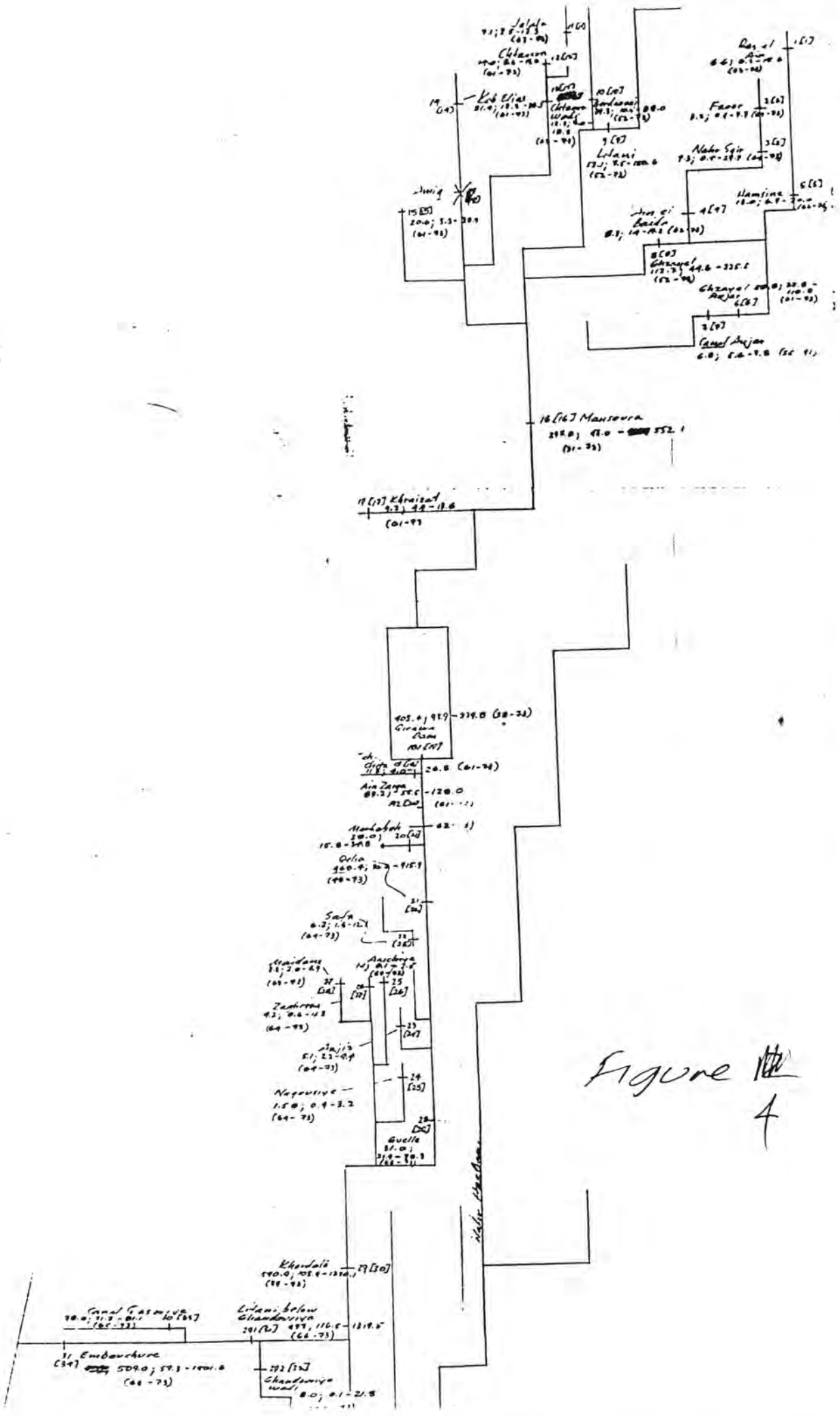


Figure 3: Locations of gaging stations on the Litani and its tributaries; gaging stations in adjacent watersheds also appear on the map.


16 [16] Mansoura
19 [17] Khrairat
405.4; 92.9 - 339.8 (58-74)
Ain Zarga
Alambahak
Orlia
Safa
Graidane
Zahrina
Nagouliye
Gueffe
Khandaki
Chandaniya wadi
Embouchure
Figure 4

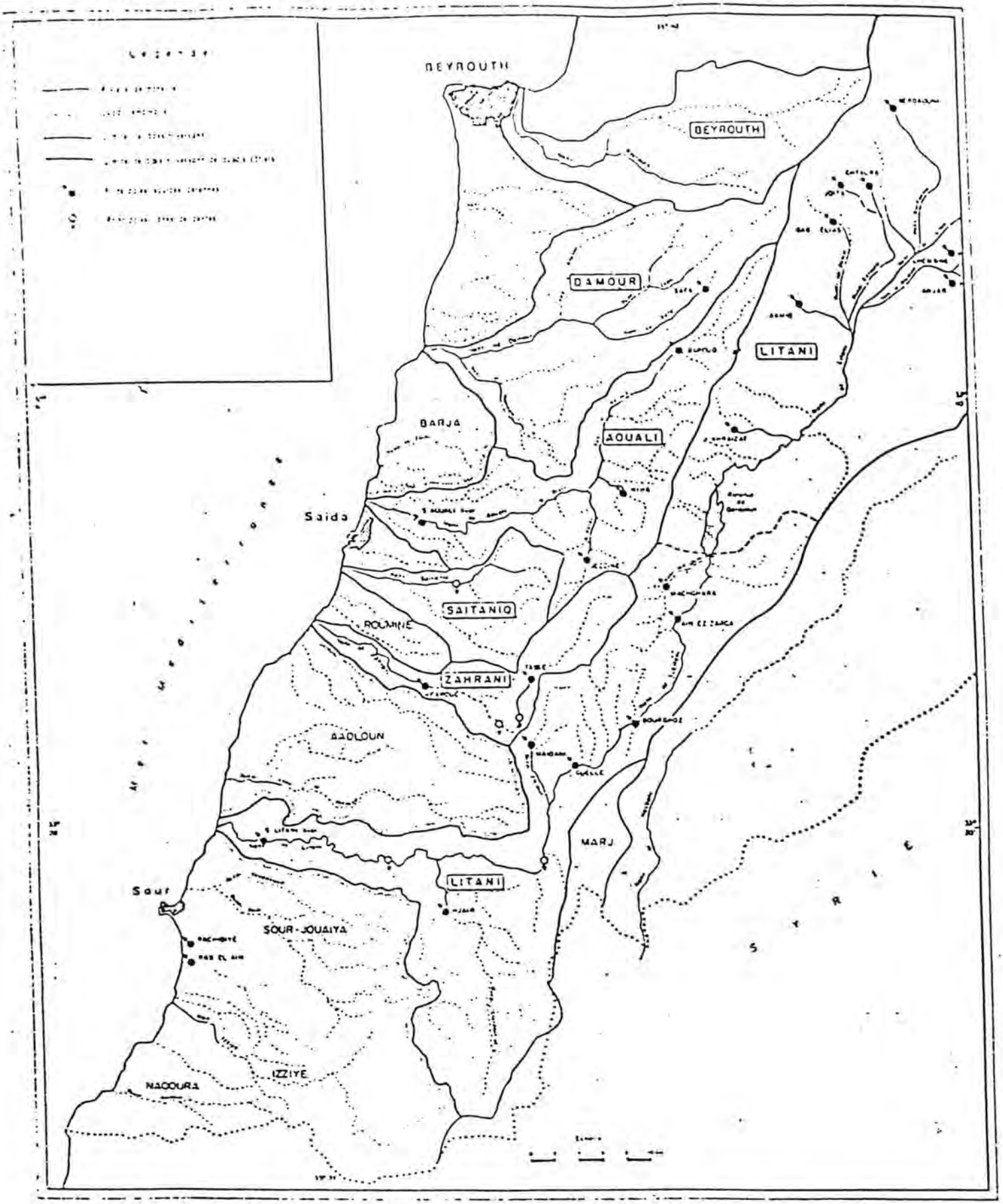


Figure 5: Configuration of drainage basins in the south of Lebanon

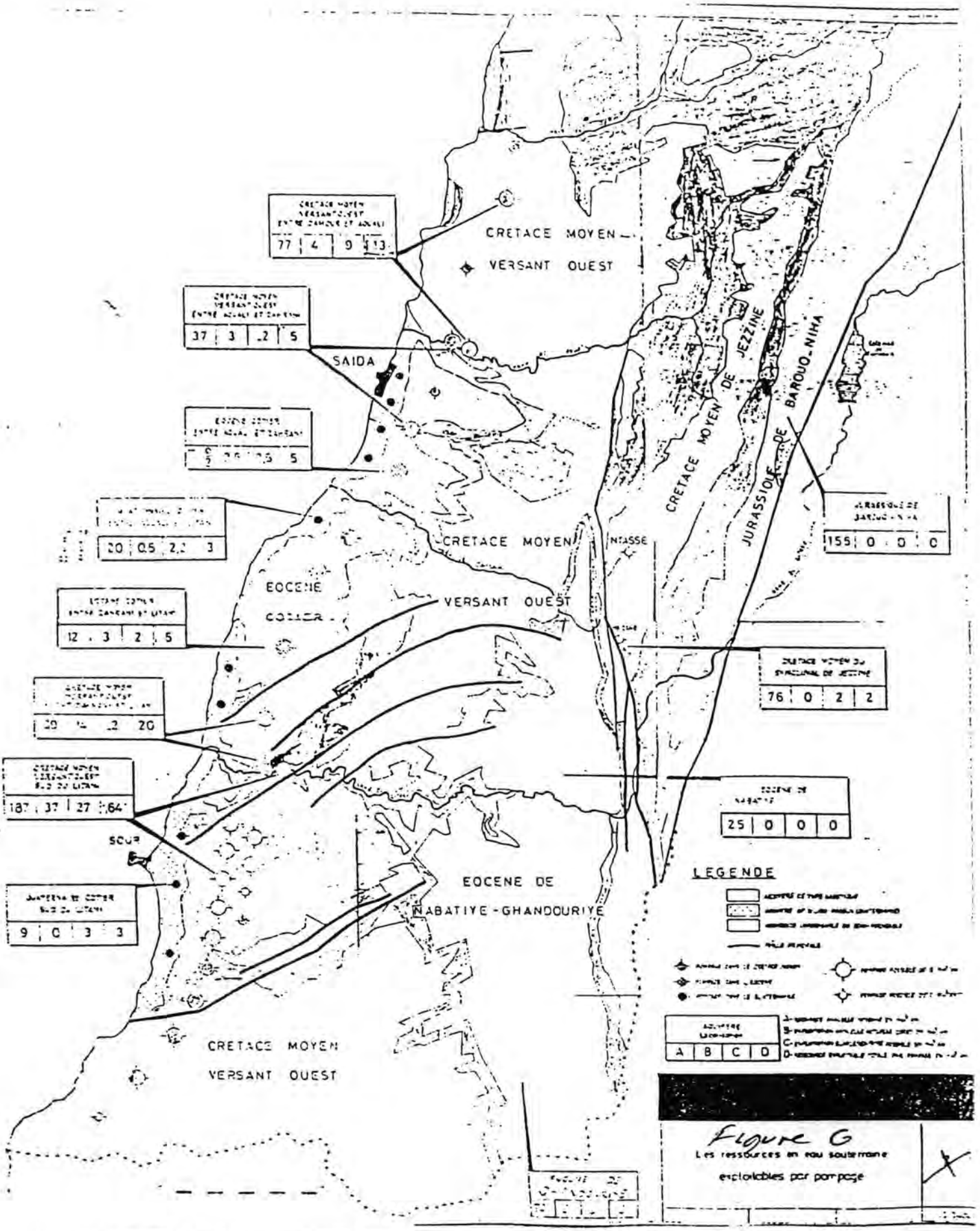


Figure 6

Les ressources en eau souterraine exploitables par pompage

TABLE 1: Rainfall in Lebanon

Station Name	Altitude (m)	Years of Observation	Yearly Avg. (mm)	Avg. for 1939-40 to 1970-71 (mm)
1-North Batroun	20	30	1024	1035
2-Ghazir	390	22	1085	1108
3-Suq Mikayel	70	28	901	901
4- Arbaniya	510	12	1299	1256
5-A.U.B.	34	95	899	926
6-St. Joseph University	45	20	885	887
7-Beirut Airport	15	18	740	757
8-Suq el-Gharb	790	23	1184	1192
9-Jisr el-Qadi	260	22	1108	1132
10-Keter-Maya	380	6	796	788
11-Sidon	5	6	690	678
12-Sfaray pilot section	570	10	1016	940
13-Deir Zahrani	450	6	1089	994
14-Arab Salim	580	6	1020	1010
15-Qasmieh (Litani mouth)	30	24	676	660
16-Ain Ebel	766	12	802	775
17-Aitaroun	680	32	787	787
18-Insariya	160	7	730	656
19-Duweir	380	10	931	860
20-Nabatiya	410	7	928	834
21-Tyre	5	6	704	627
22-Jouaya	300	6	726	719
23-Qana	300	4	631	618
24-Jarmaq	400	6	978	969
25-Qlaya	1050	28	1210	1211
26-Bikfaya	900	22	1308	1336
27-Dahr el-Baydar	1510	19	1361	1381
28-Beit Eddine	880	31	1138	1138
29-Jezzine	945	30	1380	1352
30-Rihan	1090	4	1194	938
31-Hermel Bekaa	700	32	239	239
32-Jamouneh	1370	31	982	995
33-Baalbek	1150	31	406	407
34-Qaa el-Rim	1320	32	1294	1294
35-Tel Amara (agr. research)	905	18	618	632
36-Ksara	920	50	634	650
37-Chtaura	920	19	833	845
38-Taanayel	880	5	879	?
39-Anjar	925	31	531	527
40-Mansura South Bekaa	860	33	632	637
41-Joub Jannin	920	25	720	720
42-Qirawn village	950	16	675	680
43-Mashghara	1070	28	1462	1396
44-Terbol	890	3	804	604
45-Qirawn Dam	950	9	1151	1066
46-Markabeh	670	5	1256	1040
47-Hasbaya	750	27	1030	1037
48-Marjayoun	760	25	894	885
49-Deir el-Ashayeb	1280	5	754	649
50-Rashaya	1235	25	847	847

Source: UNDP, *Annuaire des precipitations mensuelles et annuelles du Liban* (Beirut, 1973).

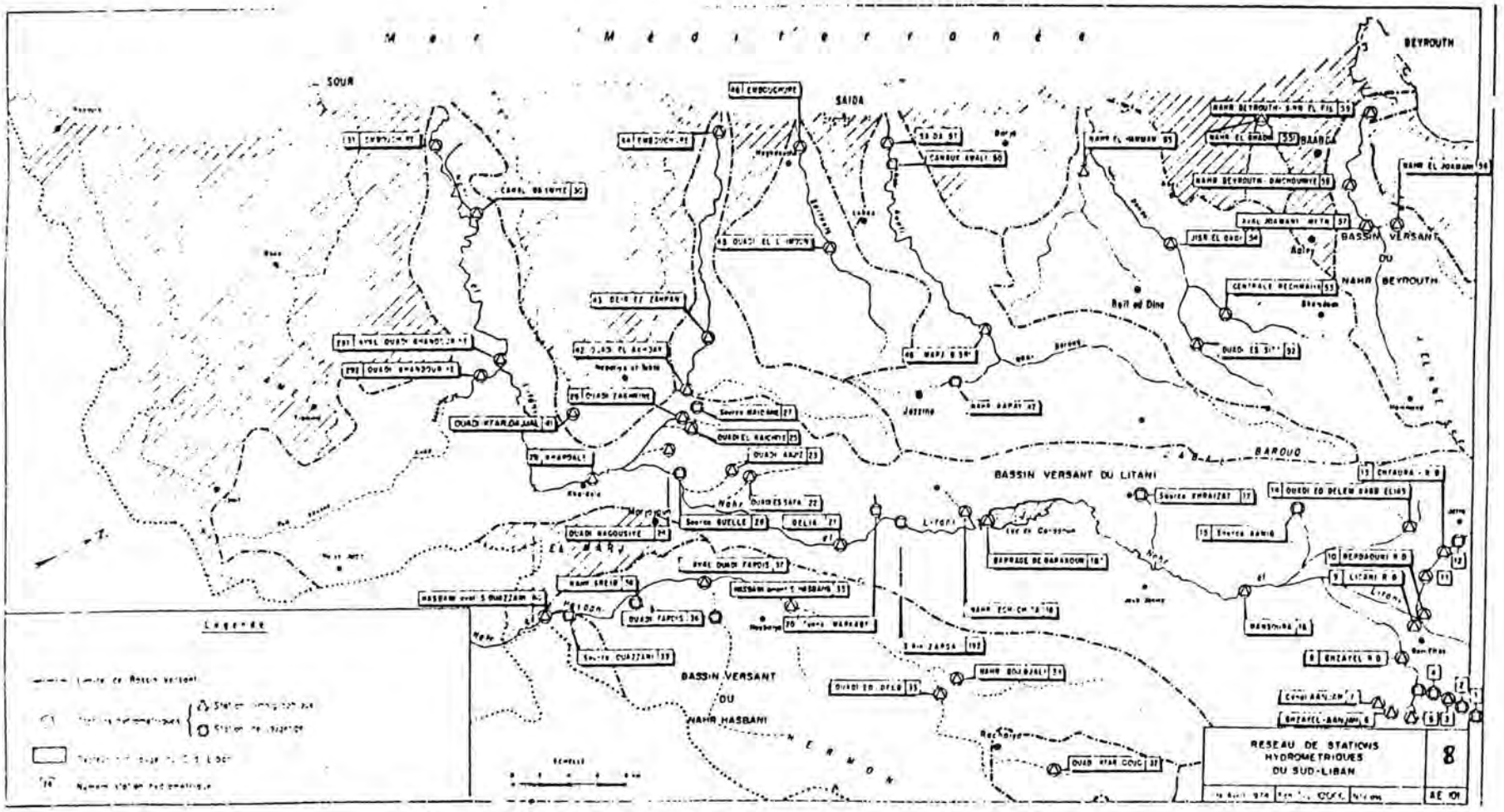


Figure 3: Locations of gaging stations on the Litani and its tributaries; gaging stations in adjacent watersheds also appear on the map.

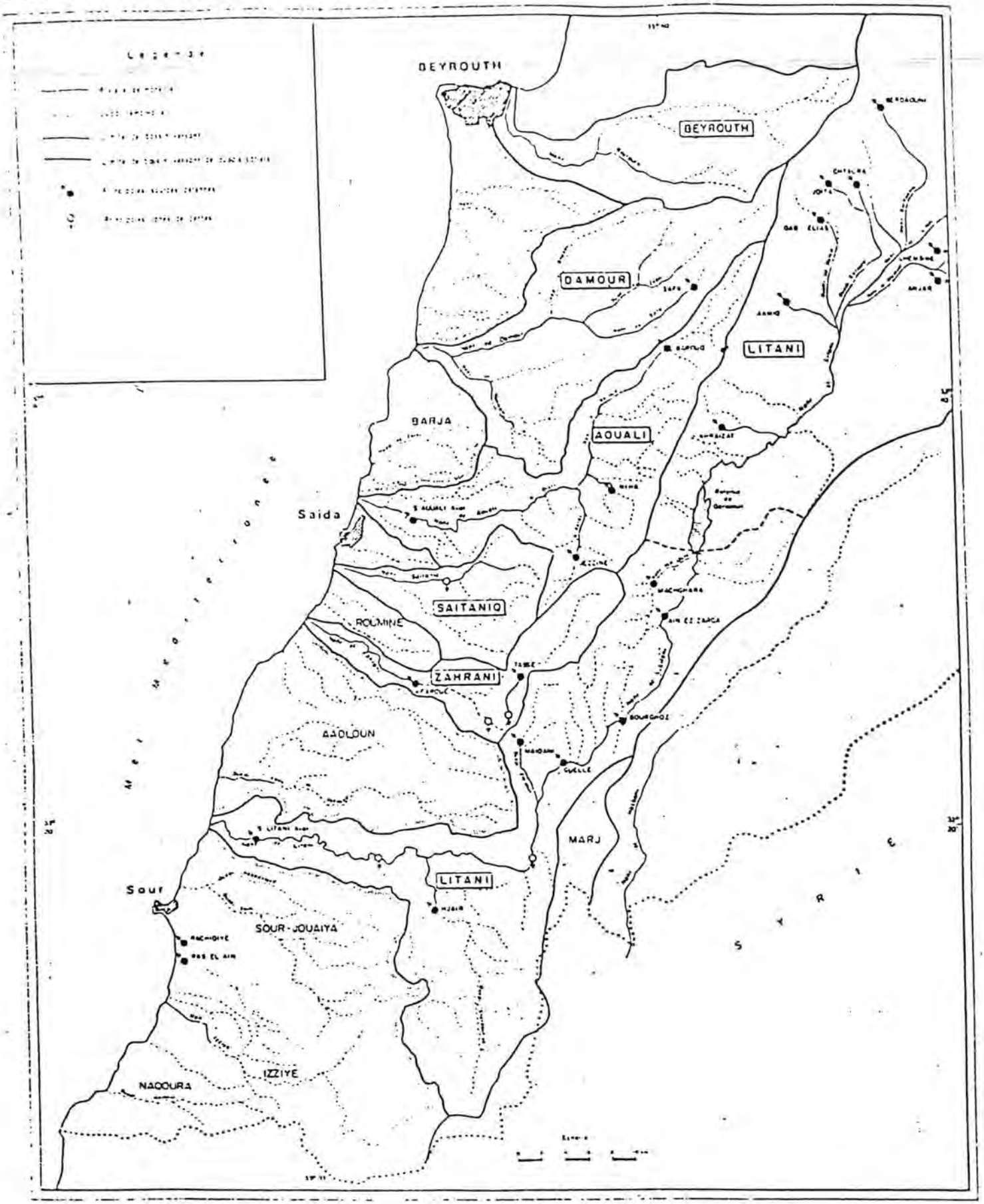


Figure 5: Configuration of drainage basins in the south of Lebanon

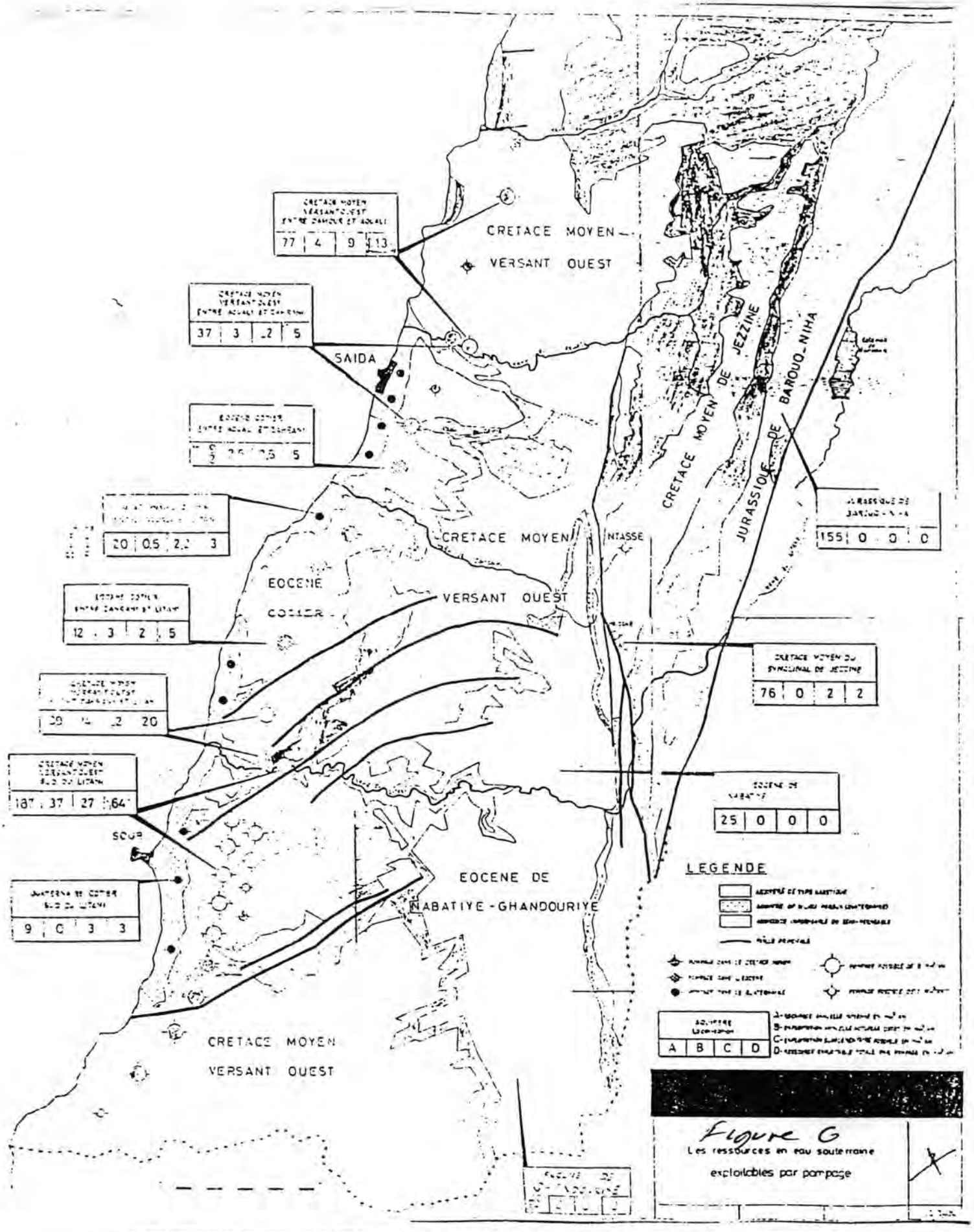
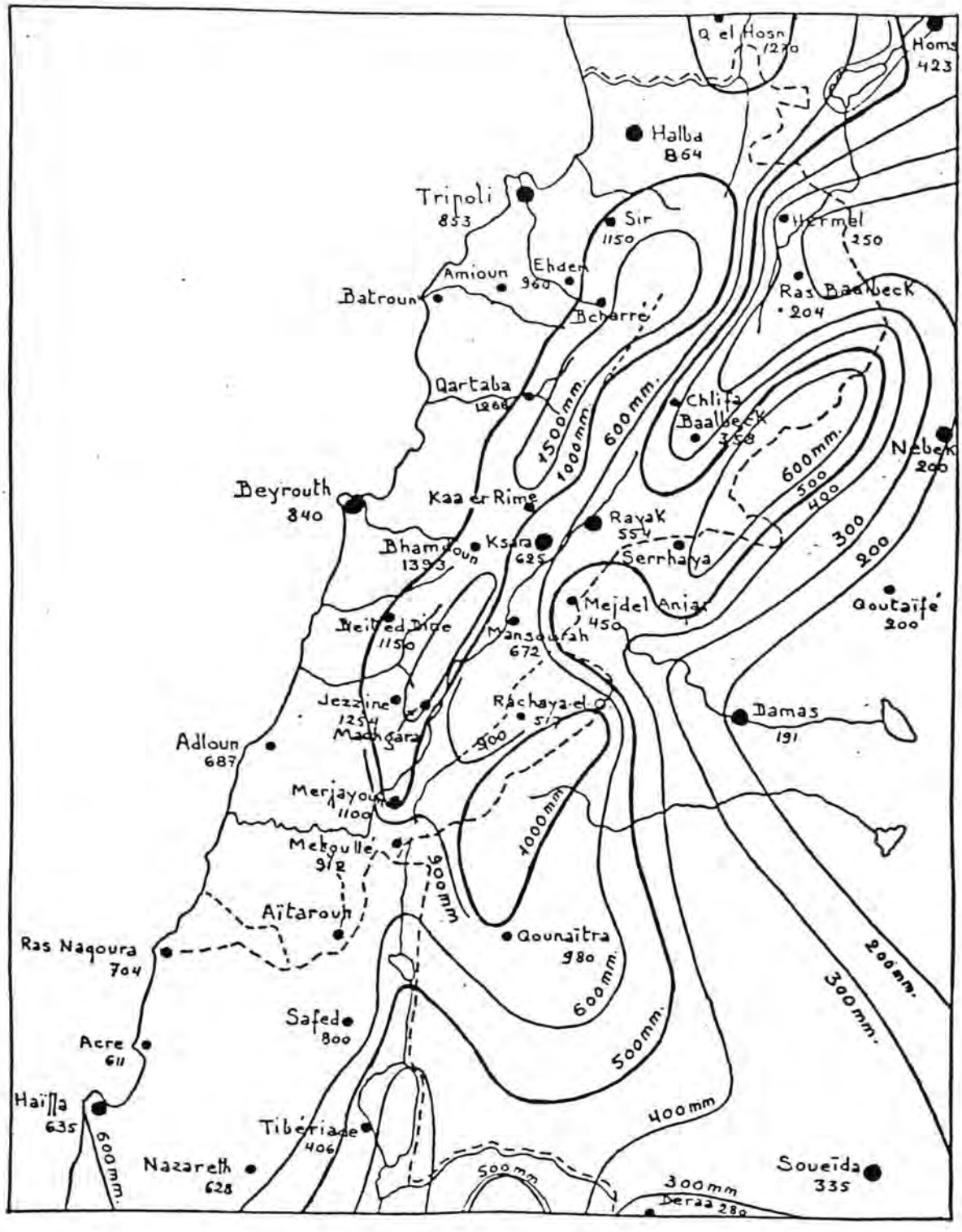


