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Hydropolitics along the Jordan River

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As part of its activities concerned with water as a critical resource, the UNU is continuing to organize a series of projects that work to harness the inextricable link between water and geopolitics in arid and volatile regions. The aim is to identify issues in disputes concerning water resources; to select alternative scenarios that could lead to the solution of the complex problems related to water issues; and to recommend processes through which the countries concerned are likely to agree to mutually satisfactory solutions to problems.

The Middle East Water Forum held in Cairo in 1993, organized by the UNU, produced an authoritative book on the subject entitled "International Waters of the Middle East: From Euphrates-Tigris to Nile." The Forum proved highly successful and contributed, informally but importantly, to the progress of the Middle East Peace Talks. This book emerged as a part of the UNU's continuing efforts in this field and is part of a series of books related to water issues and conflict resolution.

Hydropolitics along the Jordan River: Scarce water and its impact on the Arab–Israeli conflict

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For Ariella
with love

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1

Introduction

All of the countries and territories in and around the Jordan River watershed – Israel, Syria, Jordan, the West Bank, and Gaza – are currently using between 95 per cent and more than 100 per cent of their annual renewable freshwater supply. In recent dry years, water consumption has routinely exceeded annual supply, the difference usually being made up through overpumping of fragile groundwater systems. By the end of the century, shortages will be the norm. Projected water requirements for the year 2000 are 2,000 million cubic metres (MCM) annually for Israel, approximately 130 per cent of current renewable supplies, and 1,000 MCM/yr, or 115 per cent of current supplies, for Jordan. Syrian water demand is expected to exceed available supply by 2010.

Superimposed on this regional water shortage are the political boundaries of countries that have been in a technical, when not actual, state of war since 1948. In fact, much of the political conflict has been either precipitated or exacerbated by conflicts over scarce water resources. Water-related incidents include the first Arab summit, with the consequent establishment of the Palestine Liberation Organization (PLO) in 1964, armed escalation between Syria and Israel leading up to the Six-Day War in 1967 and, according to some, the war itself, as well as the current impasse over the final status of the West Bank. Israel's incursions into Lebanon and its continued presence there have also been linked to a ''hydraulic imperative.''

With only 1,400 MCM of usable flow annually (Kolars 1992), the Jordan River is the smallest major watershed in the region, compared with the Nile with 74,000 MCM/yr or the Euphrates at 32,000 MCM/yr. But, because of its geopolitical position, the Jordan has been described as ''having witnessed more severe international conflict over water than any other river system in the Middle East ... and ... remains by far the most likely flashpoint for the future'' (E. Anderson in Starr and Stoll 1988, 10).

In addition to a natural increase in demand for water due to growing populations and economies, the region can expect dramatic demographic changes from at least three sources. Israel expects about a million additional Soviet Jewish immigrants over the next decade (Bank of Israel 1991) – a 25 per cent increase over its present population. Jordan, meanwhile, recently absorbed 300,000 Palestinians expelled from Kuwait in the wake of the Gulf War. Finally, talks are being initiated over a greater level of autonomy of the Palestinians in the West Bank and Gaza. Presumably, an autonomous Palestine would strive to absorb and settle a number of the 2.2 million Palestinians registered worldwide as refugees (Jaffee Center 1989, 206). The absorption of any or all of these groups of immigrants would have profound impacts on regional water demands.

Given the important role of water in the history of the Middle East conflict, and given imminent water shortages in this volatile region, the future can appear full of foreboding. Two recent American studies of the links between water resources and politics in the Middle East were sponsored by agencies whose primary interests are strategic or defence-related. Naff and Matson (1984) were commissioned by the Defense Intelligence Agency, and a study by Starr and Stoll (1987; 1988) was carried out under the auspices of the Center for Strategic and International Studies in Washington, D.C. The executive summary of the latter report begins, ''Before the twenty-first century, the struggle over limited and threatened water resources could sunder already fragile ties among regional states and lead to unprecedented upheaval within the area.'' There is, however, some room for optimism. Along with being an impetus to conflict, water has also been a vehicle for cooperation. Throughout the 42 years of hostilities, water issues have been the subject of occasional secret talks and even some negotiated agreements between the states in the region. In regional peace talks, cooperation on regional water planning or technology might actually help provide momentum toward negotiated political settlement. According to Frey and Naff (1985, 67),

''Precisely because it is essential to life and so highly charged, water can – perhaps even tends to – produce cooperation even in the absence of trust between concerned actors.'' Finally, the pressures to cooperate might very well come from a clear understanding of the alternative. ''If the people in the region are not clever enough to discuss a mutual solution to the problem of water scarcity,'' Meir Ben-Meir, former Israeli Water Commissioner, is quoted as saying, ''then war is unavoidable'' (cited in *The Times*, London, 21 February 1989).