Figure 6

Les ressources en eau souterraine exploitables par parpage

MAP II

PRECIPITATION IN LEBANON (after Vaumas)



LEBANON

Area: 10,400 km^2

Population: 2,961,000 (United Nations estimate, 1976)

General

Lebanon is a mountainous country dominated by two parallel north-south mountain ranges: the coastal Lebanon range and the inland Anti-Lebanon range. The narrow coastal strip which borders the Mediterranean broadens in places producing the Akkar plain in the north and smaller alluvial areas in the Tripoli and Beirut localities. The inland elevated central Bekaa plain, lying between 650 and 1,000 m, is the source of the country's two major rivers, the Orontes and the Litani. Elevations up to 3,000 m along the Lebanon range and 2,300 m along the Anti-Lebanon range have a pronounced effect on the country's climate.

Lebanon's topographical configuration, with its orographical and geological structure, divides the country, into two major areas:

(a) The Mediterranean watershed (5,500 km^2) where numerous short costal rivers descend directly from spring sources on the western slopes of the Lebanon into the sea;

(b) An interior watershed (4,700 km^2), where the Orontes and Litani rivers eventually discharge into the sea.

The climate varies markedly across the country, owing to its unique physiography. The coastal mountain barrier intercepts both rain and humidity from the west; and the climate, vegetation and water resources graduate from a Mediterranean coastal environment to an inland Mesopotamian desert climate.

Rainfall is closely related to topography, elevation and distance from the coast, the coastal strip receiving annual rain of 900-1,000 mm; the coastal range, at 1,500 m, around 1,400 mm; the central Bekaa region, at Baalbeck, 400 mm; and the western flank of the Anti-Lebanon from 500 to 700 mm. Rainfall is essentially a winter event, with about 90 per cent being received during the period November to April; in general, January is the wettest month. Snow is frequently present above 1,500 m, melting snow being a valuable source of ground-water recharge. In general, the rainfall is not dependable, thus the cultivation of rainfed crops is a hazardous affair. For this reason irrigation is a most important factor, and the future development of agriculture requires that the investigation and development of ground-water sources has high priority.

Geology

Most formations are of a marine sedimentary origin and range in age from Jurassic to Quaternary. The Jurassic strata measure at outcrop more than

1,100 km^2 (600 in the Lebanon and 550 in the Anti-Lebanon), the Middle Cretaceous more than 4,200 km^2 (3,000 in the Lebanon and 1,200 in the Anti-Lebanon) and the Middle Eocene more than 200 km^2 in the central Bekaa region. The remainder of the country is covered by Quaternary alluvial and colluvial sediments, with basalts in the north.

Jurassic

This includes mainly dolomite, dolomitic limestone and reef limestone. The series has a thickness in excess of 1,600 m.

Cretaceous

Locally the Cenomanian-Turonian rocks range from 600 to 1,000 m in thickness and consist of limestone, marly limestone and dolomite. With respect to ground water, these are most important sediments and their widespread and interconnected karstic nature makes them the source of major springs in Lebanon.

Middle Eocene

These deposits occur only in the Bekaa plain region where they consist of a typical reef limestone formed in thickly stratified masses with inclusions of limestone breccia and some corals. The thickness varies widely but it is reported to be up to 1,000 m.

Vindobonian (Lower Tertiary)

These rocks have a very restricted outcrop area and occur only in the vicinity of Tripoli and at the mouth of the El Kelb river. They have a total thickness of about 250 m and include limestone and sandy marl.

The hydrogeology of Lebanon, together with the distribution of springs, their location and flow régime, is to a very large extent controlled by the geological structure imposed during the main rifting periods. In this respect Lebanon is notable for the density of its shearing and fracture network, which has had the effect of compartmentalizing wide areas of the aquifer and producing many simple overflow springs throughout the country.

The great Yammoune fault of the Lebanon range is hydrogeologically the most significant tectonic feature of the country. With a throw from 400 to 2,000 m, it possesses a thick 200-300 m zone of fault guage or breccia which acts as an impermeable barrier separating the karsts and aquifers of the east and west flanks of the Lebanon range.

Hydrogeological conditions and ground-water reservoirs

Apart from some coastal fan and plain deposits and the plains of the central Bekaa region, Lebanon's hydrogeology is determined by the distribution of the limestones and dolomites and their karstic features. The country can be divided into two distinct hydrogeological provinces: the karstic province and the province of porous formations.

Karstic province

The karstic province covers about 6,000 km^2, or about 60 per cent of the country. Throughout the province the land surface is characteristically of the karst type with sink holes, subterranean rivers, and spring seepage on the lower mountain flanks. Springs are classified according to the hydrological conditions that support them. Four types are identified:

(a) Those fed by perched unconfined aquifers;

(b) Those fed by unconfined aquifers which results from, for example, the filling and overflow of a compartment, or flow over an impermeable fault or stratigraphic barrier;

(c) Those fed by confined or artesian aquifers;

(d) Composite springs formed as a result of variations of the previous spring types.

The different régimes and localities of the karstic province can be summarized as follows:

Jurassic strata

Aquifer J I. In the north-western watershed of the Lebanon range, the springs are mostly of the overflow type, being caused by flow over a stratigraphic barrier;

Aquifer J II. In the western watershed of Lebanon, springs are caused by flow over stratigraphic barriers, although they are located at the lowest points of Jurassic outcrop and frequently in the valleys of the coastal rivers;

Aquifer J III. In the western flank of Mount Hermon, springs are again of the overflow type but, in this locality, are caused by flow over impermeable fault lines. Being on the Anti-Lebanon range, these springs are not permanent; their flow increases rapidly from April to July. The April to July period is sustained by contributions from melting snow;

Aquifer J V. Jebel Barouk-Niha. On the western and eastern watersheds springs are of the overflow type, caused by flow over a stratographic barrier and impermeable fault, respectively.

Cenomano-Turonian strata

Aquifer C I. In the western watershed of northern Lebanon, transverse fractures superimposed on fold structures produce several independent reservoirs or compartments. The springs are of the perched unconfined aquifer type and of the overflow type flowing over stratigraphic contacts. The submarine springs of the Chekka region are of the artesian type;

Aquifer C II. In the high plateaux of central Lebanon, these springs are the highest in Lebanon; they are of the overflow type caused generally by flow over an impermeable faulted barrier;

Aquifer C III. In the coastal plateaux of south Lebanon, the artesian springs occur because of the confining of the aquifer by the cover of marls and marly limestones of the Upper Cretaceous and Lower Eocene;

Aquifer C IV. In the western flank of the Anti-Lebanon, overflow springs of the stratigraphic contact type occur with some artesian sources in the Turonian-Senonian strata;

Aquifer C VI. In South Bekaa, localized river bed springs occur;

Aquifer C VIII. In the hills on the western border of Bekaa, localized overflow springs in the Yammoune fault compartment occur.

Eocene

Aquifer E I. In central Bekaa, minor artesian springs occur, which cease to flow in dry years;

Aquifer E II. In southern Bekaa, river bed springs occur where the Litani river cuts through a large synclinal formation.

Spring hydrology has been studied in detail. Conclusions are that all springs are seasonal and increase in flow following the main rains, particularly the January rains which are the heaviest. Where direct recharge exists instant response to rainfall is recorded, while those springs drawing on large reservoirs, and indirectly on recharge, show only gradual or delayed response. Some high altitude springs have a several months' delay due to water retention by the snow. This is released during the melting period in April-May. By October-November most springs have reached their lowest flow stage.

Province of porous formations

The province of porous formations covers about 4,200 km^2. Perhaps the most important area is the central Bekaa region, or the central valley, which contains the Orontes and Litani rivers. The plain is extensively developed for agricultural purposes, more than 31,000 hectares, 17,000 in the Orontes basin and 14,000 in the Litani basin, being irrigated. Water is pumped directly from the rivers and springs and from shallow wells. It is recorded that the Orontes River has regular monthly and annual flow, averaging 416 million m^3 per annum. By contrast, the Litani flow is not so regular and is most sensitive to pumping. It has a seasonally irregular average annual flow of 231 million m^3.

Aquifers in the central Bekaa region include:

(a) The Middle Cretaceous of the Lebanon range, a karstic limestone which is the source of three large springs, the Bordaouni, the Yammoune (in the mountains), and Ain Zarqa on the plain. This aquifer is very little exploited at present owing to the depth to water;

(b) The Middle Cretaceous of the Anti-Lebanon range, also a karstic limestone with important springs on the eastern edge of the plain (Anjar, Laboné-Ras el Ain Baalbek, Chemaine). These are at present exploited at 6 million m^3 per annum and there are plans to increase this to 21 million m^3;

(c) The Eocene of the Lebanon, a karstic limestone of limited extent and recharge, and little developed;

(d) The Eocene of the Anti-Lebanon, a karstic limestone with good recharge, at present developed to 21 million m^3 per annum with plans to increase pumpage to 30 million m^3 per annum;

(e) The Neogene-Quaternary aquifer of the plain, composed of conglomerates and alluvium and the most easily exploitable of all local aquifers. It is at present pumped at 36 million m^3 per annum and it is expected this could reach 60 million m^3 per annum.

In 1975, it was estimated that the total extraction in the central Bekaa was 63 million m^3 per annum. It is estimated that this yield can be safely increased to 111 million m^3 per annum.

The coastal plain of Akkar, with the Tripoli area, is the most important zone of the province of porous formations along the coast.

The plain of Akkar is located in the extreme north; it covers an area of 110 km^2 and is underlain by about 30 m of Pleistocene marine limestones, Quaternary talus, fan deposits and alluvium. Along the inland extremity of the plain there are occurrences of basalt interfingering with the sediments. Bedrock beneath the plain consists of Pliocene clays and marls from 30 to 198 m in thickness with Miocene evaporites, limestone and marl to 325 m. The plain contains both shallow and deep aquifer systems. The shallow aquifers receive recharge from the Nahr El Kebir and the Nahr Ostouene, and it is estimated that their safe yield is about 15 million m^3 annually, although an alternative estimate based on the amount of sub surface flow required to counteract sea-water intrusion is 34 million m^3.

The deep aquifer system is contained in the Turonian-Cenomanian limestone. This system has not yet been developed to any great extent in Lebanon, but it has been developed in the Syrian Arab Republic where it receives its main recharge. Beneath the plain of Akkar the aquifer is located between 495 and 547 m below land surface and is artesian. One typical test hole was tested at 95 l/sec free flow with a head pressure of 25 m above land surface.

The quality of water in the shallow aquifer is generally good, the total dissolved solids content ranging from 200 to 400 mg/l. Salinity increases towards the coast owing to a minor amount of seawater intrusion, with total dissolved solids in excess of 1,000 mg/l (3,000 mg/l near the mouth of the Nahr El Kabir). The deeper aquifer produces water of 3,725 mg/l. The water is sodium chloride in character and is believed to be contaminated with sea water.

The Tripoli-Koura-Zgharta region is the other important costal area. The main aquifer is the karstic Vindobonian reef limestone. The geology of the area includes a thin Quaternary surface veneer of conglomerates with a sandy marly matrix, overlying Upper and Middle Tertiary marls and conglomerates. The Lower Tertiary Vindobonian strata is mostly limestone, although it possesses numerous marly and sandy sections; it has a maximum thickness of 300 m though this is considerably reduced by erosion in places. The formation is karstic throughout, and in deep karsts it hosts the subterranean River Haab. Transmissivities in this aquifer vary widely as is characteristic for limestone. Best values of 10^{-2} to 10^{-3} m^2/sec are recorded in the Tripoli corridor area, whereas values recorded over the Koura-Zgharta plateau are generally in the range of 10^{-4} to 5×10^{-4} m^2/sec. In the latter region static water levels are deep at around 160 m; the aquifer is penetrated at a depth of 300-400 m.

The submarine springs of Chekka are estimated to flow at 10 m^3/sec from the Turonian-Cenomanian limestones at a depth of 120 m below mean sea level. Much investigatory work on the springs has been completed with the ultimate aim of onshore development. It has been shown that water moves to the sea via a complex of fault and karstic zones, and, like other springs, the Chekka springs show a season variation, the strongest flow being recorded in the late winter and early spring period.

Ground-water availability and use

Table 16 below gives a general evaluation of Lebanon's water balance, and shows the relatively considerable size of the water resource. It also shows that precipitation amounts to a total of 9,700 million m^3, or about 970,000 m^3/km^2 of the area of the country. Of this, about 5,400 million m^3 are lost through evapo-transpiration or go to ground-water storage, and 4,300 million m^3 run off. Of the run-off, approximately 510 million m^3 flow to the Syrian Arab Republic (415 million m^3 via the Orontes river and 95 million m^3 via the Kebir river) and 140 million m^3 to Israel (via the Hasbani river). Thus, the total amount of water available for use is approximately 3,375 million m^3, distributed as 820 million m^3 available in the dry season and 2,555 million m^3 in the wet season. The total amount at present stored, including the water in the Karaoun dam (across the Litani river) is around 500 million m^3.

Table 16. Lebanon: rainfall characteristics

(Millions of m^3/year, except where otherwise indicated)

Item	Mediterranean province	Interior province	Total (rounded)
Rainfall	6,396 (1.163 mm)	3,340 (711 mm)	9,700 (950 mm)
Total flow	2,942	1,351	4,300
Underground flow	1,980 (63 m^3/sec)	1,048 (33 m^3/sec)	3,000 (100 m^3/sec)
Streams	962	303	1,300
Flow deficit	3,454 (628 mm)	1,988 (424 mm)	5,400 (520 mm)
Run-off coefficient (percentage)	46	40	44
Underground flow coefficent a/ (percentage)	67	78	70

a/ Ratio of subsurface flow to total flow.

Ground water, theoretically utilizable, amounts to 600 million m^3 annually; of this, only 160 million m^3 are at present used, leaving a balance of 440 million m^3. Studies have shown that additional aquifer recharge during the humid season could increase the ground-water supply by 160 million m^3 as follows:

	Millions of m^3
Akkar Plain	15
Beirut area	10
Barouk/Nina mountains	50
Littoral (south)	20
South Bekaa	65

Therefore, total utilizable water resources amount to about 1,740 million m^3, as follows:

	Millions of m^3
Surface flow	820
Dam storage	500
Ground water	320
Submarine springs (Chekka springs)	100

The main planned irrigation schemes in Lebanon are as follows:

South Lebanon irrigation scheme

Eventually this scheme calls for irrigating 33,000 hectares in southern Lebanon. This includes an initial irrigation of 1,200 hectares near Saida and the reorganization of irrigation over 6,000 hectares already irrigated in the Qasmieh region. In 1972 a United Nations team prepared feasibility studies for this project.

Irrigation of south Bekaa

The irrigated area in south Bekaa was about 10,000 hectares in 1972. This project provides for normalizing and regulating the currently irrigated area, with the addition of 13,000 hectares, bringing the total irrigated area to 23,000 hectares. The water required amounts to 140 million m^3, of which 30 million m^3 will be drawn from the Karaoun lake, 74 million m^3 from ground water and 36 million m^3 from surface sources.

Hermel irrigation scheme

The project provides for irrigating 6,000 hectares in the Hermel area from the Orontes river waters in two phases. Phase one provides for the irrigation of

4,000 hectares by gravity, 2,500 hectares of which will be in the Kaa region and 1,500 hectares in the Hermel region. The second phase involves irrigating 2,000 hectares by pumping in the Kaa region and 500 hectares by pumping in Hermel;

Akkar Plain irrigation project

This project provides for irrigating 4,000 additional hectares in Akkar plus regularizing 6,000 hectares irregularly irrigated at present along with improving the irrigation supply for 2,300 hectares in the Bukaia plain (a smaller plain in Akkar near the border with the Syrian Arab Republic);

Koura Zgharta irrigation scheme

This project provides for the irrigation of 1,200 hecgares from a projected 40 million m^3 dam across the Asfour river in the Deir Beechtar area. The areas to be irrigated will be in the oases of Koura and Zgharta.

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WATER SUPPLY AND SEWERAGE SECTOR

A. DESCRIPTION OF SECTOR

Lebanon Water Resources

1. Lebanon has a relative abundance of water resources, but the demand is increasing whereas the development of water supply systems has been stopped for many years. The country will therefore face a critical situation in the near future unless prompt and effective action is taken. It was estimated, before 1975, that about 98% of the urban population (about 50% of the total population) were served with drinking water through house connections, and 85% of the rural population had reasonable access to piped water, but the service is poor because of water shortage. In the dry season, that is, the months of August to December, there is rationing throughout the country and the risk of pollution increases when the system is not under pressure: some 1,100 springs and 372 well systems are in operation. The quality of water from the springs is rather good, but their flow dwindles in the dry season. At that time, more water is pumped from the wells, even though those along the coast are salty.

Beirut Water Resources

2. The Beirut region is served by two water authorities: the "Office des Eaux de Beyrouth" (OEB) and the Aïn El Delbeh water agency. Together, they supply about 200,000 m^3/day in the dry season from the following sources:

	Dry season m^3/day
(A) OEB	
Jeita Spring	100,000
Kashkoush	50,000
Makhada wells(2)	4,500
Nahr El Kalb wells(2)	8,000
Champville well	2,500
Antelias wells(2)	9,000
Saltaneh Spring	10,000
Salomé wells	8,000
Hadeth wells	12,000
Dekwaneh wells	10,000
Sub-Total	214,000
(Water used for irrigation of agricultural land)	(60,000)
Total A available for drinking purposes	154,000

B. INSTITUTIONAL ASPECTS

6. One of the most serious obstacles to progress in water supply throughout the country is the great number of water authorities. All water supply authorities are controlled by the Ministry of Hydraulic and Electric Resources. However, a lack of clear division of responsibility among the Ministries of Interior, Public Health, Hydraulic and Electric Resources, the Municipalities and the State Agencies results in an absence of effective decision-making concerning water supply at the national level. The water supply management and control were shared among 73 authorities in 1966, but the number was reduced to 18 in 1971. At that time, the Minister of Hydraulic and Electric Resources submitted a proposal for further reduction of these bodies down to five, each one to be responsible for a province (Mohafaza). This proposal has never been acted upon.

7. For Greater Beirut, two authorities are involved in water supply:

(i) Office des Eaux de Beyrouth (OEB), which serves all the municipal area as well as its northeastern suburbs following OEB's merger with the Jal El-Dib concession. OEB has a staff of 500, including six engineers; this number is adequate to carry on the normal operation of the system.

(ii) Ain El Delbeh water agency, which serves the southern and southeastern suburbs, including Baabda, Hazmiyeh, Furn El Shebbak, Ain El Rummaneh, El Hadath, Burj El Barajneh, Mraijeh and Choueifat.

In 1974, the Government decided to merge these two authorities to create a single water authority for Greater Beirut, but this decree has not yet been implemented.

Tariffs

8. Except in Tripoli, most consumers are served through orifice controlled connections which are supposed to provide 0.5 or 1 m^3/day. Water is not metered but paid on a subscription basis. In recent years, the lack of control has greatly reduced the revenue obtained from user fees, and users remove or tamper with the orifice connection to increase their withdrawal above the subscription amount. In Beirut, the annual water charge had been unchanged from the time of the concession (before 1956) to 1978. It was agreed, during negotiations of the first Bank Reconstruction Project (Loan 1476-LE), that OEB would double that rate. A new tariff was implemented on January 1, 1979, and another one on January 1, 1982:

	From 1956 to Dec. 31, 1978	From Jan. 1, 1979 to Dec. 31, 1981	From Jan. 1, 1982
a) Orifices			
0.5 m^3/day	LL 50/year	LL 75/year	LL 175/year
1 m^3/day	LL 100/year	LL 200/year	LL 400/year
b) Meters			
1 m^3/day		LL 220/year	LL 495/year
Surplus		LL 0.70/m^3	LL 1.50/m^3

At an exchange rate of LL 4.0 for one US$, this works out at US$ 0.24 to 0.37 per m^3. These present rates should be adequate if OEB is able to collect the bills and to reduce unaccounted-for water. With this in mind, a decision has been made to replace, progressively, all the orifice connections with water meters. Its implementation is included in the study being carried out for the Beirut water distribution system, and financed by the first Bank Reconstruction Project (Loan 1476-LE).

9. For sewerage, the consultant of the National Waste Management Plan recommended that a National Waste Management Authority, responsible for planning, funding, training and monitoring enforcement, be established.

10. The mission recommends that the Government establish a National Water and Sewerage Authority, which would be responsible for the planning, designing and construction of new works, for the fixing of tariffs and for financing the execution of the various projects. It will also be responsible for the operation and maintenance of all the water and sewerage systems. The present Beirut Water Authority could serve as the nucleus for such a national entity.

C. DAMAGE ASSESSMENT

11. Many facilities were damaged, but most of these have been or are being repaired. The main problem of the water supply and sewerage sector stems from the lack of investments and maintenance over the last decade. In addition, during that period, the population has increased in most of the urban areas. Therefore, the needs cannot be met without a large rehabilitation and expansion program. This program was roughly estimated at about LL 350 million in 1982 prices.

D. RECONSTRUCTION AND DEVELOPMENT PROGRAM

12. The following investment program takes into account the priority needs, the status of preparation of necessary studies and the implementing

capability of the responsible agencies[1/]. A summary of the 1983-90 investment program is shown below, while Table 1 shows this program in greater detail.

INVESTMENT PROGRAM
(LL million in 1982 prices)

	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
I. Water Supply									
A. Reconstruction	33	121	146						300
B. Development			334	572	580	390	180	165	2221
II. Sewerage	50	80	150	320	400	350	350	350	2050
Sub-total I+II	83	201	630	892	980	740	530	515	4571
III. Supervision 5%	4	10	31	45	49	37	26	25	227
IV. Physical contingencies 15%	13	30	93	134	147	111	80	78	686
V. Studies	14.3	17.4	9.7	___	___	___	___	___	41.4
TOTAL	114.3	258.4	763.7	1071	1176	888	636	618	5525.4

E. The 1983-85 PUBLIC INVESTMENT PROGRAM

13. The 1983-85 program was estimated at LL 3028 million in 1982 prices and of which LL 1136 million are expected to be disbursed during this period. (Attachment 1 and Table 1)

F. TECHNICAL ASSISTANCE

14. Success in the implementation of the above program requires the completion, according to a reasonable schedule, of the following necessary studies:

(a) Bisri Dam feasibility study (to be completed by the end of 1983);

(b) Beirut water distribution feasibility study (to be completed by the end of 1984; a first phase would be completed in mid 1983);

1/ The Damour-Beirut water supply project could be included in this program if the updating of the Awali-Beirut study concludes that the Damour project is feasible as a first stage of the whole project.

(c) Updating of the Awali-Beirut water supply study;

(d) Beirut sewerage feasibility study;

(e) Sewerage feasibility studies for Tripoli, Jounieh, Zahle and Saida; and

(f) Oceanographic survey for sewer outfalls.

Financing of the (a), (b), (c), (d) studies above is included in the first Bank Reconstruction Project (Loan 1476-LE); the (e) study should be financed by UNDP and the Bank has agreed to finance the (f) study from the proceeds of the Loan 1476-LE.

15. Management consulting services will be necessary for the organization and establishment of a National Water and Sewerage Authority. The first phase of this action would aim at improving the management capability of OEB. The consultants would prepare detailed recommendations for organization and management, including salary structure accounting practices and tariff policy of the new authority. The contract would include technical assistance for implementation.

16. There is an urgent need for development of a national multipurpose water master plan. A major objective of the plan would be an increased coordination between developments in irrigation and potable water. The latter is often used for irrigation, while water authorities using the same resources cannot meet the needs of the population. The consultants, who would be recruited for this purpose, should be asked to prepare recommendations about the best allocation and use of all available water resources, including criteria for the decisions to be taken by the Government in this respect.

Table 1: WATER SUPPLY SECTOR INVESTMENT PROGRAM 1983-85
(LL million)

	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
I. WATER SUPPLY									
A. RECONSTRUCTION									
1. Beirut water authority									
Ongoing project	10								10
Dbayeh Treatment Plant	2	2	3						7
Improvement water resources	2	6	6						14
Tallet el Khayat pumping station	3								3
Achrafieh electrical station	1	4	7						12
Transmission line Jeïta-Dbayeh		20	30						50
Distribution system I		17	20						37
2. Aïn El Delbeh water authority									
Network rehabilitation and Improvement of water resources	3	5	7						15
Damour/Bordj Barajneh pumping stations	1	1							2
3. Networks rehabilitation									
Jounieh	2	10	13						25
Khiam	1	1	2						4
Joubeil	2	7	26						35
Saida	1	2	9						12
Zahle	1	8	11						20
Koubayat	1	1	2						4
4. Plants rehabilitation									
Taibeh treatment plant	3	3							6
Pumping equipment		24							24
Treatment plants		10	10						20
Sub-Total A	33	121	146						300
B. DEVELOPMENT									
Beirut distribution system II			100	100	100	100			400
Djebel Amel project			60	60					120
Anane project			50	100	150	20			320
Awali-Beirut water supply			50	130	180	120			480
Ouaissamani Lake			24	24					48
Azzibeh Lake			20	28					48
Chabrouh Dam			30	30	30	30			120
Beirut distribution system III							100	100	200
Tripoli water system				50	50	50	50	50	250
Tyre water system				30	30	30			90
Beit Eddine Dam				20	20	20			60
Bared Dam					20	20	20		60
Beit El Hadj Lake							5	5	10
Kafifane Lake							5	10	15
Sub-Total B			334	572	580	390	180	165	2221
Base Prices: (Total A + B)	33	121	480	572	580	390	180	165	2521
Supervision 5% 1/	2	6	24	29	29	20	9	8	127
Physical contingencies 15% 1/	5	18	71	86	87	58	27	25	377
TOTAL	40	145	575	687	696	468	216	198	3025

1/ Included in the cost of the project on Attachment I.

Source: Mission's Estimates.

Table 2: SEWERAGE SECTOR INVESTMENT PROGRAM 1983-90
(LL million)

	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
II. SEWERAGE AND WASTE DISPOSAL									
National Waste Management Plan I	50	80	100	170					400
Beirut Sewerage I			50	150	50				250
National Waste Management Plan II					200	200	200	200	800
Beirut Sewerage II					150	150	150	150	600
Sub-Total	50	80	150	320	400	350	350	350	2050
Supervision 5%	2	4	7	16	20	17	17	17	100
Physical contingencies 15%	8	12	22	48	60	53	53	53	309
TOTAL	60	96	179	384	480	420	420	420	2459
III. STUDIES									
Institution building		1.0	2.0						3.0
Awali-Beirut	0.5	1.0							1.5
Bisri dam	6.0	2.0							8.0
Beirut distribution system	4.0	4.0							8.0 1/
National Water Master Plan		1.0	3.0						4.0
Beirut sewerage	1.6	3.4	1.5						6.5
Jounieh, Zahle, Tripoli, Saïdi sewerage	1.2	2.6	1.2						5.0
Oceanographic survey	1.0	2.4	2.0						5.4
TOTAL	14.3	17.4	9.7						41.4

1/ An amount of LL 4.0 million was spent prior to 1983.

MINING, FUEL AND POWER

No minerals are known except a little lignite and some iron ore, smelted at Beirut. Salt is produced from sea water.

Because no oil was found, the Lebanese Petroleum Company (an IPC affiliate) abandoned its exploration licence in 1948. It was reported, however, that Rompetrol of Rumania in 1975 discovered large oil reserves in Akkar, the western Bekaa area of Lebanon, and in the Mairoba area. Subsequently, the government approved a draft law cancelling licences granted to three Lebanese companies, because of their failure either to meet financial obligations or to begin drilling. These companies hold concessions on over 90 per cent of Lebanese territory. The government awarded a concession for offshore oil exploration to the US company Tripco but also invited competitive bids for offshore drilling, raising doubts about the future of the Tripco concession. The situation since the war broke out is, however, unclear. With the so called end of the war in 1976, a new Higher Oil Committee was formed to be in charge of exploration, refining and oil imports. The unsettled situation since then has prevented any intensive attempts at oil exploration, although in February 1979 it was announced officially that finds had been made offshore.

Two important pipelines cross the country, both terminating in refineries at Lebanese ports. The refinery at Tripoli, owned by the government since 1973, has a capacity of 30,000 b/d and until 1976 drew its crude from Iraq's Kirkuk fields. Under normal conditions it supplies about 70 per cent of domestic demand. Cheap supplies of Iraqi crude stopped at the end of 1975 and in April 1976 pumping was suspended following disputes between Iraq and Syria/Lebanon, the latter losing significant income from transit dues. Iraq resumed supplies to Syria in 1979, but by mid 1981 the resumption of Kirkuk crude flow to and through Lebanon had not occurred. In March 1981 the Lebanese minister for industry and petroleum announced that he had initialled a ten year agreement with Iraq for the resumption of supplies for the northern terminal. According to some reports Iraq had agreed to pump 200,000 b/d along the 60 km section running through Lebanese territory. which actually has a 400,000 b/d capacity. In the interim the Tripoli refinery has been using crude brought in by sea and from Saudi Arabia via the other pipeline to the Zahrani refinery. Only 5,000 b/d were processed in 1976 (compared with an above capacity 36,000 b/d in 1975) but by 1980 approximately 30,000 b/d of Saudi crude was imported for the Tripoli refinery.

The country's other refinery is at Zahrani near Sidon. Starting operations in 1955, it is owned by Medreco (The Mediterranean Refining Company: 50 per cent Mobil, 50 per cent Caltex) and has a capacity of 17,500 b/d, accounting for the remaining 30 per cent of local demand. Tapline suspended pumping in 1975 on the grounds that tankers found it cheaper to lift supplies directly from Saudi Arabia's Ras Tanura Gulf terminal, a move which again cost the Lebanese government substantial royalties. The refinery, damaged like that at Tripoli during the civil war (an event which led to the withdrawal of most of the foreign marketing companies), restarted operations at the end of 1976 when Tapline resumed pumping (for both refineries) in order to avert an energy crisis. An agreement was finally reached on past debts

and future payments in August 1978 with Saudi help, but it was not until early 1979, after the fall in Iranian exports after the revolution, that fullscale supplies were restored. Since then, agreements to maintain supply have tended to be on an ad hoc basis, giving the impression that Saudi Arabia would prefer Lebanon to reach agreement with Iraq. Lebanon, too, would prefer the cheaper Iraqi supplies. Lebanon's debt to Tapline has been mounting rapidly and Saudi Arabia has had to intervene. In 1980, the country's fuel bill, including 6,000 b/d of imported gasoline, amounted to $560 mn, and in 1981 the government was facing a possible L£860 mn deficit on its oil account. Major price increases were announced late in 1981 to try and correct a situation in which the government was recovering only 40 per cent of the price of the oil it sold.

Lebanon is dependent on both hydraulic resources and hydrocarbon fuel for electricity production. The country gradually built up its power generation capacity in the 1960s to a level at which it could export to Syria while allowing almost 100 per cent of domestic households access to electric energy. The Electricité du Liban's network, which covers 85 per cent of the country, includes eight thermal generating plants and seven hydraulic stations which produce close to 1.7 bn kwh a year. Total power generated in 1975 was 1.826 kwh but in 1976 this level suffered a drop to 1.009 mn kwh because of damage to installations and the power grid. In 1977 total production was almost back to 1975 levels and has risen steadily since to reach 2,156 mn kwh in 1979 and 2,325 mn kwh in 1980. These production figures do not include imports from Syria via the Bekaa, which amounted to some 67 mn kwh in 1980. According to the EDL, in 1979 households and the electrification of roads and highways accounted for 46.6 per cent of total consumption and industry accounted for 25 per cent.

Electricity Production, 1974-1978
(mn kwh)

	1974	1975	1976	1977	1978
Total Lebanon	1,975	1,826	1,009	1,839	1,975
Hydroelectric	820	801	701	957	...
Thermal	1,155	1,025	308	882	...
Total EDL	1,679	1,554	858	1,525	1,687
Hydroelectric	732	706	625	845	944
Thermal	947	848	233	680	743

Source: L'Economic Libanaise, 1978.

The EDL estimates that it lost L£59 mn as of 1978 due to civil strife. And areas of Beirut and elsewhere have experienced major power failures and shortages since 1975, especially during winter months. Unable to meet total demand, the EDL concluded an agreement with the Syrian Electric Power Authority to supply additional power during a five year period, from 1978 to 1983. In 1980 the EDL announced a reconstruction plan costing some L£1.617 bn to extend to the year 1983. The plan aims to expand capacity at the Jiyyeh thermal plant, the Zouk station and to extend the Syrian-Lebanese power grids. By 1985

another power station at Batroun, of five 150 mw units, is scheduled for completion. Another seven year plan, costing L£2.2 bn, is in hand which aims at meeting demand through the 1980s. A major problem, however, is that the potential for further expansion of hydroelectric power is strictly limited, with its contribution to total electricity production estimated to fall to 13 per cent of the total by 1986.

MANUFACTURING INDUSTRY

By Middle Eastern standards, Lebanon is relatively industrialised, with industry accounting for 14.3 per cent of GDP in 1973 and industrial products accounting for the bulk of exports. According to a survey carried out by the Direction Centrale des Statistiques in 1975, there were then 18,118 industrial establishments employing 125,000 workers. Clothing, textiles and leather industries made up 39 per cent of the total and 3,467 enterprises were engaged in making wooden furniture and other items of wood. 3,043 firms produced food and beverages. Plants have been opened in recent years for milk pasturisation, paper, cosmetics and pharmaceuticals, solar equipment, steel production, aluminium articles, detergents, cans, car batteries and superphosphates. Cement production is very important, with production last year at 2.1 mn tons. A second plant at Sibline comes onstream next year. Total capital invested, according to the survey, amounted to L£2.5 bn in 1974. The value of industrial output was put at L£2.3 bn with exports valued at L£836 mn. Only five firms were capitalised at more than L£25 mn but some 150 were worth more than L£1 mn.

The civil war hit industry badly, leaving an estimated 250 factories damaged or destroyed. Direct war damage to industry in the 1975/76 war is estimated at between L£500 mn and L£700 mn while indirect damage estimates reach as high as L£2.230 bn. Some 50,000 to 60,000 skilled and semi-skilled workers have permanently emigrated. The Ministry of Industry calculated that, in addition, the outbreak of fighting between the Christian militias and the Syrians in 1978 alone cost industry L£1.25 bn. Productivity dropped sharply after the war and in 1977 operated at only two thirds of capacity, due to damage, displacement and shortages of workers, difficulties in obtaining credit, transport problems and shortages of raw materials. In 1978, plants were operating at some 60 per cent capacity and total output was estimated at L£2.5 bn. In 1979, the value of industrial exports by the private sector rose to L£1.3 bn, 51 per cent more than in 1978, although a significant portion of this rise was due to higher prices caused by rising oil costs and more expensive imported raw materials and labour. The fall in the value of the Lebanese pound was also an important factor. The Beirut Chamber of Commerce and Industry estimated that the value of industrial output in 1980 was some L£4.5 bn but undoubtedly this year's fighting has caused another decline.

There has been an increasing trend towards economic partition along the Moslem/Christian axis which has affected the industrial sector. Before the war Beirut had 80 per cent of industrial enterprises, but the capital was only third in popularity for new industrial sites in 1980 with nine new plants. Zahleh, in the Bekaa valley, was first with 13 applications, followed next by the Shouf region south east of Beirut with ten, Tripoli with seven, the western Bekaa with seven and north Metn with

prepared. In the medium term a fourth basin project will be completed and in the longer term a fifth basin is envisaged. Capacity is to be raised to 6 mn tons a year. Plans are also in hand to expand Tripoli port to handle 3.58 mn tons of cargo a year. In 1980, the Sidon multi-millionaire, Rafiq Hariri, was awarded a concession to build a new port at Sidon. He will be required to set up a joint company with the Council for Reconstruction and Development, capitalised at some L£250 mn, in return for 30 years of concessionary rights.

The problems of collecting customs revenue and of smuggling are enhanced by the fact that all ports, including the small illegal ones, have their own characteristics and effective ownership. Beirut, with its many government checkpoints, is still largely Christian run, while Jounieh, the main entrance point for consumer goods and Israeli arms, is firmly in Christian hands as are Safra (Phalangist control) and Chekka (privately owned). Tripoli, the largest port in the north, and Sidon, the largest in the south, are broadly government controlled, but Tyre and is a Palestinian port. Other illicit ports include Dbaiye Jiyye, north and south of Beirut respectively. There are said to be some 15 illegal ports along the 210 km coastline. Total customs collected at the ports rose only marginally from 1979 to 1980, up from L£679,875 to L£682,335.

All railways in Lebanon are state owned. The network comprises 335 km of standard gauge track, including the coastal line which crosses the Syrian border to Homs and a section in the Bekaa, and a 105 cm gauge line across the mountains to Damascus. There is a plan, costing L£65 mn, to develop the line from Sidon to Beirut and on to Tripoli. In 1973 the railway system carried 512,000 of freight and 2.8 mn passengers/km, grossing revenues of L£2.5 mn.

Lebanon has 7,100 km of roads, of which 1,990 km are classified as main roads. Even before the civil war, the network was considered outdated and inadequate and while some reconstruction and revamping has been carried out since, it is estimated that 3,500 km are in need of renovation. Shortage of funds has held back the reconstruction effort, as well as intermittent fighting, but there is no shortage of new projects in the pipeline, including a highway from Beirut to Tripoli, funded in part by the World Bank. Projects currently in progress are estimated to cost L£274 mn. An estimate has put the number of private cars at 325,000 in 1978 but illegal operation could make this figure significantly higher.

The expansion of Beirut international airport continues despite intermittent fighting. In 1974, Beirut handled over 2.8 mn passengers and 145,897 tons of cargo, after which there was a period of strong fluctuation. A firm upward trend was established by 1980, in which year there were 1.66 mn passengers. Expansion plans, which will cost L£1 bn, aim to boost capacity to 6 mn passengers a year by 1985. 24 international airlines use the airport. Christian separatists built a second airport at Haimat in 1977, costing some $2.5 mn, named the Pierre Gemayel International Airport, but it is not in use.

In 1979, the Association of Lebanese Industrialists claimed that they needed some L£5 bn in repair costs and capital to revive the sector. Last year, it was again claimed that extraordinary help from the government was needed to put industry on a healthy footing. Proposals included the following: legislation to spread credit over seven years, with the maximum interest put at 5 per cent; compensation to badly hit industrialists and cheap credit over a ten year period; the creation of a fund for industry; the supply of constant and cheaper electricity; the reduction of fuel and gas oil prices to industry by at least half; the repair and extension of telex and telephone lines and the reduction of their cost to industry by at least half; the guarantee of security at ports and on roads; the introduction of measures to stop smuggling; the reconsideration of the customs system and exemption of all raw materials and machinery; the reconsideration of foreign trade agreements; the simplification of the procedures to obtain work permits and permits for building and investment; the elimination of industrial zones and the freedom to establish plants anywhere; and the reconsideration of tax laws to promote industrial investment. Some measures such as tax exemptions and state guaranteed loans from banks have been made available but the industrialists claim that these are inadequate.

TRANSPORT AND COMMUNICATIONS

The Lebanese economy rests on commerce rather than industry, and is based on a free market, free port and no currency control. After a slack period, traffic at the port of Beirut increased from 642,750 tons in 1967 to 4.0 mn tons in 1974. The main petroleum traffic and some merchandise trade go through Tripoli. The port of Sidon, south of Beirut, which received only 13 ships in 1975 with 16,245 tons of cargo, became the main port for the Moslem side when the Beirut port closed. Jounieh, the Christian port south of Beirut, handled 111,024 tons in 1978.

Traffic at Lebanese Ports

('000 tons)

	1974	1978	1979	1980
Beirut	4,080	1,578	2,600	2,980
Tripoli	836	902	1,001	687
Sidon	-	174	78	140[a]

a Three quarters only.

Sources: Beirut Chamber of Commerce; Tripoli Port Administration; Sidon Port Administration.

The port of Beirut was turned into a battleground and almost totally destroyed during the war. In 1978 it was closed for five months, for 44 days in 1979, and there were periodic closures in both 1980 and 1981. War damage to the port, including the 1978 troubles, is put at L£66.2 mn. The rebuilding and development of the port is a top priority and a two stage project, costing L£1.15 bn, has been

Lebanon's Middle East Airlines (MEA) was one of the most successful lines in the world before the war and has recently regained much of its momentum. Its fleet consists of three Boeing 747s and 18 Boeing 707s and 720s. The country's other airline, the all-freight Trans Mediterranean Airways (TMA), has ten Boeing 707 cargo freighters operating worldwide cargo services.

Telecommunications, too, were disrupted by the civil war. There were 225,000 telephones in use in 1978 and 2,000 telex lines. Before the end of 1982 these will be increased by 220,000 telephone and 6,000 telex lines. Before the war Beirut's position as an international communications centre had been enhanced by the inauguration of an earth satellite station in 1969, the laying of a submarine cable to Marseilles and another, in 1972, to Alexandria (as part of the Damascus-Cairo link). There are some 425,000 television sets and 1.3 mn radio receivers.

There are a handful of important Arabic daily newspapers, several smaller ones and two French language newspapers. In addition, there are a number of weeklies and monthlies.

FINANCE

The general budget covers all government current and capital expenditure, except that of the telephone administration, the national lottery and the Cereal and Sugar Beet Office. Post war budgets have been characterised by rising deficits, reflecting high civil service salary increases and the government's inability to collect direct and indirect taxes, and by large allocations to defence, education and public works. Debt repayment is also becoming an increasing burden on the exchequer. Recent substant annual budgetary increases also reflect the high rate of internal inflation.

General Budget, 1979-1981

(L£'000)

	1980	% of total	1981	% of total
President's Office	2,603	0.1	2,733	0.1
Chamber of Deputies	14,773	0.4	14,894	0.3
Prime Minister's Office	76,102	1.9	139,930	3.1
Justice	37,737	0.9	34,015	0.7
Foreign affairs	64,159	1.6	69,111	1.5
Interior	244,305	6.1	274,058	6.1
Finance	60,233	1.5	67,882	1.5
Defence	1,140,937	28.5	1,058,463	23.6
Education	588,695	14.7	712,088	15.9
Health	125,109	3.1	134,911	3.0
Labour & social affairs	68,197	1.7	91,519	2.0

(continued)

General Budget, 1979-1981 (continued)
(L£'000)

	1980	% of total	1981	% of total
Information	17,027	0.4	18,322	0.4
Public works	579,394	14.4	489,975	10.9
Agriculture	49,918	1.2	53,837	1.2
Economy & commerce	157,714	3.9	207,346	4.6
Posts, telegraph & telephone	31,347	0.8	33,637	0.7
Hydroelectric resources	44,050	1.1	65,712	1.5
Tourism	31,347	0.8	34,452	0.8
Industry & petroleum	2,947	0.1	3,437	0.1
Housing & co-operatives	7,256	0.2	7,384	0.2
Debt repayment	372,288	9.3	392,369	8.7
Other	291,746	7.3	582,925	13.0
Total	4,007,884	100.0	4,489,000	100.0

Source: Ministry of Finance.

Annexed Budget, 1979-1981
(L£ mn)

	1979	1980	1981
Telephone	188,915	200,475	291,700
National lottery	65,500	69,000	85,000
Cereal & sugar beet office	43,500	266,500	345,500
Total	297,915	535,975	722,200

Source: Ministry of Finance.

The development budget is wholly dependent on aid but in 1980, only 38 per cent of the Arab aid promised at the Tunis summit was received. Even so, 58 per cent of the development budget was earmarked for defence. And looking at the revenue side, it is difficult to see how the government can expect the budget to be balanced by a fair rise in direct taxation, some growth in indirect taxation and funds, representing 33 per cent of the total, which are labelled "exceptional revenues". It will not be until 1983 that the government is scheduled to collect 1979's personal and corporate income tax. Smuggling has greatly reduced customs revenue.

Development and Allocation of Lebanon's Budget: 1974-1980

	1974		1980		1981	
Expenditure	L£ mn	%	L£ mn	%	L£ mn	%
Current	835.6	68.3	2,639.4	68.2	3,393.7	67.2
Capital	175.9	14.3	875.1	22.6	1,095.3	21.7
Development	213.5	17.4	354.5	9.6	562.9[a]	11.1[a]
Total	1,225.0	100.0	3,869.0	100.0	5,051.9	100.0
Revenues						
Direct taxes & levies	342.2	32.1	719.6	28.8	1,013.1	33.7
Indirect taxes	458.8	48.0	964.3	38.6	1,111.7	37.0
Public sector revenue	31.2	3.1	28.8	1.2	22.5	0.8
Various	169.8	16.8	789.3	32.4	855.7	29.5
Sub-total	1,011.0	100.0	2,502.0	100.0	3,003.0	100.0
Exceptional revenue (=deficit)	214.0		1,367.0		1,486.0	
Total	1,225.0		3,869.0		4,489.0	

a Totally dependent on Arab aid.

Sources: The Arab Economist; Arab World File; Le Commerce du Levant.

Development plans

Early in 1958 a five year, L£800 mn development plan was prepared, but the political crisis stopped progress. Subsequently, another five year development plan, effective at the beginning of 1962, was promulgated. But its application was delayed while attempts were made to reorganise the planning administration. A third five year plan was proposed in 1972 which envisaged a growth rate of 7 per cent a year and expenditure of L£7.2 bn.

Several large projects recommended in the plans were undertaken, including the construction of a third basin at Beirut port, motorways, airport improvement and rural electrification and water supply schemes. The new coastal highway from Beirut to Tripoli was being helped, before the war, with an IBRD loan of $25 mn. Extensive works to be undertaken by the Litani project office were delayed, however. Also, before the fighting started, the government launched a "Green Plan", which aimed to bring 100,000 ha of arid land under cultivation at a cost of L£27 mn; afforestation was to be also included in the scheme. Again little has been accomplished. For the most part development projects have been small and individual, with many small grants having been made to municipalities and villages.

In response to the civil unrest in 1975 caused in part by economic disparities, the government announced a programme to aid agriculture in the south and to build schools and low cost housing both in rural and urban areas. A national health plan, too, was under consideration. But as the fighting gained momentum into a full scale civil war, all such projects were abandoned. The concept of development was superseded by plans for reconstruction, requiring considerable outside aid.

A Board for Development and Reconstruction was set up in 1977 to channel inflowing loans and grants to various banks for disbursement. Given the precarious political situation, the hoped for injections of massive aid from the oil rich Gulf states did not materialise and major reconstruction plans for the port and downtown Beirut were postponed. Early in 1979, in spite of the lack of funds, the board unveiled a vast L£22 bn reconstruction plan to span five years. It includes 18 main projects in the public sector costing an estimated L£10 bn which require L£6.4 bn in the form of foreign assistance. Private sector needs are reckoned at L£12 bn, of which L£3 bn will be required from outside sources.

CDR Reconstruction Programme

(L£ mn)

Housing	
Repair and reconstruction of damaged houses	1,800
South Lebanon relief programme	200
New low cost housing units	2,500
Sub-total	4,500
Potable water and irrigation projects	
Al Awali potable water project	170
Jabal Amel and Iqlim el Kharroub water project	52
Al Assi water project	100
Sub-total	322
Schools and hospitals	
Repair, reconstruction and re-equipping various hospitals and infirmaries	393
Sub-total	393
Road reconstruction and repair	
Complete construction of major roads stopped by the 1975-76 war	1,557
Upgrading and expansion of the Beirut international airport	655
Restoration, upgrading and expansion of the port of Beirut	258
Raising electric power generating capacity	635
Communications and wireless	740
Reconstruction of the downtown commercial district of the capital	900
Private sector contribution (foreseen expenditure)	8,000
State expenditure to assist the private sector	4,000
Grand Total	21,960

Source: Council for Development and Reconstruction, 1980.

The Reconstruction Budget for 1981

Project	South Lebanon	Other areas	Total
Housing	100	50	150
Water	25	59	84
Hospitals and health	50	77	127
Roads	75	100	175
Port of Beirut	-	175	175
South Lebanon			
Unicef - CDR	150	-	150
Public housing	-	36	36
Coastal highway	-	5	5
Council for the South	100	-	100
Training	-	8	8
Litani project	-	10	10
Total	500	520	1,020

Source: Council for Development and Reconstruction, 1980.

After the war, the government did not receive anything like the aid needed to finance reconstruction. Total assistance to Lebanon over the five years to November 1979 was put at $400 mn, of which the Arab share was $130 mn to $354 mn in loans and $46 mn in grants. In November 1979, at the Arab summit conference in Tunis, Lebanon was pledged $2 bn over a five year period. The pledges were as follows:

Country	Total contribution ($ mn)	Annual contribution ($ mn)	Share (%)
Saudi Arabia	571.4	114.3	28.6
Kuwait	314.3	62.9	15.7
Libya	314.3	62.9	15.7
Iraq	297.1	59.4	14.9
UAE	228.7	45.7	11.4
Algeria	142.8	28.6	7.1
Qatar	131.4	26.3	6.6
Total	2,000.0	400.0	100.0

The Arab donors, however, dragged their feet, and only $153 mn of 1980's $400 mn allotment was received that year, with only Iraq fully honouring its commitment. Meanwhile the cost of reconstruction has soared. Nevertheless, some projects such as development at Beirut port have gone ahead and, thanks to aid from the Kuwait Fund, reconstruction and expansion of Beirut airport is in hand. In the last year, emphasis has been shifted to aid for the war devastated south and away from major capital projects in central Lebanon.