What follows is an overview of the interplay between the waters of the Jordan River and the conflict between the states through which they flow. Included are sections on the natural hydrography of the watershed, a history of water-related conflict and cooperation in the region, and a survey of some resource strategy alternatives for the future.

The underlying premise is that the inextricable link between water and politics can be harnessed to help induce ever-increasing cooperation in planning or projects between otherwise hostile riparians, in essence ''leading'' regional peace talks. To show how this might be accomplished, a three-pronged approach is taken.

In chapter 2, I present the hydrology of the Jordan River watershed, and the long and tempestuous hydropolitical relationship between the riparians, their water resources, and each other. I suggest that, throughout the history of the region, water has influenced settlement patterns, attitudes towards immigration, and political tensions. I also examine the rare instances of cooperation, albeit small-scale and secret, for lessons we might apply to the future of the basin.

In chapter 3, the literature of several disciplines that address various aspects of conflicts over water is surveyed. The disciplines included are the physical sciences, law, political science, economics, game theory, and alternative dispute resolution (ADR). I suggest that, although each discipline provides useful guidelines to analysing different aspects of a watershed, no one discipline is capable of sufficiently evaluating watershed development and conflict analysis. I therefore develop an integrated interdisciplinary framework for analysis of water conflicts. Borrowing from the disciplines listed above, I provide steps for a preliminary watershed analysis; a framework for evaluating technical and policy options that might be available to a particular basin dependent on values for technical, economic, and political viability; and a process for ''cooperation-inducing design'' for development plans and projects.

In chapter 4, I apply the framework for analysis to the Jordan River watershed. By determining, in general terms, which options are more viable than others for the Jordan basin, I suggest a four-stage process for watershed development by which cooperation can grow from ''small and doable'' planning, through steps incorporating guidelines for cooperation-inducing measures, to ever-increasing cooperation and integration of the watershed. The four steps include negotiating an equitable division of existing resources; emphasizing greater efficiency for water supply and demand; alleviating short-term needs through interbasin water transfers, if available and politically viable; and developing a regional desalination project in cooperation-inducing stages. By including feedback within the evaluation framework between the hydrologic and political aspects of hydropolitics I suggest that water issues can remain on the cutting edge of political relations, in essence ''leading'' a peace process.

As might be surmised, the approach that I take does not follow the traditional pattern of a unidisciplinary study of resources management. It is suggested that, by its very nature, water is an interdisciplinary topic. By acknowledging, and even embracing, the relationship between the disciplines that analyse water issues, I argue that the field of resource management is broadened. In the process, some of the disciplines themselves are broadened. It is argued, for example, that ''dispute systems design,'' a relatively new subfield of ADR that offers guidelines for incorporating vehicles for conflict resolution within organizations and institutions, can be applied equally well to resource plans and even physical projects for resource development. I call the process that I advocate – separating control of existing resources, examining bargaining mixes for clues to systems design, and designing for ever-increasing cooperation – ''cooperation-inducing design.''

The emphasis of this study, however, is not necessarily to broaden disciplines. My interest is water and people, and the question to be answered is, ''What works?'' for assessing international water basins in general, and for attempting to resolve the conflicts in this especially contentious basin in particular.

This work could not have been completed without a tremendous amount of help from many people – academics, policy makers, staff people, and friends. Although I cannot possibly thank them all, I would like to take this opportunity to mention a few.

My greatest debt is to Professor John Ross, recently my academic adviser and now my colleague and good friend. Throughout this lengthy and sometimes trying process, John helped guide me through university bureaucracies, kept me funded, was a helpful presence when one was needed and backed off when I had to find my own way. Mostly, though, he kept me as intellectually honest as possible, without being dogmatic or preachy. For his quiet but firm guidance, and for his friendship, I am grateful.

I also owe special thanks to Professors Jerry Kaufman, Erhard Joeres, Jean Bahr, Joe Elder, and Nancy Wilkinson, whose student I was fortunate enough to be; and to Professors Tom Naff, John Kolars, Arnon Sofer, Hillel Shuval, Steve Lonergan, and Elias Salameh, all of whom were exceedingly generous with their time although I was not, strictly speaking, their job. I owe a particular debt to Professors Ariel Dinar and Asit Biswas, both of whom went out of their way to be helpful, always had time for advice, and never considered even the most trivial question out of line.