It must be emphasised, however, that apart from the central reconstruction efforts there are plans for development in the enclaves. The Phalangists, for instance, announced this year an economic and social "plan for action" and stated that nine committees had been constituted to carry it out in the Christian enclave. Areas such as housing, social security, taxation, trades unions and education are also under study with a view to building a state within a state, including an autonomous economic and financial framework, although at the same time the enclave is happy to enjoy the benefits of such reconstruction funds as can be derived from the central government.

Banking

Before the war, Lebanon was an important banking centre. Many organisations moved their headquarters from Cairo to Beirut after 1952 and, especially after 1973, oil revenue from the Gulf was pumped into the country. During 1972 and 1973 Beirut also established itself as an international financial centre when loans were arranged through Beirut banks to the IBRD, Renault, India, Iran and Algeria. The system of free exchange and strict secrecy attracted money from a variety of sources. Total deposits in 1974 were L£9 bn and there were 79 banks.

The banking sector was badly hit by the war and banks closed between December 1975 and February 1976 and again between March 1976 and January 1977. Besides suffering a loss of international confidence, many banks were burned to the ground and looted. Nevertheless it is estimated that only L£300 mn of the sector's total investment of L£7 bn has had to be written off and part of this was covered by special reserves.

A new banking free zone law, designed to lure back foreign firms, came into effect on April 1, 1977, and the ten year moratorium on licensing new banks was lifted. But legislation was also passed regulating the opening of new branches in post war Lebanon, giving the Central Bank almost absolute powers and the minimum capital requirement was raised from L£3 mn to L£15 mn. The twelve foreign banks (out of a total of 81 banks) were required to keep 10 per cent of profits inside Lebanon in order to strengthen reserves, while Lebanese banks were required to do the same on domestic as well as foreign profits. New laws were introduced last year putting further restrictions on the banks in an attempt to soak up excess liquidity.

In general, the financial system has recovered from the war. The semi-state Agricultural and Industrial Bank, the Popular Housing Bank, the National Bank for Industrial and Touristic Development and the Banque de Financement are aiding in the reconstruction effort. In 1978 Beirut regained its position as the leading gold entrepot in the Middle East and the stock exchange reopened in March 1979. The commercial banks at end 1981 were carrying deposits of around L£26 bn.

The banking sector has become somewhat distorted over the past two years as a result both of the falling value of the Lebanese pound and the lack of local investment opportunities. About a third of all deposits are now estimated to be held in foreign currencies, principally the US dollar, and most banks concentrate on short term trade financing. The government has been heavily dependent on commercial bank loans via three month treasury bills to cover its deficit, and banks have successfully argued for higher, more competitive rates on these bonds. In mid 1981 a new low yielding six month bond was issued allowing banks to place their legal reserve requirements with the Treasury.

Although the performance of the stock exchange in 1980 and 1981 was characterised by an almost total collapse of trading, there have been developments aimed at encouraging the growth of a capital market in Lebanon. A number of bond issues, fixed rate and convertible, have been arranged for companies wishing to raise money, and in 1980 the draft constitution of a company called the Société Financière du Liban was approved; the company is to establish a secondary market for Treasury bills, government and public sector bonds, and will introduce new financial instruments such as bankers' acceptances, certificates of deposit (CDs), and security papers.

Lebanon has had difficulty in reestablishing itself as an insurance centre in the Middle East in the face of domestic inflation and competition from the Gulf states, particularly Bahrain and the UAE. In moves to improve the name of Lebanese insurance, the minister of economy and trade ordered six foreign companies to stop operations in Lebanon in August 1980 and proposed changes in insurance companies' operating conditions. These included raising the minimum capital of a company from L£1 mn to L£5 mn, and raising each branches' collateral from L£100,000 to L£600,000. In mid 1981 six local insurers formed a pool to offer limited war risk cover for houses and cars of Lebanese citizens.

Bank of Lebanon, 1974-1980

(L£ mn: end of period)

	1976	1977	1978	1979	1980[a]
Foreign assets	4,957	5,873	6,683	6,252	7,466
Claims on government	803	891	843	1,476	1,207
Claims on private sector	45	33	76	110	125
Claims on commercial banks	165	101	77	72	46
Reserve money	4,229	4,751	5,384	5,209	6,124
of which:					
currency outside banks	3,084	2,729	3,286	3,506	3,912
Government deposits	1,491	1,843	1,716	1,829	1,797

a September.

Source: IMF International Financial Statistics.

Commercial Banks, 1974-80

(L£ mn)

	1976	1977	1978	1979	1980[a]
Reserves	1,074	1,898	2,067	1,403	2,096
Foreign assets	4,525	5,770	6,052	9,379	12,119
Claims on government	10	475	949	1,066	1,988
Claims on private sector	7,247	8,031	9,919	13,030	15,248
Demand deposits	1,804	2,300	2,822	3,152	3,620
Time & foreign currency deposits	6,299	9,309	11,004	15,182	19,264
Foreign liabilities	2,807	2,558	3,111	3,909	5,101
Credit from Bank of Lebanon	165	101	77	72	46
Capital accounts	583	619	656	878	1,019

a September.

Source: IMF International Financial Statistics.

Official sources estimate the 1979 inflation rate at 29 per cent. But electricity charges rose 120 per cent and fuel prices by 600 per cent. In 1980, the rate of inflation was put at between 17 and 23 per cent.

Consumer Prices in Beirut

(1966=100)

Years	Average	Foodstuffs	Clothes	Rent	Miscellaneous
1973	121.7	135.8	145.3	105.1	105.5
1974	135.7	158.4	165.4	106.6	112.3
1975[a]	142.4	169.8	180.3	...	...
1976[a]	...	...	...	...	...
1977[b]	283.1	283.5	326.5	150.9	200.7
1978[b]	276.1	323.5	405.1	165.5	237.4

a March. b December.

Source: The Arab Economist.

FOREIGN TRADE AND PAYMENTS

Few reliable details are available in regard to Lebanese trade. Currency conversions are made at different rates and there are large amounts of contraband and unrecorded transactions; undervaluation is commonplace.

Balance of Trade Estimates

(L£ mn)

	1974	1975	1976	1977	1978	1979	1980[a]
Exports	3,386	2,792	2,323	2,365	1,930	2,698	4,100
Imports	5,168	4,504	2,178	4,500	5,200	7,500	10,000
Balance	-1,782	-1,712	145	-1,135	-3,270	-4,802	-5,900

a Estimate.

Source: Beirut Chamber of Commerce.

Trade with neighbouring countries fluctuates according to political conditions. It is probable, however, that now nearly 90 per cent of Lebanon's exports (mainly industrial goods) go to Middle Eastern countries.

Geographical Destination of Exports

	1978		1979	
	L£ mn	%	L£ mn	%
Saudi Arabia	701	36.3	998	37.0
Iraq	170	8.8	405	15.0
Syria	174	9.0	350	13.0
Jordan	217	11.2	188	7.0
Kuwait	96	5.0	108	4.0
Other Gulf states	72	3.7	117	4.3
Other Arab states	154	8.0	212	7.9
Other countries	346	17.9	320	11.9
Total	1,930	100.0	2,698	100.0

Source: Beirut Chamber of Commerce.

Main Exports

	1977		1978	
	L£ mn	%	L£ mn	%
Products				
Agricultural products, foodstuffs & beverages	567	24	600	31
Building materials	945	40	540	28
Chemical products	160	7	212	11
Textile products	118	7	195	10
Paper & cardboard	108	5	136	7
Equipment & electrical apparatus	165	7	54	3
Rubber, plastics & their products	50	2	58	3
Miscellaneous	89	3	47	2-5
Leather & skins	45	2	39	2
Furniture	70	3	30	1-5
Transport equipment	47	2	18	1
Total	2,365	100	1,929	100

Source: The Arab Economist

Imports from Selected Major Trading Partners, 1978-1980 ($'000)

	UK	West Germany	France	USA

...from Selected Major Trading Partners, 1978-1980

(000)

	Italy		USA		France		West Germany		UK	
	1979	1980	1979	1980	1978	1979	1978	1979	1979	1980
eals & products	9,960	6,576	32,400	64,056	11,376[a]	6,828[a]	360	1,488	696	816
tile fibres & waste	768	1,800	1,488	1,440	...	...	300	562	648	900
micals	33,804	28,752	15,600	15,996	25,368	53,160	20,952	30,660	27,444	29,712
per manufactures	1,956	2,364	1,572	1,464	1,164	2,664	996	1,632	744	1,116
er & manufactures	6,888	6,912	5,724	12,312	2,220	2,676	1,296	1,632	2,014	1,788
tile yarn, cloth, etc.	24,432	26,856	7,488	7,764	10,800	14,364	7,020	10,644	4,044	5,916
-metallic mineral nufactures	28,428	38,880	1,404	1,884	7,704	9,312	1,692	3,960	1,572	1,776
& steel	23,028	34,788	132	288	9,708	12,288	3,648	7,644	492	2,280
-ferrous metals	19,656	31,692	1,032	3,084	4,824	6,432	576	1,056	1,908	1,776
al manufactures	2,712	25,152	3,204	4,980	2,388	4,104	3,864	5,172	3,996	4,740
hinery, incl electric	75,600	97,092	45,228	62,568	28,428	44,292	34,992	51,936	37,644	52,248
nsport equipment	15,756	27,972	26,376	45,120	12,972	24,108	27,672	51,132	828	13,344
hing	32,928	39,528	1,212	1,476	17,160	29,760	2,700	3,900	6,324	4,776
ntific instruments, etc	4,152		4,896	7,500	4,632	6,048	3,204	5,040	3,204	5,568
l, incl others	354,804		226,872	301,932	186,084	272,640	122,880	191,604	139,584	164,448

cluded in textile yarn, cloth, etc.

ce: Trade returns of supply countries.

In 1980, re-exports accounted for 40 per cent of exports. Wood products, electrical machinery, vegetable products, metal products, textiles and chemicals were the main categories and the suppliers included the EEC (27 per cent), East Europe (23 per cent) and the USA (21 per cent).

The main suppliers of imports to Lebanon, apart from Saudi Arabia, are France, Italy, West Germany, the UK, the USA and Japan. No comparable figures with exports are available giving geographical sources or classifications for Lebanese imports. There are returns, however, based on the trade returns of supply countries.

Trade and exchange regulations

There are no exchange controls but restrictions on some imports and exports were introduced as of 1977. In addition, licences are required for certain listed imports, primarily goods competing with locally produced ones. Export licences exist to prevent shortages of local supplies. Some re-exports are prohibited for the same reason.

Tourism

Tourism played a very important role in easing the trade deficit and contributed over 15 per cent to national income before the war. In the first three quarters of 1974 there were 2.19 mn visitors to Lebanon, representing a 50 per cent increase over 1973. In 1974, foreign exchange earned from tourism was L£880 mn compared to L£573 mn in 1973. In 1975, a year which had promised to be excellent for tourism, with a 10.5 per cent increase in the first quarter over the same period of 1974, the fighting caused the number of arrivals to drop from 537,000 in the first three months to almost zero. Tourism in 1976 was also ruined and a number of the largest hotels were destroyed. Since then, there has been spasmodic tourist trade (in 1977 receipts totalled some L£200 mn) but instability is a continuing obstacle to recovery. In the first three quarters of 1980, there were 122,757 visitors compared to 107,560 in the comparable period of 1979.

*Holdings of Gold and Foreign Exchange

($ mn; end of year)

	1976	1977	1978	1979	1980
Total reserves minus gold of which:	1,302.6	1,568.8	1,834.9	1,531.5	1,588.2
SDRs	-	-	-	1.7	-
Reserve position in Fund	2.6	2.8	3.0	2.8	7.8
Foreign exchange	1,300.0	1,566.0	1,831.9	1,527.0	1,580.4
Gold (mn fine troy ounces)	9.215	9.218	9.218	9.222	9.222
Gold (national valuation)	389.0	389.2	389.2	...	...

Source: IMF International Financial Statistics.

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requisitioning the oil in the storage tanks, and Saudi Arabia then confirmed to Tapline that it was settling Lebanon's $120 mn oil bill arrears after which Saudi supplies were resumed. Electricity supplies remained spasmodic because of damage to cables during internal fighting. Additional supplies of fuel oil, required by Electricité du Liban to meet power demand until the end of 1981, are being shipped in from the Banias refinery in Syria. Lebanon is to receive 115,000 tons of fuel oil from Syria, in addition to the LPG and gasoline it has already purchased (QER No.3 - 1981, page 10).

Large fuel price increases announced

On October 18 the Lebanese government introduced increases in the official selling price of all grades of fuel in an attempt to curb the government's losses on fuel subsidies. The official price of petrol rose by 36 per cent, kerosene prices were doubled, aviation fuel went up 90 per cent, fuel oil 77 per cent and gas oil 57 per cent. Increases in LPG prices are much more modest at 15 per cent for butane and only 3.7 per cent for propane; these prices are kept down to minimise the effect of the rise on households and also because of the current weakness of the world LPG market. The oil minister said the increases were being ordered because of the L£1.6 bn paid out in state fuel subsidies in the first three quarters of 1981. Before the latest increases he was predicting a L£2 bn fuel subsidy for 1982, and the prime minister, Shafiq al-Wazzan, claimed that the government was recovering only 40 per cent of the cost of each barrel of oil sold in the country. There is somewhat of a ring of hopelessness about these price increases. The rise in fuel oil prices is really akin to passing the buck, for its impact will be felt most by the deficit ridden state electricity company. And clearly when in times of shortage petrol is readily changing hands at L£100 per 20 litre tank against the new price of L£30, there would be room for an even more stringent increase.

MEA "expand to survive"

MEA's losses in 1981 are being estimated at between $17 mn and $19 mn by the airline's managing director, Selim Salam, and yet the company has decided to press ahead with three new services by the end of the year, and finalised the contract for the first five Airbus A-310s at the beginning of November following months of delay. Operating conditions for MEA have improved marginally in recent months, particularly on the freight side, but there is no doubt that the planned expansion will prove a considerable test of nerve. According to the leading MEA spokesmen, however, MEA must either expand or return to the days of being a regional carrier only. And the latter course of action is unthinkable for the largest employer in Lebanon. Even so it seems possible that MEA may temporarily lose some of its operating independence as it seeks short term funds to help cover operating costs. A few months ago the company raised its capital from L£100 mn to L£150 mn, and Selim Salam announced that the airline was considering raising a soft loan of about $50 mn at an interest rate below commercial levels over the next three years. He also indicated that the approach to the Lebanese government for additional funding might be necessary. On April 30 MEA was forced to cancel two loans, one for $350 mn in export credits for the first five Airbuses, the other for $70 mn for ten years on very generous terms. Both could be resurrected now that the Airbus deal is signed. The three new services are to Brazil via West Africa, to New York via Paris, and

to Manila in the Philippines. All three routes could be in operation by December, with the Manila run, operated in conjunction with Saudia and Philippine Airlines, an almost certain revenue winner.

MEA lost one of its Boeing 720 aircraft in August when it was blown up in Beirut shortly after arrival from Libya. The three Boeing 747s are now back in Beirut after several short charter deals connected with the Hajj. They might be used on the new routes, and MEA is fully aware of the difficulties it could expect in selling them in the present climate for the world's airlines.

Better communications in the South, with the Gulf

Ten emergency bridges across the Litani and Zahrani rivers are being installed by army units to replace bridges damaged in Israeli air raids. The first bridge was being erected on August 27 after leaving England on August 13. The UK supplier Thomas Storey (Engineers) has a $1.35 mn contract to supply 13 emergency bridges, ten for immediate installation, three for reserve, and has dispatched an engineer to supervise operations. Telephonic communications in the South have also been improved recently with the opening of 1,000 new lines in Sidon on October 15. The lines are the first stage of a L£150 mn plan to connect 27,000 new lines in the South over the next two years, and an additional 3,000 lines linking the South with the rest of the country. Lebanon's plans to establish direct dialling to all Arab countries by the end of 1982 were recently boosted by the introduction of direct dialling to Saudi Arabia and the UAE.

Lebanese pound continues weak

The Lebanese pound reached an all time low on August 11 of $1 = L£4.7650. By September 21 there had been a slight rally to $1 = L£4.42, but at the end of October it had slipped back again to $1 = L£4.6950. It would appear that the Central Bank has virtually abandoned the cause of maintaining the value of the pound in favour of restricting its fall to a gradual series of effective devaluations. This is largely because of the contradictory demands being made of the bank to try to contain inflation by a high interest policy, at the same time as generating profit to cover the government's deficit and adjusting to a situation where almost a third of total deposits are held in US dollars. One new measure introduced by the Central Bank in the last quarter has been a six month low interest bearing bond issue aimed at attracting banks' compulsory reserve requirements; income can be generated on these reserves at a higher commercial rate. The rate for the fortnightly three month bond issues has remained stable at 14 per cent.

Doubt over French shares in Lebanese banks

The new French socialist government's decision to nationalise the Compagnie Financière de Paris & des Pays-Bas and the Compagnie Financière de Suez, holding companies of the Banque de Paris & des Pays-Bas and Banque de l'Indochine & de Suez (BIS), respectively, has cast doubts over certain Lebanese-Franco joint ventures. For it appears that the French government will not take into state ownership the share portfolios of nationalised private banking groups. This means that the ownership of the following banks is likely to alter: the Beirut based Banque Libanc

Française, in which BIS has a 63.3 per cent stake, the French registered Banque Libano-Française, where BIS's stake was 90 per cent, and the Compagnie Financière de Syrie & du Liban, a French registered concern in which the Compagnie Financière de Paris & des Pays-Bas had a majority stake.

Ex-premier Salim al-Hoss has been appointed chairman of the Luxemburg based Compagnie Arabe & Internationale d'Investissement (CAII) to succeed the new Kuwaiti minister of finance, Abdel-Latif al-Hamad. CAII is expected to expand rapidly under al-Hoss's chairmanship, largely through the activities of the Paris based commercial and investment banking subsidiary BAII, which will not be affected by the new nationalisation moves.

New war risk pool insures citizen losses

Six Lebanese local insurance companies have formed a pool to offer limited cover for cars and homes owned by Lebanese citizens against war risk. The companies are breaking new ground as previously commercial underwriters have only insured life and maritime transport against these risks. The initiative to provide this new insurance service was taken by Société Nationale d'Assurances, which has so far been joined by Compagnie d'Assurances & de Reassurances de Liban & du Monde Arabe, Prosperity Insurance Company, Société Arabe-Européene d'Assurances & de Reassurances, Arab Universal Company, and Fidelity Assurance & Reinsurance Company. A limit of L£30,000, or 80 per cent of the goods' value, whichever is lowest, has been set. Some insurance companies who have not joined the pool claim that the new scheme represents something of a loss leader for other business, and also claim it is at variance with the 1976 Waterborne Agreement which restricts war risks cover to goods at sea. The government's Institute for the Guarantee of Investments has provided similar cover in Lebanon for industry and commerce since 1977.

New minimum wage to be introduced in 1982

Among all the other inflationary factors currently troubling the economy, the government has had to decree an 18.5 per cent increase in the minimum wage as of January 1, 1982 to avoid a national strike. The new wage of L£800 is binding on all employers, government or private sector. For workers who have been in employment over a year, the minimum monthly wage is stipulated at L£835. A sliding scale of percentage increases is applied to all wage brackets, with a 15 per cent increase dictated for the first L£2,500 of monthly salary, 10 per cent on the next L£1,500 and 5 per cent on anything over L£4,000 a month, subject to a maximum increase of L£650 a month.

Iraq topples Saudi as main Arab export market

Exports to the Arab world accounted for 37.6 per cent of all Lebanese exports in the first half of 1981. Total value of exports was L£2,567 mn of which Arab countries took L£965 mn. In 1980 Arab countries took 82 per cent of all exports. The most significant change has been the ascendancy of Iraq over Saudi Arabia as Lebanon's main Arab export market. In the first six months of this year Iraq took L£362 mn worth of Lebanese goods compared with Saudi Arabia's L£344 mn. Both Lebanon

hardly surprising therefore that the committee's meetings have become irregular and inconsequential. The latest wave of what is called by the Lebanese "the war on the diplomats" has also affected the French badly, partly because the Egyptian interests section has been housed in the French embassy since the Camp David agreements, but also because of President Mitterrand's visit to Israel earlier in the year. Last September the French ambassador was killed, in March bombs were let off outside the Egyptian interests section and tossed into the French cultural centre, and in April gunmen shot dead a French diplomat and his pregnant wife as they awaited dinner guests at their flat. If it is accepted that all the attacks on diplomats are the work of one faction or group, then their clear aim would seem to be to frighten Arab, European and even the US government from taking initiatives to solve the Lebanon situation and weaken Syria's influence in the country.

THE ECONOMY

Budget set at L£6.3 bn

The final figure for government expenditure in the 1982 budget has been put at L£6.3 bn, after the cabinet approved a provisional total of L£5.9 bn last September (QER No. 4 - 1981, page 7). Announcing the figures to the National Assembly, the finance minister, Mr Ali al-Khalil, explained that only 55 per cent of these expenditures are expected to be covered by government revenues. Revenues are expected to total L£3.5 bn compared with L£3.6 bn in 1981. When an inflation rate of over 20 per cent is taken into account, this drop in revenue is seen as even more serious and a telling testament to the breakdown of the revenue collecting apparatus. Customs revenue has declined most markedly from 47 per cent of all revenues in 1974, when budget deficits were minimal, to about 14 per cent of all government expenditure in 1981. Returns for the first two months of 1982 suggest a final figure for customs revenues of around L£450 mn, which would represent 13 per cent of expected revenues, and only 7 per cent of budgeted expenditure. The collapse of customs revenues has not been matched by any new tax, but certain sources of revenue such as stamp duty on property transactions have held up better, and in 1981 this particular duty accounted for 26.6 per cent of all tax revenue, or L£279 mn in money terms. The bulk of the deficit for 1982 will be funded by the simple expedient of printing money in tune with the steady erosion of the exchange rate of the Lebanese pound; short term Treasury bills will continue to be issued and the government is hoping that Arab governments will contribute $190 mn, marginally less than the $204 mn received in 1981 and still less than half of the annual total pledged at the Tunis summit in November 1979. There may even be a shortfall on this $190 mn if the Gulf States weigh up the combination of a diplomatic waning of interest in Lebanon and pressure on their own current accounts against their Tunis commitments.

Determination to tackle water and sewage problems

The serious health problems caused by Beirut's dilapidated and war damaged water and sewerage system is prompting action from several of the authorities responsible. The extent of the breakdown of the system in Beirut is illustrated by figures provided by the general manager of Eaux de Beyrouth which indicate that at least 50 per cent of water provided to the Beirut area is lost through leakages and another quarter is

stolen without payment of the recently doubled water rate. Earlier this year Eaux de Beyrouth announced that it had revived plans to award a masterplan contract for a water system for the capital, to be part financed by the World Bank. Three prequalified groups were asked to bid: Bureau Central d'Etudes pour les Equipements d'Outre-Mer (BCEOM), Société Française d'Etudes et de Gestion (Safage) and a partnership of France's Sogreah and the UK's Watson-Hawksley. The masterplan contract was expected to be awarded in April, but further delays in a project that was first tendered in 1970 would not be surprising. One contract that the Beirut Water Authority has awarded this year is to the Yugoslav Geological Institute of Skopje to undertake geological surveys for a proposed new accumulation dam that would supply water to Beirut. The surveys should be completed by the autumn. The Conseil Executif des Grands Projets de la Ville de Beyrouth is the client for a sewerage project already begun by the UK firm, Land and Marine. The £10 mn contract is to build a 2.6 km long and 1.2 m wide sewage sea outfall just south of Beirut. Meanwhile, further details of the sewerage masterplan submitted by Camp Dresser and McKee of Boston (QER No. 1 - 1982, page 8) reveal that of the $563 mn to be spent over the next nine years, only $125 mn is likely to be spent in the first three years, 1982-84. Certain parts of the plan, especially those covering the southern towns, are already threatened by the kind of political impediments that have hindered so many of the projects devised by the Council for Development and Reconstruction (CDR).

Electricity consumption keeps on rising

A surprisingly large increase in electricity consumption during the first three months of the year has been reported by local Beiruti newspapers. Compared with the January-March period in 1981, electricity consumption rose by 17 per cent to 769 mn kwh; some 77 per cent of the power was generated in thermal power stations, the rest by hydro stations. Any increase in consumption under the present regime of the state company Electricité du Liban can only mean a larger deficit for the government to meet. The electricity company is currently seeking to increase charges by 63 per cent to cover some of the increase in fuel prices introduced last year, but even if these go through it is estimating a $30 mn deficit for 1982. Theft of electricity is thought to be as rampant as non-payment of water rates, while tariffs in general are too low to encourage conservation measures.

Syrians stop flow of Iraqi crude to Tripoli

The Syrian action of April 10 in cutting off Iraqi exports though the Kirkuk-Banias pipeline also put an end to the ill fated plans to revive the spur line to Tripoli. The spur has been in intermittent operation since the beginning of the year, but it has been the object of sabotage attacks on January 3 and again on March 24 and 25. The motive of the saboteurs was the same as that of the Syrians, namely to prevent Iraq receiving extra oil revenues to fund its war efforts with Iran. The latest attack on the spur pipeline to Tripoli took place just inside the Syrian border, and was repaired by March 31. The operating capacity of the spur is 400,000 b/d, but it is unclear whether actual oil flows ever rose above 200,000 b/d. Nor is it known how much of the agreed 35,352 b/d of Iraqi crude was delivered to the Tripoli refinery for domestic consumption. Nevertheless, the cut off of Iraqi crude throws Lebanon again into near total dependence on oil supplies from Saudi Arabia via Tapline and how long these continue depends on Saudi patience with Lebanon's

disastrous payments record (QER No. 1 - 1982, page 10). Lebanon does, of course, have the option of importing spot cargoes of crude for refining at Tripoli, and it has experimented with this course of action over the past year. There are also plans, prepared by the US firm Stone and Webster, to expand the Tripoli refinery to 70,000 b/d, but the proposed source of crude is not known.

Cement production up, exports down

Production of black cement in 1981 rose to 2,224,793 tons from 2,143,592 tons in 1980. Production is from two plants, one owned by the Société Nationale des Ciments, whose production fell slightly to 580,482 tons last year, the other by Société des Ciments Libanais. The latter company accounted for all increased production with a total of 1,644,310 tons compared to 1,538,482 tons in 1980. Exports fell by as such as 36.6 per cent as a result of declining demand from Syria where new plants have made the country nearly self sufficient in cement; local demand picked up sufficiently, however, mainly as a result of major projects such as the coastal motorway and expansion of Beirut airport. During 1982 commercial production from the new Sibline works in the South is due to start.

MEA faces snags in Airbus finance

The $350 mn finance package for MEA's five Airbus A310 wide bodied aircraft has run into certain difficulties, not so much with regard to the commercial loan of $70 mn which MEA has to raise on its own, but as concerning the structure of the export guarantee facilities and loans that Airbus Industrie has to raise from its three owner governments, West Germany, France and the UK. Rocked no doubt by recent financial failures in the airline world related to Airbus financing, the export credit agencies of the three countries have apparently stipulated that the three main banks involved in arranging the guaranteed credit of $280 mn for the MEA purchases should agree to share the risk if the loan is not repaid by the airline. Dresdner Bank and Midland Bank are reported to be balking at these terms, leaving Crédit Lyonnais as the sole organiser of this part of the package. Crédit Lyonnais is also one of the lead managers for the $70 mn commercial loan for MEA, the terms of which are having to be slightly revised because of the difficulties surrounding the guaranteed credits. The loan, which is believed to be slightly oversubscribed at a price of $\frac{3}{4}$ per cent above Libor, will now include a precedent condition, that MEA is assured of the Airbus Industrie financing. MEA's own short term financial problems, including an estimated loss of $17-$18 mn in 1981 and a projected loss of $10-$15 mn in 1982, have been eased slightly by a L£150 mn loan from the Council for Development and Reconstruction (CDR). The company is still looking for new leasing customers for its three Boeing 747s, although it has commissioned the West German firm, Ruterbau, to build a $7.5 mn hangar for two of them at Beirut airport, and is seeking to market some of its 21 Boeing 707s as converted long range executive jets.

New UK-Lebanon air traffic agreement now in force

A new air traffic agreement between the UK and Lebanon came into force on April 1 after difficult negotiations that are partly blamed for the Lebanese decision to ban supersonic overflights by Concorde in its airspace. The new deal allows British Airways and MEA to operate five flights a week each in each direction, but

a commercial arrangement between the two airlines means that there will in fact be daily flights operated under both companies' names. Trans Mediterranean Airways, the Lebanese freight operator, is also to cut back its services to London from six to three a week, although it recently opened talks with MEA on possible shared use of converted Boeing 747s for mixed passenger and cargo use.

Banque du Liban reports on 1981 performances

End of year figures produced by Banque du Liban show that in 1981 commercial bank lending to the private sector failed to keep pace with the rise in public sector borrowing and the growth in banks' overseas deposits. Private sector credits rose by only 29 per cent to L£23,286 mn, representing 44 per cent of the commercial banking sector's total assets. Foreign assets and claims on government increased by 57 per cent to L£24,774 mn, the lion's share being accounted for by foreign assets. The trend of private sector deposits away from the Lebanese pound also continued. In 1974 deposits in the national currency accounted for 71 per cent of all deposits, by 1980 this figure had fallen to 60 per cent, and a further 5 per cent drop was recorded in 1981. The rapid devaluation of the Lebanese pound and controlled interest rates offer no hold on investors aware of the high interest rates still posted on the US dollar and certain European currencies.

The Banque du Liban itself made a 1981 profit of L£855.9 mn, up 37.6 per cent on 1980. Much of the increase was naturally eroded by the continuing decline of the Lebanese pound and by inflation. 80 per cent of the profits were handed over to the Treasury, and the remainder added to reserves which at end 1981 stood at L£650.2 mn, the equivalent of twelve months import coverage. In the first week of May the exchange rate was $1 = L£4.946.

Diners Club franchise purchased by Saudis

The Lebanese Diners Club card franchise, which also covers Jordan, Saudi Arabia and Egypt, has been bought by a new local company, capitalised at $10 mn. 20 per cent of the capital is subscribed by Citibank, the rest by a group of Saudi shareholders led by Shaikh Khalid bin Mahfouz. The new company is closely associated with the new United Bank of Saudi Lebanon, set up by Khalid bin Mahfouz in 1981 following the purchase of the local branch of Canada's Toronto-Dominion Bank. Another Western bank has also announced plans to sell all or most of its Beirut operations: the First National Bank of Chicago has put its Beirut operation, First National Bank of Chicago (Lebanon), up for sale. With three branches in Beirut and assets of more than $50 mn, the company was described by the vendors as a 'money making operation'.

Industrial exports increase in 1981

There was a 25 per cent increase in the value of industrial exports in 1981 compared with 1980. The total value was L£2,285 mn. Large increases were recorded in the value of clothing, textiles, and non-metallic minerals exported, but the value of cement (see above), processed food, mineral water, shoes and wood fell. Iraq was the leading customer for industrial goods worth L£888 mn, an increase of 82 per cent over 1980. Exports to Syria fell by 26 per cent to L£141 mn, but these may rise again in 1982 following a Syrian decision to allow general imports of

Arab Aid Pledged at the Tunis Summit, 1979
($'000)

	Annual commitment	Amount received 1980	Amount received 1981	Outstanding balance 1980-81
Saudi Arabia	114,320	38,107	76,213	114,320
Kuwait	62,840	25,000	67,840	32,840
Libya	62,840	-	-	125,680
Iraq	59,440	59,440	-	59,440
UAE	45,720	45,720	45,720	-
Algeria[a]	28,560	-	-	57,120
Qatar	26,280	-	13,143	39,417
Total	400,000	168,267	203,916	428,817

a In Tunis, Algeria requested an exemption from the payment of its pledged contributions to Lebanon, due to its financial difficulties.

Source: Middle East Economic Survey, Nicosia.

- and the reconstruction programme is to be scaled down -

In the CRD's report, it was noted that the failure of the Arab states to extend aid to the level promised meant that reconstruction projects scheduled for 1982 would have to be scaled down. Lack of aid, however, must be only part of the story. In the CDR's financial statement to April 30, 1981, it was clearly shown that of the $213 mn received from the Arab states up until that time, only a meagre $34 mn had in fact been used (QER No. 4 - 1981, pages 8 & 9). Obviously it is not only the absence of funds that is preventing the country rebuilding after the devastation of the civil war but the continuing state of unresolved conflict and outbreaks of fighting that prevents implementation of projects even when money is available.

- but the priorities will remain the same

The CDR announced towards the end of last year that a new twelve month plan was under preparation which would replace the twelve month plan approved in July 1980. Problems with funding and poor security, especially in the South, delayed many of the projects which will be carried over to the present plan. In the private sector emphasis will remain on the country's agricultural, industrial and tourism sectors. In the public sector priorities will include reconstruction of destroyed housing in the South and construction of new housing for low income families; construction of Beirut's water system; the building of schools and hospitals throughout Lebanon; construction of roads; reconstruction and expansion of the port of Beirut and the airport; and the rebuilding and modernisation of the capital's city centre.

Sewerage masterplan unveiled

A 20 year masterplan for a national drainage, waste water and sewerage scheme has been unveiled. The plan, which will cost some $563 mn in three stages over nine years, was prepared by the US company, Camp Dresser & Mckee (CDM). The programme is to be funded by the UNDP, the EEC, USAID and the World Bank. The CDM will supervise the works which are expected to be put out to contract to international companies.

of the 1974 output and fell another 1 per cent in 1978. The generation of electricity, however, reached the 1974 level of 1,975 mn kwh by 1978. Industrial production was badly affected by the war with its share of GNP falling from 16.6 per cent in 1974 to 13.0 per cent in 1977. The monetary value of industrial exports was the same in 1977 as 1974 (L£836 mn) but fell by 7 per cent in 1978. The building industry also declined. Its contribution to GNP fell from L£325 mn in 1974 to L£280 mn in 1977. Sales of cement in 1978 were 26 per cent lower than in 1977 although such sales had in 1977 only reached 56 per cent of those transacted in 1974. The GNP contribution of the transport system in 1977 amounted to L£630 mn compared with L£568 mn in 1974. The turnover in the port of Beirut fell due to the upsurge in activity in secondary ports such as Sidon and Jounieh - 2.1 mn tons in 1977 and 1.58 mn tons in 1978 compared with 4.08 mn tons in 1974. Air traffic fell from 2.3 mn air passengers in 1974 to 1.4 mn in 1977 and 1.3 mn in 1978. The value of the service sector was estimated in 1977 at L£1,920 mn, which almost corresponded to the 1974 level. The tourist sector was very badly hit with the occupation of hotels in Beirut in 1977 only 18 per cent of the figure for 1974. Altogether, the activity of the sector in 1977 and 1978 represented only 44 per cent of the pre war level. Trade was greatly affected by the general economic stagnation and political turmoil. Its share of GNP fell from 31 per cent in 1974 to 28 per cent in 1977. Particularly felt was the decline in transit trade. In 1974 978,000 tons of goods passed through Beirut in transit but in 1977 the tonnage dropped to 267,000. In 1978, however, the quantity recovered to 875,000 tons.

Gross investment remained low although there are no precise figures for individual sectors. Investments in 1977 were estimated at L£1,718 mn but it seems they fell again in 1978. According to the Banque du Liban, of total public and private investment 56 per cent (L£960 mn) was made up of equipment and transport goods (of which L£675 mn was imported) and 44 per cent was spent on building. This situation is the reverse of that obtaining in 1974 when 57 per cent was invested in building. Estimates of investment in the building sector in 1977 are put at L£756 mn compared with L£839 mn in 1973 despite the rise in building costs in the intervening years. Building activity seems to have again weakened in 1978: building areas in Beirut and Tripoli dropped from 2.04 mn sq m in 1977 to 1.6 mn sq m in 1978.

AGRICULTURE

Though one quarter of Lebanon is mountainous terrain, swampy areas and forest, there are excellent agricultural areas in the hot coastal strip and the rich valley of the Bekaa. Irrigation projects were in progress in both before the war and about a quarter of the 400,000 ha of arable land was irrigated. Farming is more intensive than in Syria, but scope for expanding the cultivated areas is also more limited; only 33 per cent of the land is cultivable, and much of this is marginal. There are many small independent landowners. About 378,000 people were engaged in agriculture in 1977 but the war and subsequent outbreaks of fighting have seriously disrupted agricultural production, especially in the south where whole

plantations have been destroyed. Of the area under commercial cultivation, including forestry plantations, it is estimated that forest plantings account for 27 per cent, fruit trees 30 per cent, cereals 19 per cent, vegetables 10 per cent, industrial crops 7 per cent and fodder crops 7 per cent.

Agricultural, forestry and fishing contributed L£664 mn to GDP in 1973 compared with L£700 mn in 1977. In 1973 the value of fruit production was put at L£352 mn, vegetables at L£117.4 mn and cereals at L£23.1 mn. In 1974 fruit exports amounted to 338,118 tons, with apples making up 35 per cent and citrus over 54 per cent. In 1977, despite the troubles which led to neglected orchards, fruit exports recovered to 90 per cent of their pre war levels. In 1979 fruit exports reached 318,152 tons and in 1980 were 333,134 tons, with apples reaching 87,373 and citrus 182,531. Grape production rose to 135,000 tons in 1979 compared with 70,000 in 1977. Other crops include olives, sugar cane, sugar beet and tobacco. And Lebanon, at least until the outbreak of the war, was the principal producer of wine and arak in the Middle East. Principal importers of Lebanese agricultural products are first Syria, followed by Saudi Arabia, Kuwait and Jordan.

It is difficult to calculate the damage to agriculture that the war and its aftermath have inflicted. It is obvious, however, that the Israeli invasion of the south, in 1978, was one of the worst blows. And, over the past year or so, constant shelling in the south has made work in the fields a nightmare. Tobacco, for instance, has been badly hit. Exports of leaf tobacco totalled L£60 mn last year but the crop was only 4.1 mn kilos, compared to 4.4 mn kilos in 1979 and 9.3 mn kilos in 1974. Last year, only 3,273 ha were planted to tobacco compared with 8,000 ha before the war years. In addition to this problem, the Regie Libanaise des Tabacs et Tombacs raised tobacco prices by only 60 per cent over the 1974-80 period.

Production of Main Crops
('000 tons)

	1974	1975	1976	1977	1978	1979
Wheat	76	65	40	50	45	40[a]
Citrus fruit	311	284	289	309	314	318
Potatoes	94	80	85	45	70	112
Sugar beet	160	145	36	123	98	108
Apples	180	170	85	106	109	79
Grapes	105	100	70	71	100	135

a Exports.

Sources: FAO Production Yearbook; EIU estimates.

The latest figures for animal population show that in 1978 there were 330,000 goats, 84,000 cattle and 240,000 sheep. In 1977 the poultry population was estimated at 8 mn. Much of the livestock was lost on account of the civil war and especially during the invasion of the south by Israel.

The deficit is likely to grow

The deficit is likely to be considerably higher this year than the government estimated when the cabinet approved the L£5.9 bn provisional budget for 1982 last September (QER No. 4 - 1981, page 7). As we stated, the government's habit of choosing a deficit figure no higher than a third of planned expenditure makes its realisation a somewhat hit and miss operation. Not only did the government eliminate from its calculations the massive subsidies on oil and petrol prices, but it overestimated the revenue collecting powers within its limited authority. As discussed below, the subsidies have been slashed but poor returns from customers in the first nine months of 1981 indicate that revenue will continue to contract during the present year. 1982 revenues are expected to show a fall in current prices from L£3,950 mn in 1981 to L£3.910 mn, leaving a budget deficit of L£1,990 mn compared with the officially forecast L£1,500 mn deficit for 1981. Admittedly, 1981 was a bad year for Lebanon in terms of security and closures at the port and airport - customs revenues slipped during January to September to L£316.9 mn compared with L£536.1 mn during the first nine months of 1980. In dollar terms, this figure is more alarming: $68.74 mn in 1981 compared with $144.26 mn in 1980. Customs revenue used to be a very important factor in the budget, accounting for nearly 50 per cent of spending, but in the first six months of 1981 it accounted for just 14 per cent and it will be surprising if even this figure is attained in 1982.

Iraqi oil supplies are resumed -

On December 26, Iraqi oil began flowing through the spur line from the Kirkuk-Banias pipeline system to the Tripoli terminal in northern Lebanon. This was the first such delivery in six years. Almost a year ago, talks began between Lebanon and Iraq to sort out the disputes over transit fees and other issues which caused Baghdad to turn off the tap in 1976. These negotiations apparently continued until last November when the Lebanese minister of industry and oil, Mr Muhammad Yousif Beydoun, announced that an agreement had been signed with his Iraqi counterpart, Mr Tayeh Abdul-Karim. The initiative for reopening the 60 km line, with a capacity of 400,000 b/d, to the Tripoli refinery with its 35,000 b/d refining capacity, obviously came from Iraq which is desperate to find additional methods of exporting its crude as the war with Iran continues to disrupt its traditional outlets in the Gulf. This was also the reason for Iraq's agreement to resume pumping through the Syrian pipeline system to Banias in early 1980. The Iraqi-Lebanese agreement, according to press reports, includes a commitment on the part of Iraq to supply the Tripoli refinery with 1.75 mn tons/year (35,352 b/d) of crude at $34.2789 a barrel (including the transit fee due to Syria). Shifting the feedstock from the more expensive Saudi Arabian light crude will represent a saving to Lebanon of $1 a barrel. Iraqi exports would start off at around 200,000 b/d rising to the full capacity of the spur - 400,000 b/d. The transit fee owing to Lebanon would be 3.11 cents a barrel.

- but a bomb blast caused disruption

In mid December a test run of oil was pumped to Tripoli and just as the year ended, it was announced that the pipeline was again in use. On January 3, however, a bomb blast ripped open and set fire to the newly reopened line causing damage to

a large area in and around the town of al-Jaisa. It is unclear who set off the bomb or who shelled an oil tanker being loaded with Iraqi oil in Tripoli port the day before. It is highly likely, though, given that the level of Iraqi exports was increased dramatically with the re-opening of the line, that Iran or its supporters in Lebanon (Shi'ite militiamen-Amal) were behind the attack. A committee was set up to assess the damage and the line was reopened on January 8. In any case, should the pipeline again be bombed and closed for some time, it will not be as disastrous to the Lebanese economy as some observers are predicting. After all, the Tripoli refinery has managed to operate for a long time without Iraqi crude.

Tapline again threatens to halt oil supplies

A major and recurrent problem for Lebanon, however, remains the persistent outstanding debt to the Trans-Arabian Pipeline Company (Tapline) for supplies of Saudi Arabian light crude to Tripoli in the north (35,000 b/d capacity) and Zahrani near to Sidon (17,000 b/d capacity). It may be remembered that Tapline had several times threatened to cut off supplies in retaliation for a $90 mn debt that had accrued as of June 1981. In each case it appeared that the Saudi government intervened to ensure that adequate supplies reached the Zahrani terminal for subsequent onshipment to the Tripoli refinery. Last July the Lebanese government transferred two payments of $15 mn to Tapline in part payment of its debt, in return for which Tapline agreed to pipe a further 360,000 barrels of oil which guaranteed supplies until September. On July 20, the Saudi government announced its decision to provide the Lebanese government with $120 mn in order to pay off the entire debt. In November, however, Tapline again served warning that it would stop supplies unless the Lebanese government settled its new oil debt, which by then amounted to $55 mn. Even if the Saudis should again step in with the cash, the country seems to be facing an intractable problem in ensuring an efficient flow of fuel. The present industrial and commercial pricing system for fuel in Lebanon, even after the cut in subsidies last autumn, means that the government faces a possible L£650 mn ($140 mn) cost in subsidies in the next twelve months. The new pricing measures have proved very unpopular and apparently have failed to eliminate profiteering. In times of shortages the price of a 20 litre tank can rocket to as high as L£100 against the new official rate of L£30 and even in relatively normal times some petrol stations are selling fuel for around L£33 for a 20 litre tank.

MEA bravely soldiers on

Middle East Airlines (MEA) is going through a very bad patch but is bravely pushing ahead with its "expand to survive" strategy. Last year's losses, due mainly to instability in Lebanon and long airport closures, are now predicted to be worse than previously thought (QER No. 4 - 1981, pages 11 and 12). The managing director, Selim Salam, put the airline's losses at $17-19 mn at the end of the year but now MEA has disclosed that the final figure could be $26 mn. The chairman, Assad Nasr, is blaming the loss on continued unrest in Lebanon, claiming that since foreign companies had no wish to return, negotiations were being hampered for new traffic rights to New York and the Far East. The company hoped to get on its feet by introducing a twice weekly Beirut-Manila service, via Dhahran and Bangkok, a twice weekly run to New York and a service to Brazil via West Africa with stops at São Paulo and Rio de Janeiro. The new routes were to be covered by the release of

three Boeing 747 jets previously leased to Nigeria Airways for the Hajj traffic. The five new Airbus Industrie A310s, which are to replace MEA's fuel guzzling Boeings (which in any case may fail the noise restrictions to be introduced in Europe), will not start to be delivered until mid 1984. The cost of the planes, $350 mn, is to be covered by external loans. At the beginning of this year Crédit Lyonnais, the lead manager of a $70 mn loan to MEA, renegotiated the terms whereby the engines of the new planes are mortgaged. Guarantees are extended by the suppliers, the life of the loan is ten years and the interest is 1.5 per cent above Libor. In December, the Lebanese government agreed to a L£350 mn ($33 mn) loan to help ease the company's current problems. The government is a 25 per cent shareholder in Intra Investment Company which itself owns 62 per cent of the airline. Aside from its interest as a shareholder, the Lebanese government sees the obvious value in keeping MEA going as it is the country's largest employer.

Devaluations erode commercial banks' deposit increases

The government and Central Bank decision no longer to defend the value of the local currency shows up clearly in a series of monetary statistics for the first half of 1981. During the first six months of last year commercial bank deposits rose 16 per cent to L£31,583 mn, although in dollar terms deposits fell by 1.4 per cent from $7,399 mn in December 1980. Of these deposits L£13,731 mn, or 43.5 per cent, were in foreign currencies; this represents a 2.5 per cent increase over the first quarter of 1981 even, and reflects the rising importance of foreign currency deposits and the overall dollarisation of the economy. During the first half of 1981 the market rate for the Lebanese pound fell from $1 = L£3.6475 in December 1980 to $1 = L£4.3000 at the end of the second quarter of 1981. Since then the pound has continued on its downward course almost without interruption, and on February 3, 1982, stood at $1 = L£4.8120. The country's reserve position also deteriorated during the first half of 1981, although slightly less rapidly than the exchange rate. At end 1980 total reserves were valued at $1,588.2 mn; by June 1981 they had fallen to $1,342.0 mn.

Beirut bank opens London office

On January 14, 1982, the Beirut-based Beirut Riyad Bank formally opened its London branch, although it in fact opened for business in London in October 1981. The significance of the bank's decision to operate a London branch is twofold: it appears to follow a trend for Arab banks to move away from Paris which has set in since the Mitterrand government came to power, and it also ties in with the Beirut Riyad Bank's intention of seeking business with the Lebanese community in West Africa which focuses its trading activities on London. The Beirut Riyad bank will also be joining the increasing number of foreign banks trying to catch the rich Arab and other millionaire personal accounts by opening a West End branch.

THE ECONOMY

1982 budget envisages curb on real spending -

Less than three months after the much delayed 1981 budget was finally approved by a special session of parliament, the Lebanese cabinet on September 30 approved a provisional 1982 budget of L£5.9 bn. This is only 8.25 per cent higher than the final figure for the 1981 budget ratified in June, but 32 per cent up on the original 1981 budget proposed at about the same time in 1980. If the provisional figures are adhered to, it is clear that there will be a real decline in spending on defence and most productive sectors with the exception of public works. The proposed 1982 budget is as follows:

General Budget, 1982
(L£ mn)

	1981	1982	% change 1982/81
President's office	2.7	3.0	11.1
Chamber of deputies	14.9	23.1	55.0
Cabinet	139.9	131.3	-6.2
Justice	34.0	52.2	53.5
Foreign affairs	69.1	84.5	22.2
Interior	274.1	362.8	32.4
Finance	67.9	87.6	29.0
National defence	1,058.5	1,245.7	17.7
National education	712.1	1,003.2	40.9
Public health	134.9	191.9	42.2
Labour & social affairs	91.5	145.6	59.1
Information	18.3	49.8	172.1
Public works	489.9	981.2	100.2
Agriculture	53.8	69.5	29.1
Economy & commerce	207.3	147.4	-28.9
PTT	33.6	36.2	7.7
Hydroelectric resources	65.7	95.1	44.7
Tourism	34.4	45.6	32.6
Industry & petroleum	3.4	3.7	8.8
Housing & cooperatives	7.4	8.3	12.2
Debt repayments	392.4	481.7	22.8
Budget reserves	599.8	695.5	15.9
Total	4,505.6	5,944.9	32.0

Source: As-Safir, Beirut.

- as concern over deficit grows

Guessing the size of the Lebanese government deficit has now become almost a daily ritual in the country. The government never likes to put it at more than a third of planned expenditure, but to arrive at that vaguely reassuring figure it has to eliminate from its calculations the massive subsidies on oil and petrol prices as

well as overestimate the revenue collecting powers within its limited authority. Even so in 1982 revenues are expected to show a fall in current prices from L£3,950 mn in 1981 to L£3,910 mn, leaving a budget deficit of L£1,990 mn compared with the officially forecast L£1,500 mn deficit for 1981. No allowance is made in any calculation for the fuel subsidy, although this should not necessarily be interpreted as government resolve to eradicate this drain on its resources (see below). One of the reasons for the expected fall in total revenues is that the new government is likely to introduce an adjusted customs tariff system, with average rates cut by about a half, in order to try to stamp out smuggling and achieve a net gain in customs revenues. Recent statistics have shown that while customs revenues used to account for 47 per cent of budget expenditure, in the first half of 1981 they stood at L£212 mn, just 14 per cent of government spending. Smuggling is estimated to be depriving government of 75 per cent of its anticipated revenues in this area. Arab aid, or the lack of it, is another factor in the sorry revenue picture; Lebanon has so far received only $236 mn of the $400 mn annually it was promised from January 1980. Faced with this situation the Treasury has been forced into a steady devaluation of the local currency in order to maximise the note cover available in the monthly remittance flow of $150 mn, but the prime minister, Shafiq al-Wazzan, has acknowledged that this situation cannot continue and has forecast economic disaster if the budget is not brought under stricter control shortly.

CDR report details slow progress -

A recent progress report by Lebanon's Council for Development & Reconstruction (CDR) shows clearly that it is not only the absence of Arab aid that is preventing the country rebuilding after the devastation of the civil war; it is as much the continuing state of unresolved conflict and of outbreaks of fighting that prevents implementation of projects even when money is available. The financial statement of CDR to the end of 1980/81 shows that of the $213 mn received from Arabs during the accounting period, only a meagre $34 mn had in fact been used.

CDR Financial Statement, April 30, 1981
(L£ mn)[a]

Sources of funds	
Internal loans	183.0
External loans (drawn)	656.3
External loans (undrawn)	665.9
Treasury advances	180.0
Tunis aid (drawn)	158.4
Tunis aid (undrawn)	816.6
Funds for credit programme to damaged establishments (undrawn)	153.4
Other grants	0.1
Other funds	129.4
Total	2,943.1

(continued)

Exchange Rate Trends, 1974-81
(L£ per $1: period average)

1974	2.3278
1975	2.3095
1976	2.9037
1977	3.0690
1978	2.9554
1979	3.2428
1980	3.4362

Source: IMF International Statistics

GENERAL ECONOMY

The civil war has been dubbed the "greatest economic catastrophe" in Lebanon's history. Since April 1975, the commercial and economic life of the country has been overshadowed by violence and political uncertainty. No sector of the economy has been spared. Many estimates of war damage have been made but the 1977 Beirut Chamber of Commerce and Industry's tabulation (endorsed in 1978 by the Ministry of Finance) is thought to be the most accurate. Real and potential losses to the year 1980 were estimated at L£21 bn (1974 prices). Further fighting since then has pushed the total figure still higher.