A study of this nature would not have been possible without the assistance and openness of water policy makers throughout the US and the Middle East, Special thanks are due to Jerome Delli Priscoli, Allen Keiswetter, Fred Hof, Joyce Starr, Steve Lintner, John Hayward, and Ulrich Kuffner, in Washington; Yehoshua Schwartz, Menahem Cantor, Yossef Elkanna, Shmuel Cantor, Zeev Golani, Avner Turgeman, Reuven Pedhatzor, Irv Speiwak, and Generals Avraham Tamir, Aryeh Shalev, and Moshe Yisraeli, in Israel; Jad Isaac, Nader El-Khatib, and Hisham Zarour, in the West Bank; and Jamil Rashdan, Sweilem Haddad, Munther Haddadin, and Mohammed Maali, in Jordan.

Special thanks are due also to those in Oak Ridge, Tennessee, who first coined the concept ''water-for-peace,'' and who were so open in sharing their experiences: Alvin Weinberg, Cal Burwell, and Senator Howard Baker. The Center for Environmental Policy Studies, the University of Wisconsin Graduate School, and the US Institute of Peace each provided funding and technical support for various stages of this project, for which, of course, I am particularly grateful. I would like specifically to mention Barbara Borns of the University of Wisconsin, and Otto Koester and Ambassador Sam Lewis of the USIP for their advice and assistance. Thanks, too, to Ofra Perlmutter of the Weizmann Archives in Rehovot, for teaching me how to say ''serendipity'' in Hebrew.

I am likewise indebted to the staff at the United Nations University

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I am, of course, grateful to all of the interviewees listed throughout this volume. I am particularly grateful to those interviewees who could not be named but who, through sharing their information, showed their belief that open information is a prerequisite to fruitful dialogue.

I owe a tremendous debt of gratitude to a very special couple – David Shutkin and Connie Friedman – the former for allowing me to bounce even the most far-fetched ideas off him over a game of chess and a beer, and the latter for taking pen in hand to read a draft when need be.

Finally, this project would not have been possible, nor the past eight years of my life quite so enjoyable, without the constant support of my wife, Ariella. Our respective, and now collective, families were also tremendously patient and supportive. But for putting up with late-night typing sessions, the shifting piles of paper sprawled around the apartment, and a honeymoon squeezed between the second and third drafts, it is to Ariella that I dedicate this volume, with love.

A note on terminology and sources. In a region as politically volatile as the Middle East, the language one uses for subjects as seemingly innocuous as geographic locations takes on grave political implications. I have tried to steer what narrow middle road there is in usage. For example, I use West Bank, rather than Occupied Territories or Judaea and Samaria, and Sea of Galilee, rather than Lake Tiberius or Lake Kinneret. The ''Green Line'' refers to the armistice line that held between Israel and her neighbours between 1948 and 1967. Other place names vary between English, Hebrew, and Arabic usage.

Also, in investigating a somewhat sensitive topic, I have discovered some sources that cannot be cited and encountered some interview subjects who prefer to remain unnamed. In my research, I tried to verify every point of information with at least two, and preferably three, independent sources. In some cases, however, I am able to cite only one source, or, on rare occasions, none at all.

2

Hydrography and history

The Middle East is a thirsty land. What it wants is neither kings nor constitutions, but water.
—*New Statesman and Nation*, 10 March 1945

Hydrography

Natural system: Surface water

The Jordan River watershed drains an area of 18,300 km^2 in five political entities – Lebanon, Syria, Israel, Jordan, and the West Bank (Naff and Matson 1984, 21) (see appendix I, maps 1–4).

Three springs make up the northern headwaters of the Jordan: the Hasbani, rising in Lebanon with an average annual flow across the border of 125 MCM/yr, the Banias in the Golan Heights, averaging 125 MCM/yr, and the Dan, the largest spring at 250 MCM/yr and originating in Israel. The streams from these springs converge 6 km into Israel and flow south to the Sea of Galilee at 210 m below sea level (Inbar and Maos 1984; Kolars 1992) (see table 2.1).

The Yarmuk River has sources both in Syria and Jordan and forms the border between those countries before it adds about 400 MCM/yr to the Jordan, 10 km south of the Sea of Galilee. Beyond this confluence, the Jordan picks up volume from springs and intermittent tributaries along its 320 km meander southward along the valley floor of the Syrio-African Rift. At its terminus at the Dead Sea 400 m below sea level, the Jordan River has a natural annual flow of 1,470 MCM/yr.