Estimate of Civil War Losses to 1977
(L£ mn)

Private sector	
Commerce	3,000
of which:	
contents of port warehouses	1,900
stocks & equipment	600
buildings, furnishings, etc.	500
Industry	1,500
of which:	
plant & equipment	1,000
stocks & inventory	500
Agriculture	300
Tourism	180
of which:	
hotels (Beirut)	125
restaurants (Beirut)	25
other (outside Beirut)	30
Road vehicles	90
Housing	1,000
Private schools	50
Universities	30

(continued)

Estimate of Civil War Losses (continued)
(L£ mn)

Private hospitals & clinics	10
Miscellaneous	15
Total private sector losses	6,175
Total public sector losses	1,335
Total losses	7,510

Source: Beirut Chamber of Commerce & Industry.

In early 1980, the Banque du Liban (Central Bank) published its first economic survey since 1974, covering mainly the period 1975-78. In its sector by sector analysis, the report states that GNP (excluding public services) for 1977 is estimated at L£8,200 mn compared with L£7,103 mn in 1973 (the last year for which there are detailed figures). At constant 1973 prices, production in 1977 was slightly under two thirds of the 1973 performance. In 1978 production fell in terms of constant 1973 prices although nominally it rose by 8-10 per cent.

Gross Domestic Product Trends, 1966-77
(L£ mn)

					% of total	
	1966	1972	1973	1977	1973	1977
Agriculture, forestry & fishing	442	631	664	700	9.3	8.5
Energy & water resources	87	129	145	445[a]	2.0	5.4[a]
Industry & handicraft	512	884	1,021	1,070	14.3	13.0
Construction	231	290	310	280	4.4	3.4
Transport & communications	310	478	526	630	7.4	7.7
Services[b]	784	1,469	1,632	1,920	23.0	23.4
Commerce	1,193	2,007	2,300	2,320	32.4	28.3
Administration	319	477	505	835	7.2	10.3
GDP at current prices	3,878	6,365	7,103	8,200	100.0	100.0

a The contribution of energy production rose because of higher oil prices, but actual production at the refineries in 1977 represented only 73 per cent of the 1973/74 output (and fell another 1 per cent in 1978).
b Including imputed rents of owner occupied dwellings.

Source: Banque du Liban.

The report states that agriculture, which contributes about 8.5 per cent to GNP, still suffers from a shortage of labour. Stocks of animals are 50 per cent lower than in 1974 and exports of fruit in 1977 and 1978 were considerably down over pre war figures. The contribution of energy production rose because of higher oil prices but actual production at the refineries in 1977 represented only 73 per cent

Tableau 2

LISTE DES ETUDES PEDOLOGIQUES

a – Etudes pédologiques fondamentales

Localisation sur fig. 1	Origine	Titre	Echelle	Région intéressée
–	FAO–Plan Vert	Carte provisoire d'aptitude des sols (1967)	1/100 000 1/200 000	Ensemble du Liban
6	FAO–IRAL	Phase I: 1963–1967 Enquête pédologique et programme d'irrigation connexes (Projet FAO/LEB 10)	1/20 000	Zone Saïda–Litani (67 000 ha)
		Phase II: 1972–1974 Enquêtes pédologiques (sous–contrat ONL à IRAL)	1/20 000	Zones Iklim el Kharroub, Naqoura et Marjayoun (90 000 ha)
7	IRAL–ORSTOM	Etude pédolcgique de la zone côtière entre Sour et Saïda (1974)	1/10 000	Bande côtière de largeur moyenne 2 km

b – Etudes pédologiques diverses et complémentaires

		i. Etudes diverses		
	B. Geze	Carte de reconnaissance des sols du Liban (1956)	1/200 000	Ensemble du Liban
	FAO–IRAL	Carte schématique des unités des sols	1/50 000	Liban Sud
	FAO–IRAL	Carte des unités de sols de la région Naqoura (1963–67)	1/50 000	Naqoura
5	Verheye	Carte des sols du Liban Sud	1/50 000	Région Damour–Litani
1	IRAL	Sols et aptitudes des sols du périmètre Aouali–Leimoun (1963)	1/25 000	Périmètre–pilote de Saïda
2	Bureau Reclamation	Development Plan for Litani River Basin 1954	1/70 000	Région Nabatiyé
3	Plan Vert	Watershed resources and problems of the Aouali–Saghbine Perimeter	1/50 000	Jezzine, Moukhtara Barouq
		ii. Etudes complémentaires (Sous–contrat ONL à l'IRAL)		
7	IRAL	Etude pédologique détaillée de la plaine du Marj (projetée)	1/10 000	Plaine de Marjayoun
8	IRAL	Enquête pédologique Phase III (en cours)	1/20 000	Régions Damour–Beyrouth et Damour–Zahrani au–dessus de 600 m

IRAL: Institut de la recherche agronomique au Liban (Tal–Amara)
ORSTOM: Organisme de la recherche scientifique dans les territoires d'outre–mer
ONL: Office national du Litani.

Tableau 3

SUPERFICIE DES PROSPECTIONS PEDOLOGIQUES PAR REGION GEOGRAPHIQUE

(en ha bruts)

Région	Zone Nord Prospection 1/100 000 et 1/200 000	Zone Liban Sud Prospection au 1/20 000	Zone d'habitat	Bande côtière Prospection au 1/10 000	Total
1 - Beyrouth-Damour	24 700	-	-	-	24 700
2 - Damour-Aouali	11 100	12 300	100	100	23 600
3 - Aouali-Saïtaniq	4 700	5 600	1 300	400	12 000
4 - Saïtaniq-Zahrani	3 100	11 300	400	300	15 100
5 - Zahrani-Litani	-	40 900	600	1 800	43 300
6 - Litani-Frontière	-	77 400	1 900	2 300	81 600
7 - Marjayoun	-	9 900	300	-	10 200
Total ha bruts	43 600	157 400	4 600	4 900	210 500
%	21	75	2	2	100

Tableau 4

CARACTERES COMMUNS DES ENSEMBLES PEDOLOGIQUES

A - Ensemble d'Aadloun	:	Plateau tabulaire profondément découpé par un réseau assez dense et ramifié de vallées. Association de sols argileux, bruns, calcaires, peu ou très peu profonds sur roches calcaires de dureté variable mais généralement moyenne.
B - Ensemble de Babliyé	:	Plateau ondulé plus ou moins profondément découpé par un réseau très ramifié de vallées. Association de sols gris-brun, limono-argileux, très calcaires, de profondeur variable sur des calcaires tendres, marno-calcaires et marnes.
S - Ensemble de Sarba	:	Plateau fortement et irrégulièrement ondulé, découpé par un réseau assez large de vallées peu ramifiées et de cañons. Association de sols rouges très argileux, non ou peu calcaires, sur calcaires durs peu fissurés.
N-Z - Ensemble de Nabatiyé-Zaoutar	:	Plateau découpé par un réseau très ramifié de vallées. Association de sols bruns et rougeâtres non ou peu calcaires sur calcaires durs, fissurés.

Tableau 5

CARACTERISTIQUES DOMINANTES DES UNITES CARTOGRAPHIQUES

a - Classe de sols : i2

Ensemble	Unité	Topographie (p : pente)	Profondeur sol (cm)	Pierrosité caillouteux	Rochosité rocheux	Aménagement actuel
1°- A	A1	Plateaux à pente faible	30-60	peu	non	champs ouverts
	A2	Versants p.8 - 20 %	30-80	peu	non	larges terrasses bon état
2°-B	B1	Sommets buttes-replats p < 8 %	30-80	peu	non	terrasses, murets ou champs ouverts
3°-S	S1	Sommets buttes, replats	20-80	oui	peu	champs ouverts
	S2	Versants p.8 - 20 %	30-70	oui	peu	larges terrasses à murets
4°-N-Z	N1	Sommets buttes-replats Versants p. < 20 %	20-50	oui	non	champs ouverts
	N2	Idem	20-60	très	non	terrasses à talus, cailloux
	Z1	Sommets buttes, replats p.0 - 8 %	40-100	oui	non	champs, murets, terrasses
	Z2	Versants p: 8 - 20 %	40-100	oui	non	terrasses
5°-a et b	a	Fonds de vallées	30-80	peu	non	terrasses, murets
	b	Etroites bandes, fonds de vallées	> 60	non	non	champs étroits

b - Classe de sols : i3

1°-A	A3	Bords plateaux p: 0-20 %	0-50	oui	oui	terrasses irrégulières
	A4	Sommets buttes p: 0-20 %	0-30	très	très	terrasses dégradées
2°-B	B2	Versants p: 8-20 %	30-80	peu	non	larges terrasses
	B3	Sommets de buttes p: 0-20%	0-40	oui	peu	terrasses irrégulières
	B4	Sommets de buttes et versants p < 20 %	10-30	très	peu	champs et talus d'épierrage
3°-S	S3	Sommets de buttes p < 20 % ou replats	0-40	très	oui	terrasses dégradées
4°-N-Z	N3	Sommets de buttes, replats et versants p < 20 %	0-40	très	peu	non aménagé
	Z3	Sommets de buttes, replats et versants p < 20 %	20-50	oui	peu	bourrelets d'épierrage

La majorité de ces terres est actuellement cultivée annuellement.

Tableau 6

SUPERFICIES PROSPECTEES PAR REGION GEOGRAPHIQUE

N.	Régions géographiques	Superficies brutes (ha)
1	N. Damour - N. Aouali	12 300
2	N. Aouali - N. Saïtaniq	5 600
3	N. Saïtaniq - N. Zahrani	11 300
4	N. Zahrani - N. Litani	40 900
5	N. Litani - Frontière	77 400
6	Marjayoun	9 900
	Total	157 400

Tableau 7

SUPERFICIES PROSPECTEES PAR TRANCHE D'ALTITUDE
(en ha bruts)

Zone d'altitude (m)	0	100	200	300	400	500	Total 0-500
Superficie	11 200	20 800	22 700	29 800	23 100		107 600
%	7	13	14	19	15		68

Zone d'altitude (m)	500	600	700	800	900	Totaux 500-900	Totaux 0-900
Superficie	18 500	20 900	8 800	1 600		49 800	157 400
%	12	13	6	1		32	100

Tableau 8

CLASSES D'APTITUDE A L'IRRIGATION PAR REGION GEOGRAPHIQUE

(Superficies en ha bruts)

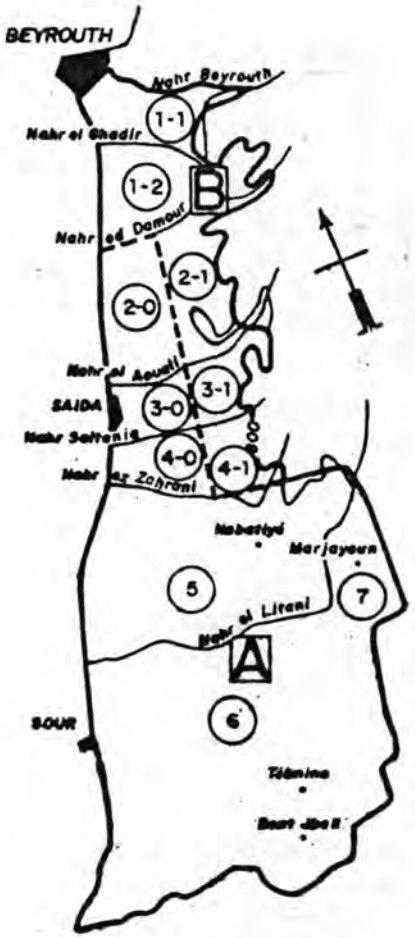
Région	Classes d'aptitude à l'irrigation					
	i2 moyennement favorable	i3 marginale	i4 défavorable	Total i2+i3+i4	Total i2 + i3	%
2 - Damour-Aouali	1 800	2 500	8 000	12 300	4 300	6
3 - Aouali-Saïtaniq	900	1 300	3 400	5 600	2 200	3
4 - Saïtaniq-Zahrani	2 400	2 600	6 300	11 300	5 000	6
5 - Zahrani-Litani	12 500	10 100	18 300	40 900	22 600	30
6 - Litani-Frontière	22 100	14 000	41 300	77 400	36 100	48
7 - Marjayoun	3 100	2 000	4 800	9 900	5 100	7
Total	42 800	32 500	82 100	157 400	75 300	100
%	27	21	52	100	48	

Tableau 9

REGION D'EQUIPEMENT HYDRO-AGRICOLE (210 500 ha)

Répartition des superficies globales des classes d'aptitude des terres pour l'irrigation par région géographique

Sous-région	Superficie brute ha						Genre cartog.
	i1 + i2	i3	i4	i1 à i4	Habit.	Total	
1-1	630		7 250	7 880		7 880	B
1-2	420	3 040	13 340	16 800		16 800	B
1 Total	1 050	3 040	20 590	24 680		24 680	
2-0	1 880	2 460	7 990	12 330	120	12 450	A
2-1	90	2 680	8 380	11 150		11 150	B
2 Total	1 970	5 140	16 370	23 480	120	23 600	
3-0	1 200	1 350	3 420	5 970	1 340	7 310	A
3-1	720	1 590	2 390	4 700		4 700	B
3 Total	1 920	2 940	5 810	10 670	1 340	12 010	
4-0	2 770	2 570	6 330	11 670	360	12 030	A
4-1		650	2 430	3 080		3 080	B
4 Total	2 770	3 220	8 760	14 750	360	15 110	
5 Total	14 280	10 070	18 320	42 670	630	43 300	A
6 Total	24 430	14 030	41 280	79 740	1 840	81 580	A
7 Total	3 134	2 034	4 770	9 938	320	10 258	A
Total	49 554	40 474	115 900	205 928	4 610	210 538	



LEGENDE

Sous-régions

1-1 Beyrouth	Ghadir
1-2 Ghadir	Damour
2 Damour	Aouali
3 Aouali	Saïtaniq
4 Saïtaniq	Zahrani
5 Zahrani	Litani
6 Litani	Frontière
7 Marjayoun	

A - Inventaire d'après la cartographie au 1/20 000 et 1/10 000: 166 900 ha[1/]
B - Inventaire d'après la cartographie au 1/50 000 et 1/200 000: 43 600 ha

210 500 ha

1/ Décomposition de A: 166 900 ha

- Zone Liban Sud 157 400 ha
- Bande côtière 4 900 ha } 162 300 ha
- Zone d'habitation 4 600 ha

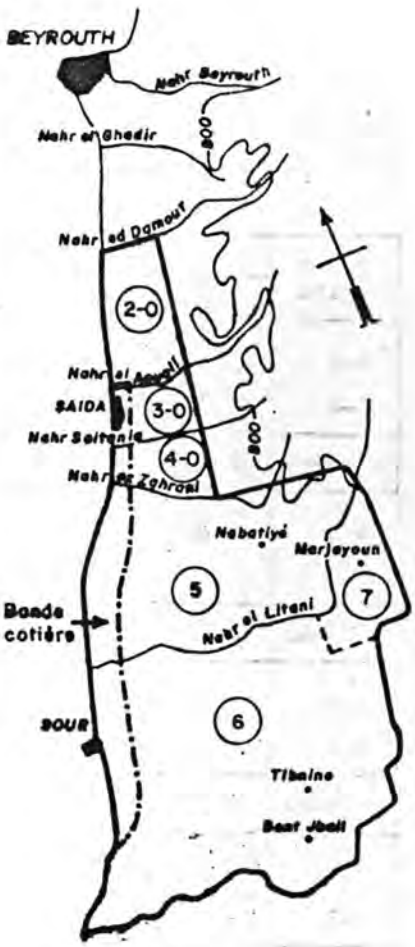
Tableau 10

ZONE DE PROSPECTION PEDOLOGIQUE 1/20 000 (157 400 ha)

Répartition globale des ensembles pédologiques par région

(Superficies brutes en ha - total général arrondi à 100 ha)

Ensembles pédologiques	Région						Total 2-0 à 7
	2-0	3-0	4-0	5	6	7	
A		268	1 438	5 843	6 927		14 476
B	3 103	3 405	3 824	9 795	10 146	125	30 398
S	8 506	1 322	4 021	10 781	32 772	3 022	60 424
N		24	356	2 196	3 887	1 872	8 335
Z		192	728	5 921	16 183	882	23 906
a	141	76	184	1 741	3 908	1 756	7 806
b	461	351	743	2 820	3 600	145	8 128
T				319		97	416
J				961		933	1 894
G				498		1 109	1 607
Totaux	12 211	5 638	11 294	40 883	77 423	9 941	157 400



Répartition globale des ensembles pédologiques par zone d'altitude

Ensembles pédologiques	Zone d'altitude en m									
	0 100	100 200	200 300	300 400	400 500	500 600	600 700	700 800	800 900	Total 0-900
A	4 108	6 007	2 780	1 023	217	125	191	25		14 476
B	1 403	7 799	8 650	7 160	2 891	681	1 044	736	34	30 398
S	3 062	5 471	8 083	13 635	8 997	6 929	8 631	4 707	909	60 424
N			120	696	1 426	1 869	3 266	900	58	8 335
Z		12	1 007	3 963	6 037	5 600	5 146	1 616	525	23 906
a	48	172	599	1 022	1 820	2 089	1 575	467	14	7 806
b	2 557	1 341	1 211	1 743	789	112	224	146	5	8 128
T			100	63	40	104	89	20		416
J			11	106	582	651	466	78		1 894
G			170	398	324	367	228	120		1 607
Totaux	11 178	20 802	22 731	29 809	23 123	18 527	20 860	8 815	1 545	157 400

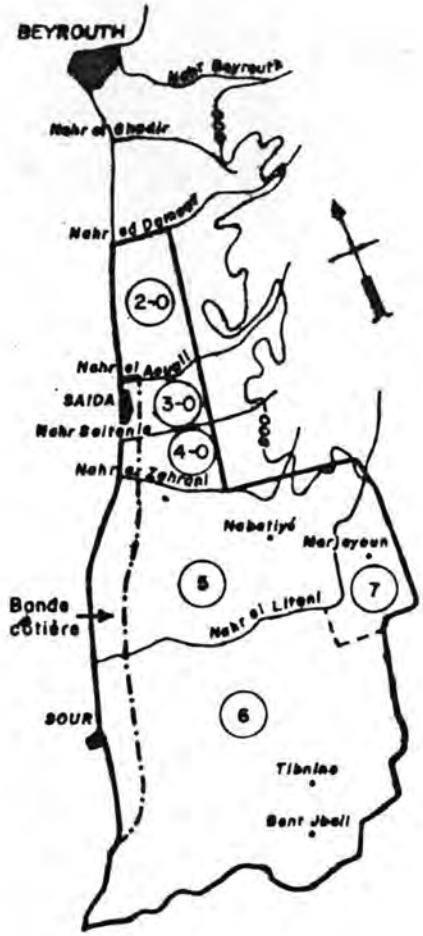
Tableau 11

ZONE DE PROSPECTION PEDOLOGIQUE 1/20 000 (157 400 ha)

Superficie brute des unités pédologiques par région géographique

Régions	Unités pédologiques Classe i-2														
	A1	A2	B1	S1	S2	N1	N2	Z1	Z2	a	b	G	T	J	Total
2-0			24	82	1 100					141	463				1 810
3-0	35	90	181	32	59	19			23	16	454				909
4-0	211	229	208	282	303	19	44	101	74	184	747				2 402
5	1 695	814	1 011	835	568	663	770	553	863	1 741	2 825	30	100	23	12 489
6	1 732	1 341	921	400	4 219	899	956	941	3 220	3 908	3 602				22 139
7					381	133	386	3	77	1 755	141	231	19	8	3 134
Tot.	3 673	2 474	2 345	1 629	6 630	1 733	2 156	1 598	4 257	7 745	8 232	261	119	31	42 883

	Unités pédologiques Classe i-3											
	A3	A4	B2	B3	B4	S3	Z3	N3	G	T	J	Total
2-0			735	225		1 500						2 460
3-0	24	12	666	596	2	28		22				1 350
4-0	137	29	1 012	444	34	635	229	52				2 572
5	514	446	2 243	1 824	870	2 135	1 479	431	25	29	76	10 072
6	1 013	611	2 725	1 071	237	4 690	3 313	370				14 030
7			21	20		661	878	238	34	36	146	2 034
Tot.	1 688	1 098	7 402	4 180	1 143	9 649	5 899	1 113	59	65	222	32 518



Récapitulation

i2	42 800 ha
i3	32 500 ha
i4	82 100 ha
	157 400 ha

	Unités pédologiques Classe i-4																		
	A5	A7	B6	B7	S4	S5	S7	N6	N7	Z4	Z5	Z6	Z7	G	T	J	B5	B8	S6	Total
2-0			547	1 011	1 575	586	3 377										561		[illegible]	7 990
3-0	19	88	1 125	835	57	172	972	3	2	35		102	10							3 420
4-0	235	597	1 544	582	489	560	1 753	10	54	24	24	297	161							6 330
5	273	2 099	2 456	1 388	1 816	580	4 770	173	158	737	59	472	1 757	207	192	894			389	18 420
6	545	1 685	3 888	1 304	7 028	2 876	12 566	1 003	659	1 147	310	2 456	4 796						[illegible]	[illegible] 260
7			61	3	494	92	1 219	206	184	195	6	29	417	843	43	751		20	177	4 770
Tot.	1 072	4 469	9 621	5 123	11 459	4 866	24 657	1 395	1 057	2 138	399	3 356	7 141	1 050	235	1 [illegible]	561	20	1 [illegible]	[illegible] 110

Tableau 12

DECOMPOSITION DE LA ZONE DE PROSPECTION PEDOLOGIQUE AU 1/20 000

Symbole	Relations	Définition	Résultats globaux arrondis à 100 ha près	Part de ST
		I - SUPERFICIES IRRIGABLES		
SIN	0,93 SIB	Superficie irrigable nette ou somme nette des taches i2 et i3 à l'intérieur des ensembles II et III	52 300 ha	33 %
SIB		Superficie irrigable brute ou somme brute des taches i2 et i3 à l'intérieur des ensembles II et III	56 200 ha	36 %
SG	SIB + E_3 = ST-E_1-E_2	Superficie géographique brute des ensembles irrigables de type II et III	62 400 ha	40 %
		II - EXCLUSIONS (Superficies brutes)		
		a) à l'intérieur des ensembles irrigables		
E_4	7% . SIB = SIB-SIN	i. Pertes pour emprises	3 900 ha	3 %
E_3		ii. Terres non irrigables (i4) à l'intérieur des ensembles irrigables	6 200 ha	4 %
		b) à l'extérieur des ensembles irrigables		
E_2	S2.3-SIB	i. Terrains irrigables constitués de taches i2 et i3 dispersées non regroupées dans les ensembles irrigables (S2.3 = superficie exhaustive de la totalité des taches i2 et i3 = 75 300 ha - cf. tableau 8)	19 100 ha	12 %
E_1	S4 - E_3	ii. Terrains non irrigables (i4) en dehors des ensembles irrigables (S4 = superficie exhaustive de la totalité des taches i4 = 82 100 ha)	75 900 ha	48 %
E	E_1+E_2+E_3+E_4	Somme des exclusions	105 100 ha	67 %
		III - ZONE PROSPECTION PEDOLOGIQUE LIBAN SUD AU 1/20 000		
ST	E + SIN	Superficie géographique brute de l'ensemble de la région prospectée	157 400 ha	100 %

Tableau 13

SUPERFICIES DES ENSEMBLES IRRIGABLES II ET III PAR TYPE

Ensembles	SG (ha bruts)	E3 non irrigable	E3/SG %	SIB (ha bruts)	E4 Emprises - 7%	SIN = Si2+Si3 (ha nets)	Si2	Si3	Si2/SIN %	Si3/SIN %
II	37 600	- 3 400	9	34 200	- 2 400	31 800	24 100	7 700	76	24
III	24 800	- 2 800	11	22 000	- 1 500	20 500	6 600	13 900	32	68
Total	62 400	- 6 200	10	56 200	- 3 900	52 300	30 700	21 600	59	41

Tableau 14

SUPERFICIES DES ENSEMBLES IRRIGABLES PAR REGION GEOGRAPHIQUE ET CLASSE D'APTITUDE

Région géographique	Superficies des ensembles (SG-ha bruts)			Superficies irrigables nettes SIN (ha nets)								
				II			III			II + III		
	II	III	II+III	i2	i3	i2+ i3	i2	i3	i2+i3	i2	i3	i2+ i3
2 - Damour-Aouali	1 798	1 739	3 537	602	583	1 185	297	1 228	1 525	899	1 811	2 710
3 - Aouali-Saïtaniq	369	1 427	1 796	256	73	329	301	796	1 097	557	869	1 426
4 - Saïtaniq-Zahrani	2 678	1 686	4 364	1 514	661	2 175	374	1 061	1 435	1 888	1 722	3 610
5 - Zahrani-Litani	10 392	9 088	19 480	6 822	2 124	8 946	2 429	5 074	7 503	9 251	7 198	16 449
6 - Litani - Frontière Sud	19 309	10 685	29 994	12 611	3 813	16 424	3 183	5 572	8 755	15 794	9 385	25 179
7 - Marjayoun	3 069	204	3 273	2 317	434	2 751	47	141	188	2 364	575	2 939
Total	37 615	24 829	62 444	24 122	7 688	31 810	6 631	13 872	20 503	30 753	21 560	52 313
arrondi à 100 ha	37 600	24 800	62 400	24 100	7 700	31 800	6 600	13 900	20 500	30 700	21 600	52 300

Tableau 15

SUPERFICIES DES ENSEMBLES IRRIGABLES PAR REGION GEOGRAPHIQUE ET TRANCHE D'ALTITUDE

Ensembles type II + III	Superficies nettes par tranche d'altitude (en ha nets)									Somme SIN (ha nets)
Région géographique	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	
2 - Damour-Aouali	700	600	400	800	200	-	-			2 700
3 - Aouali-Saïtaniq	200	400	300	300	200	-	-			1 400
4 - Saïtaniq-Zahrani	300	300	300	1 200	1 200	300	-			3 600
5 - Zahrani-Litani	900	3 300	2 600	4 600	4 200	900	-			16 500
6 - Litani-Frontière Sud	2 800	3 100	2 300	3 700	3 500	3 000	3 900	2 600	300	25 200
7 - Marjayoun	-				400	1 600	800	100	-	2 900
Total	4 900	7 700	5 900	10 600	9 700	5 800	4 700	2 700	300	52 300
%	9	15	11	20	19	11	9	5	1	100

Tableau 16

CARACTERISTIQUES DES ENSEMBLES IRRIGABLES PAR REGION GEOGRAPHIQUE ET PAR TYPE

Région géographique	Ensembles irrigables II				Ensembles irrigables III			
	Nombre	Superficie nette (ha) SIN			Nombre	Superficie nette (ha) SIN		
		max.	min.	totale		max.	min.	totale
2 - Damour-Aouali	4	674	72	1 185	5	625	64	1 525
3 - Aouali-Saïtaniq	6	99	19	329	5	326	68	1 097
4 - Saïtaniq-Zahrani	11	1 064	30	2 175	10	308	45	1 435
5 - Zahrani-Litani	13	3 051	22	8 946	15	3 412	45	7 503
6 - Litani-Frontière Sud	36	2 996	56	16 424	33	1 038	60	8 755
7 - Marjayoun	3	1 880	626	2 751	1	188	188	188
Total	73	3 051	19	31 810	69	3 412	45	20 503

- Nombre total d'ensembles II et III : 142
- Superficie totale irrigable des ensembles : 52 313 ha
- Superficie nette irrigable moyenne d'un ensemble:
  II: 436 ha - III: 297 ha - II + III: 368 ha
- Superficie minimale d'un ensemble: 19 ha
- Superficie maximale d'un ensemble: 3 412 ha

Coefficient d'irrigabilité moyen

	II	III	II + III
$\frac{\Sigma \text{ SIN}}{\Sigma \text{ SG}}$	$\frac{31\,800}{37\,600} = 84\%$	$\frac{20\,500}{24\,800} = 83\%$	$\frac{52\,300}{62\,400} = 84\%$

Tableau 17

SUPERFICIES ACTUELLEMENT IRRIGUEES

(En ha nets))

Région géographique	Eaux souterraines	Eaux superficielles disséminées	Périmètre Qasmiyé	Total
2 - Damour-Aouali	470	1 364	-	1 834
3 - Aouali-Saïtaniq	180	818	-	998
4 - Saïtaniq-Zahrani	250	139	268	657
5 - Zahrani-Litani	1 900	1 142	1 930	4 972
6 - Litani-Frontière	3 405	57	1 819	5 281
7 - Marjayoun	-	300	-	300
Total	6 205	3 820	4 017	14 042

Tableau 18

SUPERFICIES ACTUELLEMENT IRRIGUEES A L'INTERIEUR DES ENSEMBLES IRRIGABLES

(En ha nets)

Région géographique	Eaux souterraines	Eaux superficielles disséminées	Périmètre Qasmiyé	Total
2 - Damour-Aouali	170	263	-	433
3 - Aouali-Saïtaniq	30	-	-	30
4 - Saïtaniq-Zahrani	124	-	-	124
5 - Zahrani-Litani	1 270	34	-	1 304
6 - Litani-Frontière	2 550	95	-	2 645
7 - Marjayoun	-	300	-	300
Total	4 144	692	-	4 836

Tableau 19

IRRIGATIONS EXISTANTES PAR EAUX SOUTERRAINES

(Superficies en ha nets)

Résultats de l'enquête de la section HG effectuée en été 1972 - Cf.Rap.HG-006

Région	0 - 50 m			50-200 m	200 m	Total	Répartition intérieur / hors Zone côtière		Part hors-zone côtière 3/ incluse dans les ensembles irrigables / hors les ensembles irrigables	
	0-CI (a)	CI-LZC (b)	LZC-50 (c)	(d)	(e)	(a+b+c+d+e)	0-LZC (a+b)	(c+d+e)	(f) 4/	(c+d+e-f)
2 - Damour-Aouali	-	-	300 1/	155	15	470	-	470	170	300
3 - Aouali-Saïtaniq	-	70 2/	-	110	0	180	70	110	30	80
4 - Saïtaniq-Zahrani	55	60	-	135	0	250	115	135	124	11
5 - Zahrani-Litani	30	90	270	1 420	90	1 900	120	1 780	1 270	510
6 - Litani-Frontière Sud	60	135	520	2 500	190	3 405	195			
a - Litani - // 33°10'								2 860	2 490	370
b - / 33°10' - Frontière								350	60	290
Total	145	355	1 090	4 320	295	6 205	500	5 705	4 144	1 561

Abréviations: CI : Canaux d'irrigation de Qasmiyé et Ras el Aïn
LZC: Limite de la zone côtière ou limite occidentale des études pédologiques.

Nota: 1/ Dans cette région l'étude pédologique au 1/20 000 va jusqu'à la côte: la LZC s'identifie théoriquement avec la bordure côtière.

2/ CI n'existe pas: 70 ha = superficie de 0 à 50 m.

3/ La répartition des superficies irriguées par eaux souterraines hors-zone côtière, c'est-à-dire dans la zone d'études pédologiques, à l'intérieur ou à l'extérieur des ensembles irrigables est effectuée au prorata du nombre de forages figurant sur la carte au 1/50 000.

4/ Seule cette part viendra en diminution du potentiel irrigable.

Tableau 20

IRRIGATIONS EXISTANTES PAR EAUX SUPERFICIELLES DISSEMINEES

(Superficies en ha nets)

(D'après résultats de l'enquête AE 1972; CE rap. AE 108)

Petits périmètres côtiers et irrigations disséminées

Bassin versant	Altitude									Total		
	0 à 100 m			100 à 800 m			800 m					
	Zone côtière			Bassins moyens			Bassins supérieurs					
	RD	RG	Somme	RD	RG	Somme	RD	RG	Somme	RD	RG	Somme
Nahr Damour	640	-	640	324	352	676	63	565	628	1 027	917	1 944
Nahr Aouali	263	250	513	34	126	160	150	416	566	447	792	1 239
Nahr Saïtaniq	-	-	-	26	112	138	-	-	-	26	112	138
Nahr Zahrani	-	-	-	27	58	85	-	-	-	27	58	85
Nahr Litani sup. Amont prise Qasmiyé	-	-	-	553	57	610	531	-	531	1 084	57	1 141
Plaine du Marj				-	300	300	-	-	-	-	300	300
Total	903	250	1 153	964	1 005	1 969	744	981	1 725	2 611	2 236	4 847

Tableau 21

IRRIGATIONS EXISTANTES DANS LE PERIMETRE DE QASMIYE - RAS EL AÏN

(Superficies en ha nets)

(D'après enquête du groupe irrigation du projet - 1973)

Adducteur	Région	Irrigation gravitaire	Irrigation par pompage	Total
I - Canaux-Qasmiyé				
Tête morte	5 - Zahrani-Litani	-	-	-
(lit du Litani)	6 - Sud-Litani	144 1/	-	144
Branche Nord	5 - Zahrani-Litani	1 359	537	1 896
	4 - Saïtaniq-Zahrani	167	101	268
Branche Sud	6 - Sud-Litani	641	191	832
Total Qasmiyé		2 311	829	3 140
II - Canaux Ras el Aïn				
Branche Nord	6 - Sud-Litani	110	171	281
Branche Sud		296	171	467
Total Ras el Aïn		406	342	748
III - Nahr Litani				
(Aval Prise de Qasmiyé	5 - Zahrani-Litani	-	34	34
	6 - Sud-Litani	-	95 2/	95
Total Litani		-	129	129
Total périmètres irrigués		2 717	1 300	4 017

1/ Dont 100 ha de droits acquis.
2/ Droits acquis.

Tableau 22

REPARTITION PAR REGION DES SUPERFICIES IRRIGUEES PAR EAUX SUPERFICIELLES

(Superficies en ha nets)

Région géographique	Périmètre Qasmiyé Ras el Aïn	Autres périmètres côtiers	Bassins moyens	Bassins supérieurs + 800 m	Total (y compris bassins supérieurs)
Nord-Damour (pour mémoire)	-	640	324	63	1 027
Damour-Aouali	-	263	386	715	1 364
Aouali-Saïtaniq	-	250	152	416	818
Saïtaniq-Zahrani	268	-	139	-	407
Zahrani-Litani	1 930	-	611	531	3 072
Litani-Frontière Sud	1 819	-	57	-	1 876
Plaine du Marj	-	-	300	-	300
Total sans Nord Damour	4 017	513	1 645	1 662	7 837

Tableau 23

REPARTITION DU POTENTIEL IRRIGABLE PAR REGION GEOGRAPHIQUE

(Superficies en ha nets)

Sous-région	Ensembles irrigables (i2 + i3) Superficies nettes		Superficies actuellement irriguées			Potentiel irrigable (i2 + i3)	
			Eaux souterraines		Eau de surface dans II (et II+III)		
	dans II+III	dans II	dans II+III	dans II		dans II+III	dans II
2 - Damour-Aouali	2 710	1 185	170	100	263	2 277	822
3 - Aouali-Saïtaniq	1 426	329	30	10	-	1 396	319
4 - Saïtaniq-Zahrani	3 610	2 175	124	124	-	3 486	2 051
5 - Zahrani-Litani	16 449	8 946	1 270	860	34	15 145	8 052
6 - Litani-Frontière Sud	25 179	16 424	2 550	2 190	95	22 534	14 139
7 - Marjayoun	2 939	1 751	-	-	300	2 639	2 451
Total général	52 313	31 810	4 144	3 284	692	47 477	27 834
Arrondi à 100 ha	52 300	31 800	4 200	3 300	700	47 400	27 800

Tableau 24

REPARTITION DU POTENTIEL IRRIGABLE PAR REGION GEOGRAPHIQUE - VALEURS ARRONDIES

(Superficies en ha nets)

Région géographique	Superficie irrigable nette des ensembles		Superficie actuellement irriguée		Potentiel irrigable i2 + i3	
	dans II	dans II+III	dans II	dans II+III	dans II	dans II+III
2 - Damour-Aouali	1 200	2 700	400	400	800	2 300
3 - Aouali-Saïtaniq	300	1 400	-	-	300	1 400
4 - Saïtaniq-Zahrani	2 200	3 600	100	100	2 100	3 500
5 - Zahrani-Litani	8 900	16 500	900	1 400	8 000	15 100
6 - Litani-Frontière	16 400	25 200	2 300	2 700	14 100	22 500
7 - Marjayoun	2 800	2 900	300	300	2 500	2 600
Total	31 800	52 300	4 000	4 900	27 800	47 400

Tableau 25

ESTIMATIONS PROVISOIRE ET DEFINITIVE DU POTENTIEL IRRIGABLE

(Superficies en ha nets)

Région	Potentiel irrigable (i2 + i3)					
	Ensembles II			Ensembles II + III		
	Estimation provisoire	définitive	écart %	Estimation provisoire	définitive	écart %
2 - Damour-Aouali	1 197	822	- 31	2 763	2 277	- 18
3 - Aouali-Saïtaniq	212	319	+ 50	1 270	1 396	+ 10
4 - Saïtaniq-Zahrani	2 030	2 051	+ 1	3 465	3 486	+ 1
5 - Zahrani-Litani	9 058	8 052	- 11	16 445	15 145	- 8
6 - Litani-Frontière Sud	13 214	14 139	+ 7	20 865	22 534	+ 8
7 - Marjayoun	2 269	2 451	+ 8	2 484	2 639	+ 6
Total: - 2 à 7	27 980	27 834	- 1	47 292	47 477	0
- 5 à 7	24 541	24 642	0	39 794	40 318	+ 1

Tableau 26

INDICES DE PRODUCTIVITE DES FACTEURS PHYSIQUES DES SOLS

Facteurs physiques	Caractéristiques limites	Indices limites
a - Profondeur du sol	0 - 100 cm	0,10 - 1,00
b - Texture i - Cailloux (0-20 cm)	2 - 100 %	0,98 - 0,50
ii - Pierres	2 - 100 %	
iii - Particules <2 mm	Limon - Argile	1,00 - 0,95
c - Pente	0 - 40 %	1,00 - 0,75
d - Roche	0 - 100 %	1,00 - 0,01
e - Pierres en surface	0 - 100 %	1,00 - 0,01
f - Perméabilité	1,3 mm/h - 130 mm/h > 130 mm/h	0,90 - 1,00 0,90
g - C.E.C.	0 - 20 mEq/100 g	0,70 - 1,00
h - Horizon A	Ochric-Mollic 50 cm	0,95 - 1,00

Tableau 27

INDICES D'AMENAGEMENT DES SOLS

Facteurs physiques	Caractéristiques limites	Indices limites
a - Terrasses existantes	pas d'aménagement maximum 12 000 LL/ha	1,00 - 0,01
b - Pente	0 - 10 %	1,00 - 0,01
c - Rochosité	0 - 90 %	1,00 - 0,01
d - Graviers et cailloux	0 - 90 %	1,00 - 0,94
e - Pierres	0 - 90 %	1,00 - 0,01

Tableau 28

CLASSES D'IRRIGABILITE DES PARCELLES

Classe	Irrigabilité	Limites des recettes nettes (LL/ha)
1	Favorable	+ 4 000
2	Moyennement favorable	2 500 - 4 000
3	Marginale	1 000 - 2 500
4	Très marginale	0 - 1 000
5	Non irrigable	Néant

Tableau 29

COEFFICIENTS DE CORRELATION DES ETUDES PEDOLOGIQUES 1/20 000 - 1/2 000
SECTEUR-TEMOIN DE DOUAIR

(Superficies nettes en ha)

Etude pédologique au 1/20 000	Classe d'aptitude à l'irrigation	i2			i3	i4		Total
	Unité physiographique	a	S1	S2	S3	S4	S7	
	Superficie : S 20	45,9	30,8	30,0	61,9	9,6	0,5	178,7
Etude détaillée au 1/2 000	Classes d'irrigabilité							
	1	25,7	0,2	0	0	0	0	25,9
	2	11,1	14,9	8,5	4,1	0	0	38,6
	3	5,0	7,7	7,3	9,5	0	0	29,5
	1+ 2+ 3 : S 2	41,8	22,8	15,8	13,6	-	-	94,0
	4	0,7	2,5	4,0	14,5	2,1	0	23,8
	5	3,4	5,5	10,2	33,8	7,5	0,5	60,9
	4 + 5	4,1	8,0	14,2	48,3	9,6	0,5	84,7
Coefficients de corrélation	Rapport $\frac{S_2}{S_{20}}$	0,91	0,74	0,53	0,22	-	-	

Superficies nettes irrigables globales :

	i2	i3	i2 + i3
S_2 : 1/2 000	80,4	13,6	94,0
S_{20} : 1/20 000	106,7	61,9	168,6
S_2 / S_{20}	75 %	22 %	56 %

Tableau 30

COEFFICIENTS DE CORRELATION DES ETUDES PEDOLOGIQUES 1/20 000 - 1/2 000
SECTEUR-TEMOIN DE BARAACHIT

(Superficies nettes en ha)

Etude pédologique au 1/20 000	Classe d'aptitude à l'irrigation	i2			i3	i4		Total
	Unité physiographique	a	N1-Z1	N2-Z2	N3-Z3	N6-Z6	N7-Z7	
	Superficie : S 20	3,8	5,5	76,5	14,4	10,3	1,0	111,5
Etude détaillée au 1/2 000	Classes d'irrigabilité							
	1	0	1,5	3,1	0	0	0	4,6
	2	0,7	1,8	12,9	0,3	1,3	0	17,0
	3	3,1	1,4	31,8	3,5	2,2	0	42,0
	$1+2+3 = S_2$	3,8	4,7	47,8	3,8	3,5		63,6
	4	0	0,6	7,3	1,8	0,6	0	10,3
	5	0	0,2	21,4	8,8	6,2	1,0	37,6
	4 + 5	0	0,8	28,7	10,6	6,8	1,0	47,9
Coefficients de corrélation	Rapport $\frac{S_2}{S_{20}}$	1,00	0,85	0,62	0,26	-	-	

Superficies nettes irrigables globales :

	i2	i3	i2 + i3
S_2 : 1/2 000	56,3	3,8	63,6
S_{20} : 1/20 000	85,8	14,4	100,2
S_2 / S_{20}	66 %	26 %	64 %

Tableau 31

COEFFICIENTS DE CORRELATION GENERALISES

Coefficients obtenus				Aptitude à l'irrigation	Unités pédologiques	Coefficients de corrélation généralisés
Douair		Baraachit				
Unité	Valeur	Unité	Valeur			
a	0,91	a	1,00		a - b	0,90
S_1	0,74	N1-Z1	0,85	i2	A1-B1-S1-N1-Z1	0,85
S_2	0,53	N2-Z2	0,62		A2-S2-N2-Z2	0,65
				i3	B2	0,65
S_3	0,22	N3-Z3	0,26		A3-A4-B3-B4-N3-Z3	0,30

Tableau 32

REPARTITION GEOGRAPHIQUE DU POTENTIEL IRRIGABLE

(Superficies nettes en ha)

Ensembles	Zone basse		Zone intérieure		Total	
	II	II+III	II	II+III	II	II+III
Région						
2 - Damour-Aouali	-	-	822	2 277	822	2 277
3 - Aouali-Saïtaniq	-	-	319	1 396	319	1 396
4 - Saïtaniq-Zahrani	202	202	1 849	3 284	2 051	3 486
5 - Zahrani-Litani	1 422	1 544	6 630	13 601	8 052	15 145
6 - Litani-Frontière	2 121	3 272	14 469	21 901	16 590	25 173
Total	3 745	5 018	24 089	42 459	27 834	47 477

Tableau 33

SOLS EFFECTIVEMENT IRRIGABLES DES REGIONS NABATIYE ET SUD-LITANI

(Superficies nettes en ha)

i. Potentiel des sols irrigables (d'après prospection au 1/20 000)

	Ensembles II			Ensembles II + III		
	i2	i3	Total	i2	i3	Total
Nabatiyé	4 931	1 699	6 630	7 323	6 688	14 011
Sud-Litani	11 187	3 582	14 769	13 822	8 379	22 201
Total	16 118	5 281	21 399	21 145	15 067	36 212

ii. Sols effectivement irrigables (d'après étude-tests au 1/2 000)

	Ensembles II			Ensembles II + III		
	i2	i3	Total	i2	i3	Total
Nabatiyé	4 257	690	4 947	5 799	2 196	7 995
Sud-Litani	8 580	1 253	9 833	10 661	3 058	13 719
Total	12 837	1 943	14 780	16 460	5 254	21 714

iii. Différence (en % du potentiel irrigable)

	Ensembles II			Ensembles II + III		
	i2	i3	Total	i2	i3	Total
Nabatiyé	- 14%	- 59%	- 25%	- 21%	- 66%	- 43%
Sud-Litani	- 23%	- 65%	- 33%	- 23%	- 64%	- 38%
Total	- 20%	- 63%	- 31%	- 22%	- 65%	- 40%

iv. Superficie totale des unités pédologiques (sans distinction d'ensembles)

	Prospection pédologique 1/20 000			Sols effectivement irrigables		
	i2	i3	Total	i2	i3	Total
Nabatiyé	8 200	9 800	18 000	6 700	2 700	9 400
Sud-Litani	17 400	12 800	30 200	13 700	4 600	18 300
Total	25 600	22 600	48 200	20 400	7 300	27 700

Tableau 34

SOLS EFFECTIVEMENT IRRIGABLES DES REGIONS NABATIYE ET SUD-LITANI

(Superficies en ha nets)

Région	Ensembles II	Ensembles II + III	Unités pédologiques
Nabatiyé	5 000	8 000	9 400
Sud-Litani	9 800	13 700	18 300
Total	14 800	21 700	27 700

Tableau 35

SOLS EFFECTIVEMENT IRRIGABLES DE LA ZONE DE PROSPECTION AU 1/20 000

(Superficies en ha nets)

Ensembles	Zone basse		Zone intérieure		Total	
	II	II + III	II	II + III	II	II + III
Région						
2 - Damour-Aouali	-	-	500	1 300	500	1 300
3 - Aouali-Saïtaniq	-	-	200	800	200	800
4 - Saïtaniq-Zahrani	200	200	1 300	2 000	1 500	2 200
5 - Zahrani-Litani	1 000	1 000	5 000	8 000	6 000	9 000
6 - Litani-Frontière	1 400	2 000	9 800	13 700	11 200	15 700
Total	2 600	3 200	16 800	25 800	19 400	29 000

Tableau 36

RESULTATS GLOBAUX DE LA PROSPECTION PEDOLOGIQUE

(Superficies arrondies en ha)

Superficie brute en hectares :	i2	i3	i4	Total
- des ensembles irrigables	33 000	23 200	6 200	62 400
- des terrains exclus des ensembles	9 700	9 400	75 900	95 000
- totale prospectée au 1/20 000	42 700	32 600	82 100	157 400

Tableau 37

COMPOSITION DES ENSEMBLES IRRIGABLES

(Superficies arrondies en ha)

Ensembles	Surfaces brutes	Sols non irrigables	Emprises futures	Superficies irrigables nettes (ha)		
				i2 + i3	i2	i3
II	37 600	3 400	2 400	31 800	24 100	7 700
III	24 800	2 800	1 500	20 500	6 600	13 900
II + III	62 400	6 200	3 900	52 300	30 700	21 600

Tableau 38

REPARTITION GEOGRAPHIQUE DES ENSEMBLES IRRIGABLES

(Superficies arrondies en ha)

Région géographique	Superficie brute	Superficie irrigable nette		
		Ensembles II	Ensembles III	II + III
Damour-Aouali	3 500	1 200	1 500	2 700
Aouali-Saïtaniq	1 800	300	1 100	1 400
Saïtaniq-Zahrani	4 300	2 200	1 400	3 600
Zahrani-Litani	19 500	8 900	7 500	16 500
Litani-Frontière	30 000	16 400	8 800	25 200
Marjayoun	3 300	2 800	200	2 900
Total	62 400	31 800	20 500	52 300

Tableau 39

POTENTIEL IRRIGABLE - REPARTITION PAR REGION GEOGRAPHIQUE

(Superficies arrondies en ha nets)

Région géographique	Superficie irrigable nette des ensembles		Superficie actuellement irriguée		Potentiel irrigable i2 + i3	
	dans II	dans II+III	dans II	dans II+III	dans II	dans II+III
Damour-Aouali	1 200	2 700	400	400	800	2 300
Aouali-Saïtaniq	300	1 400	-	-	300	1 400
Saïtaniq-Zahrani	2 200	3 600	100	100	2 100	3 500
Zahrani-Litani	8 900	16 500	900	1 400	8 000	15 100
Litani-Frontière	16 400	25 200	2 300	2 700	14 100	22 500
Marjayoun	2 800	2 900	300	300	2 500	2 600
Total	31 800	52 300	4 000	4 900	27 800	27 400

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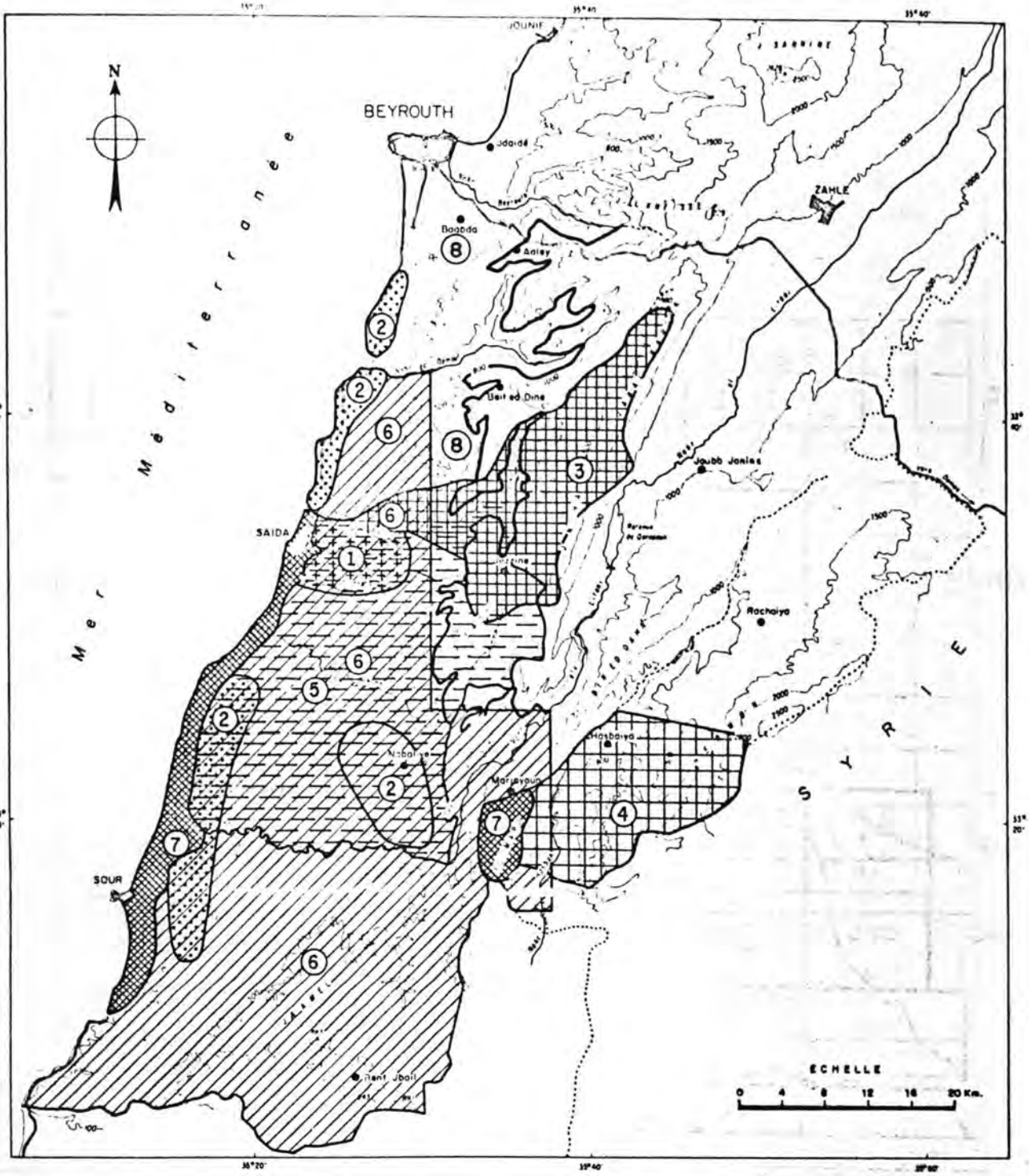
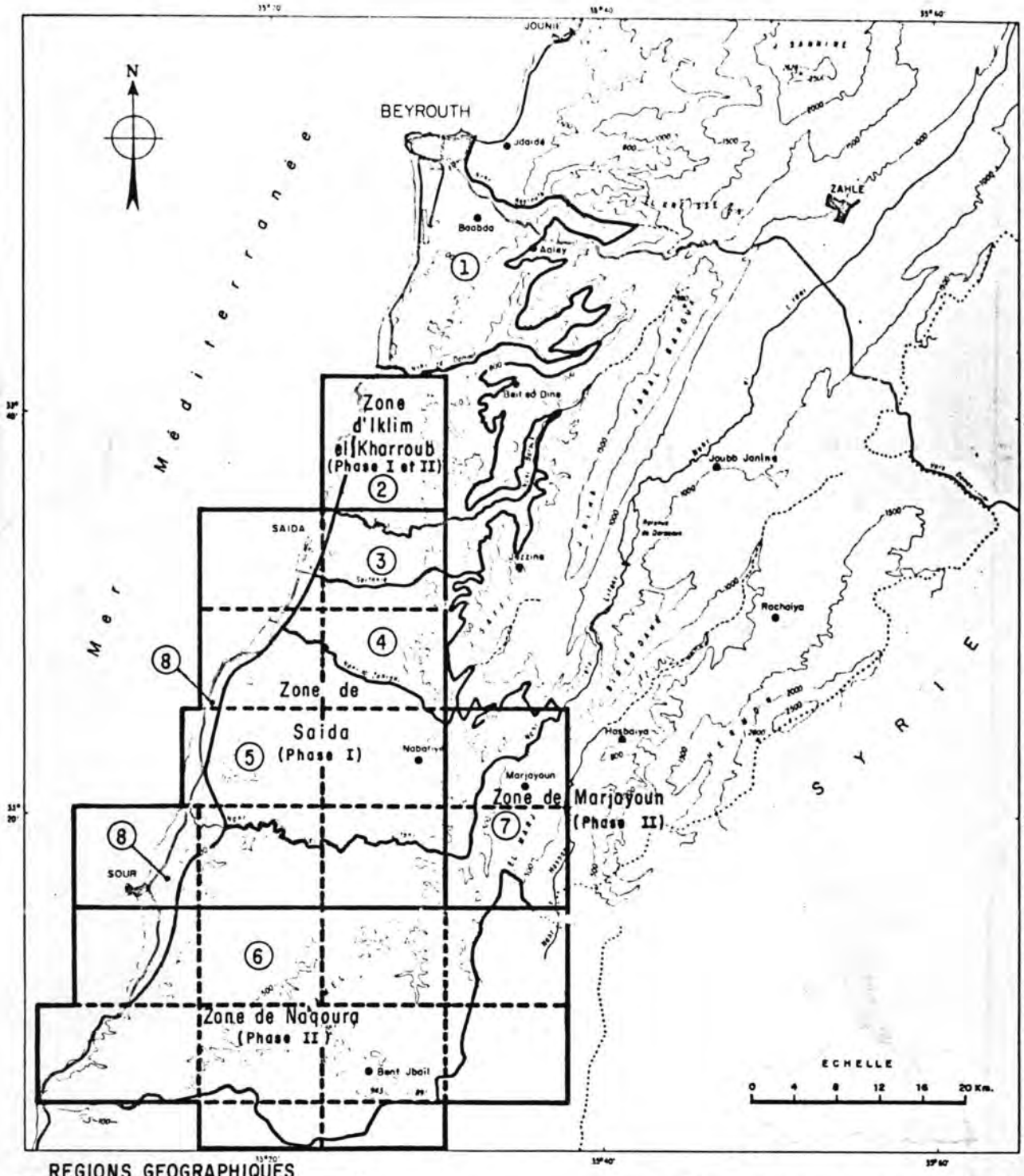


Nº	Symbole	Désignation	Echelle
1	+ + + + +	IRAL: Périmètre Aouali	1/25.000
2		USDA B.R.: Litani River basin	1/70.000
3		PLAN VERT: Périmètre Aouali-Saghbine	1/50.000
4		PLAN VERT: Hermon Périmètre	1/50.000
5		VERHEYE: Soils in south Lebanon	1/50.000
6		Enquête pédologique Proj. Liban Sud 1967 et 1973	1/20.000
7		Enquête pédologique Proj. Liban Sud 1973-1974	1/10.000
8		Enquête INRAL en cours 1974-1975	1/20.000

LOCALISATION SCHÉMATIQUE DES TRAVAUX DE CARTOGRAPHIE DES ENQUÊTES PÉDOLOGIQUES DANS LE SUD DU LIBAN.

Figure 1



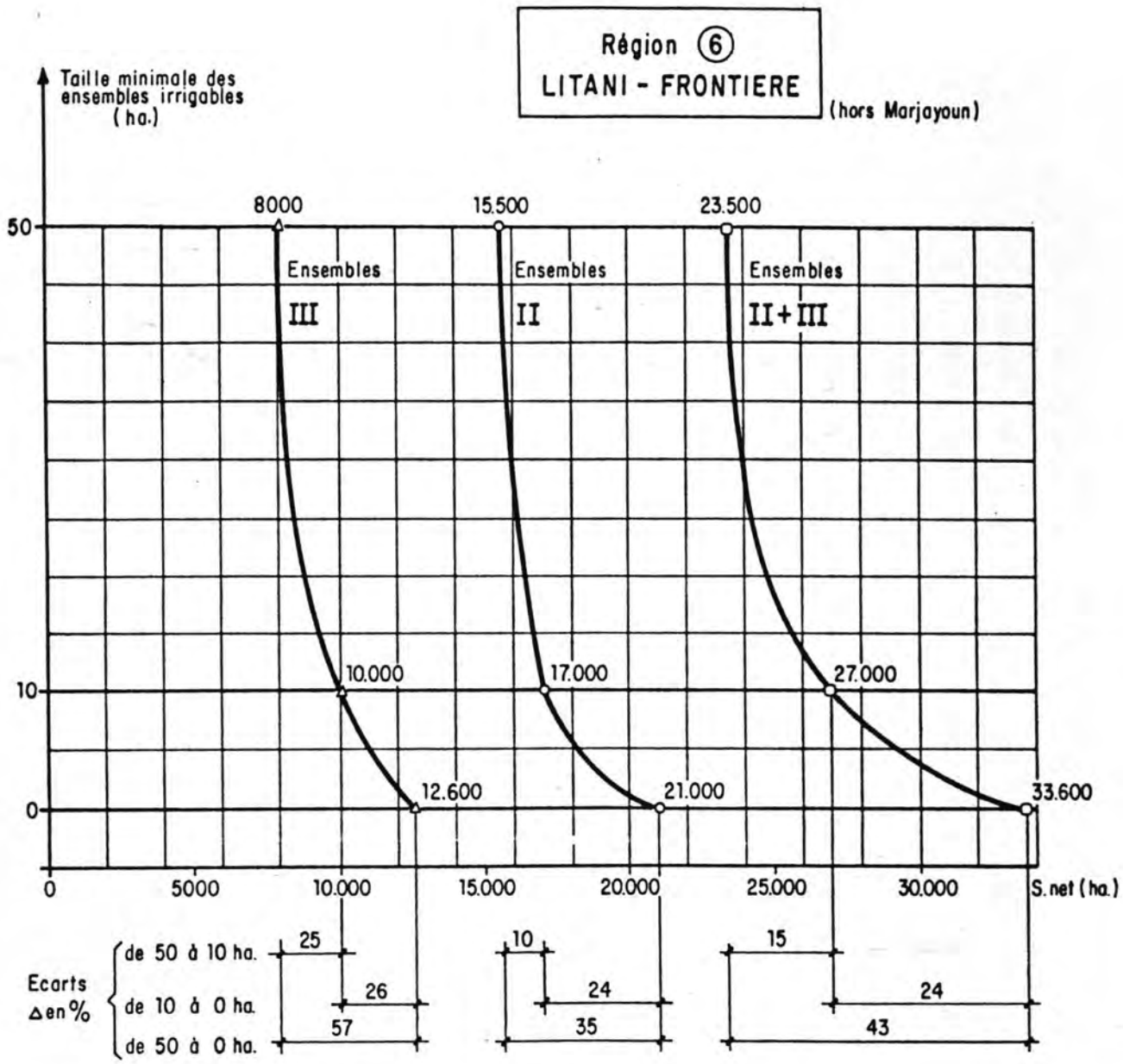
REGIONS GEOGRAPHIQUES

1	DAMOUR NORD	
	Zone de prospections pédologiques Liban-Sud au 1/20.000	
2	DAMOUR - AOUALI	Phase I
3	AOUALI - SAITANIQ	
4	SAITANIQ - ZAHRANI	
5	ZAHRANI - LITANI	
6	LITANI - FRONTIERE	Phase II
7	MARJAYOUN	
	Zone de prospections pédologiques Liban-Sud au 1/10.000	
8	COTE	

Assemblage des coupures 1/20.000

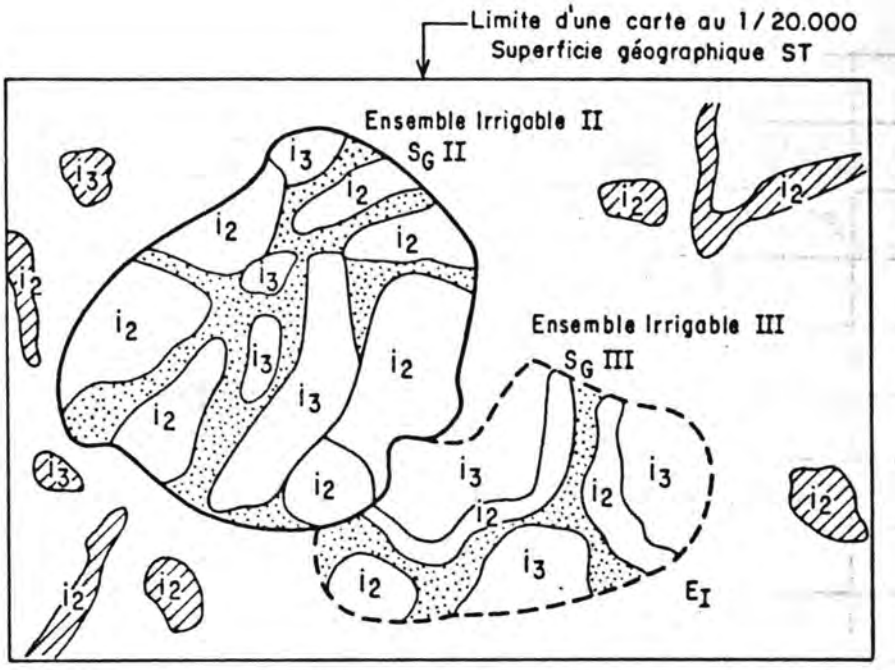
RÉGIONS DE PROSPECTIONS PÉDOLOGIQUES DU LIBAN-SUD

Figure 2



SURFACES DES ENSEMBLES IRRIGABLES
EN FONCTION DE LEUR TAILLE MINIMALE
(Extrait de IR 101)

Figure 3



SG (II+III) : Superficie géographique brute des ensembles

$ST = E_i + E_2 + E_3 + SIB$

EXCLUSIONS

E_1 non irrigable

E_2 Irrigable disséminé

E_3 non irrigable inclus dans S_G

SUPERFICIES IRRIGABLES BRUTES

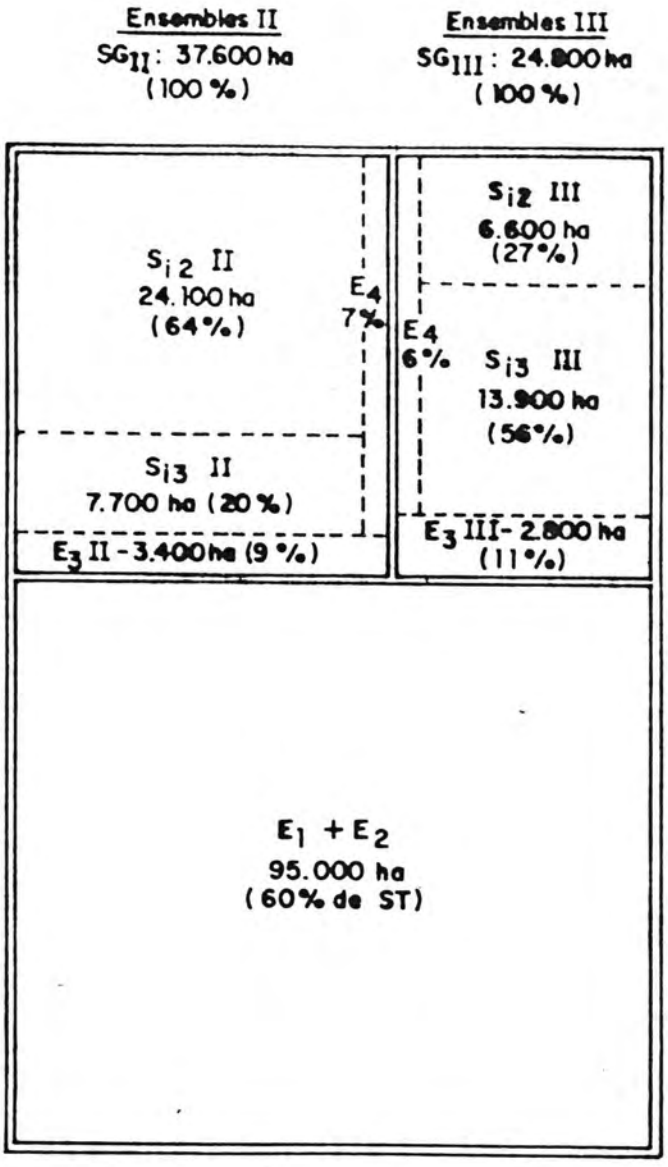
$SIB = S_{i2} + S_{i3} = SIN + E_4$

SUPERFICIES IRRIGABLES NETTES

$SIN = 0,93 \cdot SIB$

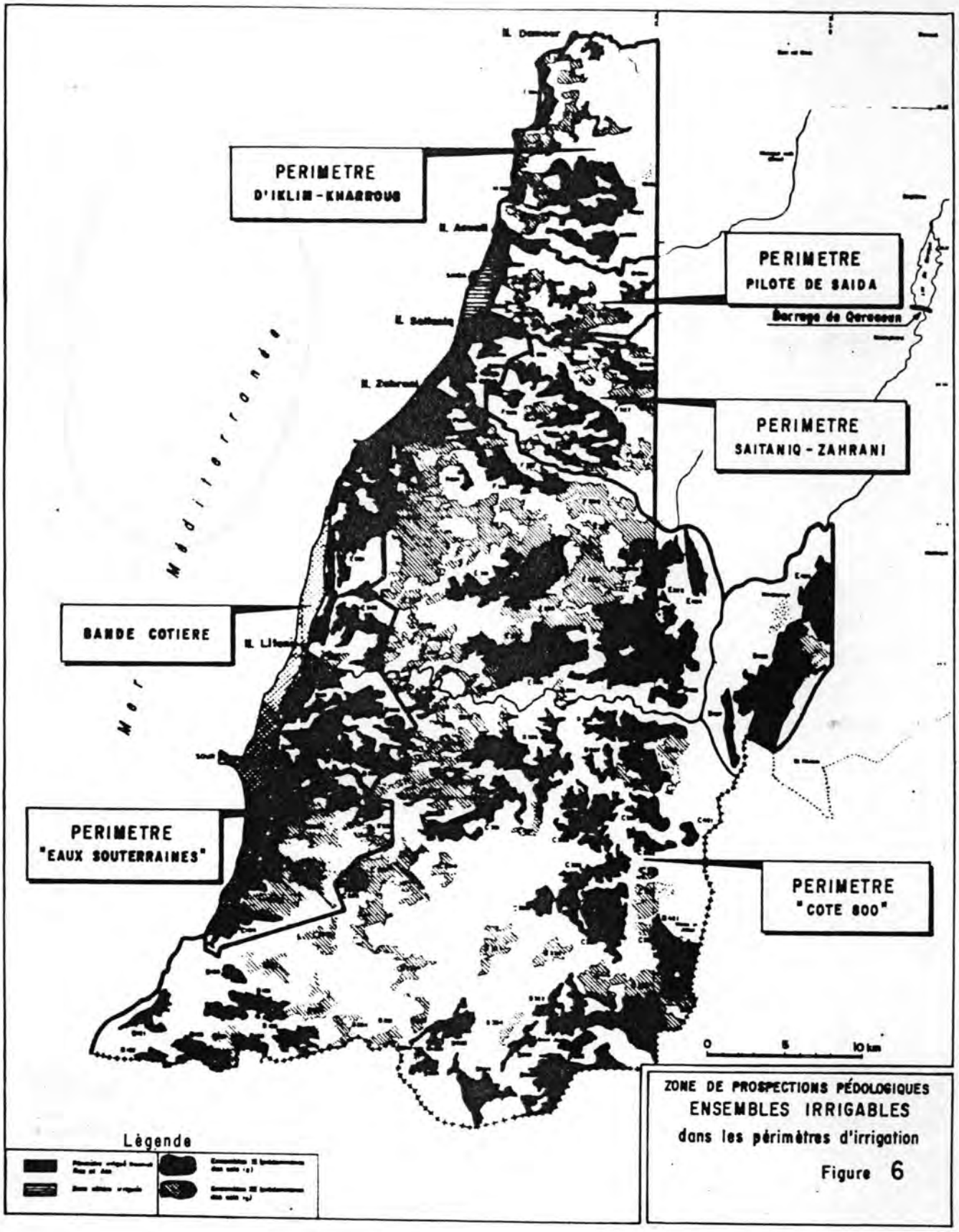
CONSTITUTION DES ENSEMBLES IRRIGABLES

Figure 4



SCHÉMATISATION DES SUPERFICIES
DES ENSEMBLES IRRIGABLES

Figure 5



ZONE DE PROSPECTIONS PÉDOLOGIQUES
ENSEMBLES IRRIGABLES
dans les périmètres d'irrigation

Figure 6

N

Mediterranean Sea

TRIPOLI 870
CHEKKA 950
AMIOUN 785
Abou Ali 885
Kalloun 1085
BATROUN 1035
Kfar Halda 1069
Meyfouk 1429
Lakloug (Hôtel) (1695)
Tourzaya 1453
JEBAIL
Karkaba 1491
Ghebale 1322
Ghazir 1108
JOUNIÉ
Ghosta 1225
Reytoun 1271
Kleiate 1211
Zouk 903
Bikfaya 1336
Kornet Chehwan 1050
BEYROUTH
Arkoubie 1256
Jouar el Hsouz 1251
Ras el Metene 1058
Antoun 1140
Fatougha 1209
Jamhour 901
Chouelfat 907
Bhamdoun 1524
Grayeh 1355
Dahr el Baidar 1361
Souk el Gharb 1112
Ain Zhalta 1826
Abey 923
Jisr el Kadi (1152)
Mejdel Meouch 1006
DAMOUR
Dmit 1030
Beit ed Dine 1158
Kfar Nebrak 1275
Jdaideh 1301
Ghariré 1043
Kaitermaya 789
SAÏDA 678
Sfarai 940
Maghdouche 786
Ankoun (1708)
Jbaa 917
Jarjoua 929
Deir Zahrani 994
Rihane 938
Arab Salim 1010
Ansarieh 656
El-Qasmiyé 660
SOUR 627
Jouaya 719
Kana 618
Aïn Ebel 775
Bent Jbail
Alfaroun 786
Aïna Chamb 779
Douair 861
Nabatiyé 834
Jarmak 979
MARJAYOUN 895
Hasbaya 1037
Kfar Zaile 991
RACHAYA 847
Kfar Qouq 876
Markaba 1042
Dahr dara jeh 1248
JEZZINE 1552
Machghara 1386
Karaoun-Barrage 1066
Karaoun 680
Beit ed-dine Lagch
Deir el Achayer 649
Yanta 546
Joub Jannine 720
Sultan YaKoub 468
Mansourah 833
Ammik 905
Anjar 527
Terbol 604
Tanayel 701
Chtoura 841
Ksara 650
Taali Amara 632
Rayak 632
ZAHLE 723
Sarghine Tahta 516
Haouch el Ghanam 608
Deir el Ahmar 1294
Haouch Snaid 489
Haouch ed Dehab 432
Kfar Dane 404
BAALBEK 406
Younine 420
Chlifa 497
Nabha 405
Arsal 329
Fakié 149
HERMEL 239
El Qah 172
Sir Danie 1190
BCHARREH 1205
CEDRES
Hesroun 1035
Faraya 1585
Faraya-Mzaar 1592
Baskinta 1633
Michmich 1002
HALBA 770
Abdé 905
Qlaiâate 895
Qouboyate 975
Arida 985

825 : Average Annual Precipitation in mm.

Figure 2

REPUBLIC OF LEBANON LITANI RIVER AUTHORITY	HYDRO - AGRICULTURAL DEVELOPEMENT PROJECT FOR SOUTH LEBANON	UNITED NATIONS DEVELOPEMENT PROGRAM FAO

PLUVIOMETRIC MAP OF LEBANON

FOR AN AVERAGE YEAR

(PERIOD : 1939 - 1970)

1

AE - 106

Date June 1973 | Scale 1 : 200 . 000 | Class N° : ae 120 | Drawn by: [redacted] | Checked by:

Mer Méditerranée

N

P	788	71,7
ETR	490	43,7
S	308	28,0
EC	62	5,6
D	246	22,4

BARJA
(91 Km²)

P	1084	83,3
ETR	475	36,6
S	609	46,9
EC	544	41,9
D	65	5,0

HAMMAM
(77 Km²)

P	1352	300,1
ETR	462	102,5
S	890	97,6
EC	727	161,3
D	163	36,3

ANAI I AMONT
(222 Km²)

P	1192	110,8
ETR	501	46,6
S	691	64,3
EC	691	64,3
D	0	0

DAMOUR MOYEN
(93 Km²)

P	226	112,8
ETR	442	40,7
S	784	72,1
EC	784	72,1
D	0	0

DAMOUR AMONT
(92 Km²)

P	1030	31,9
ETR	513	15,9
S	517	16,0
EC	517	16,0
D	0	0

DAMOUR AVAL
(31 Km²)

P	913	73,0
ETR	504	40,3
S	409	32,7
EC	403	32,2
D	6	0,5

AWALI AVAL
(80 Km²)

P	787	22,8
ETR	529	15,3
S	258	7,5
EC	258	7,5
D	0	0

SAÏDA
(29 Km²)

P	958	81,6
ETR	508	54,4
S	348	37,2
EC	178	19,0
D	177	18,2

SAITANIQ
(107 Km²)

P	805	43,5
ETR	512	27,7
S	293	15,8
EC	170	9,2
D	123	6,6

ROUMINE
(54 Km²)

P	1248	58,6
ETR	446	20,9
S	802	37,7
EC	802	37,7
D	0	0

ZAHRANI AMONT
(47 Km²)

P	725	45,0
ETR	490	29,7
S	245	15,3
EC	187	3,6
D	58	11,7

ZAHRANI AVAL
(62 Km²)

P	751	220,8
ETR	509	149,8
S	242	71,2
EC	86	25,4
D	156	45,8

ADLOUN
(294 Km²)

P	885	119,5
ETR	492	66,4
S	393	53,1
EC	393	53,1
D	0	0

LITANI MOYEN INF.
(135 Km²)

P	719	69,7
ETR	508	49,3
S	211	20,4
EC	205	19,9
D	6	0,5

LITANI AVAL INF.
(97 Km²)

P	748	66,6
ETR	457	40,8
S	291	25,8
EC	187	16,5
D	104	9,3

LITANI AVAL SUP.
(89 Km²)

P	719	190,5
ETR	492	130,1
S	227	60,4
EC	149	39,7
D	78	20,7

SOUR-JOUAÏYA
(265 Km²)

P	748	138,4
ETR	475	87,9
S	273	50,5
EC	32	6,0
D	241	44,5

OUADI GHANDOURIYE
(185 Km²)

P	779	787
ETR	466	47,1
S	313	31,6
EC	64	6,4
D	249	25,2

NAQOURA
(101 Km²)

P	775	122,4
ETR	428	67,6
S	347	54,8
EC	70	11,0
D	277	43,8

IZZIYÉ
(158 Km²)

Damour · Baited Dine · Jezzine · Nabatiyé · Marjayoun · Taïbé · Jouaïya · Bent Jbaïl · Adloun · Naqoura · SOUR · SAÏDA

Lac de Qaraoun · Galerie de Jezzine · Nahr Litani · Nahr Damour · Nahr Awali · Nahr Saïtaniq · Nahr Zahrani

LEGENDE

- 40,0 — Sources principales et débit en Mm^3/an
- 13,5 — Exploitation des eaux souterraines du bassin par pompage en Mm^3/an (valeur de 1972)
- 8,0 → Transfert d'un bassin à un autre par voie souterraine en Mm^3/an
- 6,0 ➡ Perte des rivieres en Mm^3/an
- 2,5 ⇢ Eau exploitée par pompage

P			P = pluie moyenne annuelle (corrélée sur 32 ans)
ETR			ETR = evapotranspiration réelle moyenne annuelle
S			S = surplus disponibles = P - ETR
EC			EC = écoulement des eaux du bassin par voie de surface
D			D = différence $\hat{S} - \hat{EC}$

Valeurs exprimées en 10^6 m^3/an
Valeurs exprimées en mm /an
Limite de bassin

Figure 7

BILAN DES EAUX SOUTERRAINES PAR BASSINS HYDROLOGIQUES