Table 2.1 **Water balance of the Jordan River system**

	Estimated flow (MCM/yr)[a]		
	Observed		Natural
North Jordan System			
Hasbani River (Lebanon)	125		125
Dan Spring (Israel)	250		250
Banias River (Golan Heights)	125		125
Local run-off (Upper Valley)	140		140
Irrigation-return flow (Huleh Valley)	−100		
Subtotal to Lake Tiberius	540		640
Lake Tiberius			
Spring flow (salty)	65		65
Precipitation	65		65
Local run-off	70		70
From Yarmuk	100		—
Subtotal	+840		840
Evaporation	−270		−270
To National Water Carrier	−500		
Subtotal to Lower Stem of Jordan River (N. Jordan)	+ 70		570
The Yarmuk River	(Al-Fataftah) (Salameh)	(Beaumont) (Gruen)	
Flow from Syria	+400[b]	495[b]	400
Syrian irrigation	− 90	−250[c]	
Syrian return flow	+ 20	+ 50(est.)	
To East Ghor Canal	−158[b]	−150[b]	
To Israel (via Tiberius)	−100[b]	− 80[b]	
Subtotal to Lower Stem of the Jordan River (Yarmuk)	+ 72	+ 65	970
Lower stem of Jordan River			
Lower Jordan spring flow	+185		185
Zarqa River and Wadis	+322	+539	322
East Ghor return flow	+ 32		
Total	+611[d]	+604[d]	1,477

Source: Kolars (1992).

a. Million cubic metres in an average year; climatic variations can change the values by ±30%.

b. Conflicting sources of data account for these variations.

c. Smaller values from the Johnston Plan; 1991 evidence indicates as many as 20 small diversionary dams have been built on the headwaters of the Yarmuk in Syria. Larger withdrawal values reflect such possible diversions.

d. Once in the main stream, this water is unusable owing to high salt concentrations.

The salinity of the water rises greatly even as its flow increases, because much of the Jordan's flow is below sea level and the small springs that contribute to its flow pass first through the salty remains of ancient seas. Though the headwaters at the Hasbani, Banias, and Dan have a salinity of 15–20 parts per million (ppm), levels at the south end of the Sea of Galilee are 340 ppm. This is diluted to some extent by the Yarmuk, which has a salinity of 100 ppm, but increases significantly downstream, reaching several thousand parts per million by the Allenby Bridge near Jericho. The Dead Sea, a terminal lake, has a salinity of 250,000 ppm, seven times that of the ocean (Naff and Matson 1984).

The river flows through the transition zone from the Mediterranean subtropical climate of Lebanon and the Galilee region in the north to the arid conditions of the Negev Desert and the Rift Valley to the south. Similarly, rainfall patterns vary spatially, with decreasing rainfall generally from north to south and from west to east.

Natural system: Groundwater

The hills along both banks of the Jordan serve as recharge areas for extensive aquifer systems in the West Bank, Israel, and Jordan. Rain that falls on these mountain ridges and does not evaporate or run off as surface water, percolates down to the water-table and then flows laterally, albeit extremely slowly, through the pores and cracks of the underlying rock layers. One measure of an aquifer's utility is its "safe yield," or the amount of water that can be pumped without adverse effects to the water left in storage. This is usually considered to be equal to the annual recharge rate.[1]

There are three principal aquifer systems west of the Jordan (Kahan 1987; Nativ and Issar 1988; State of Israel, Office of the Comptroller 1990) (see appendix I, map 5). Based on the current working assumptions of water managers in Israel, the aquifers have the

1. Strictly speaking, most of the aquifers discussed here are not technically part of the Jordan River watershed. However, they are such integral parts of the issues presented that they are included in the study.

   It should be noted, too, that all values for "safe yield" throughout this study should be used with extreme caution. Groundwater recharge and flow is notoriously difficult to estimate, and values given can be in error even by orders of magnitude. Also, groundwater yield and flow direction can be greatly affected by variability in rainfall, surface conditions, and pumping practices. Although I offer the average values that are provided in water budgets for the region, I do so with some hesitancy, and with the acknowledgement that both the term and the concept of "safe yield" are misleading.

following safe yields: the north-east basin, which recharges in the northern West Bank and discharges in Israel's Bet She'an and Jezreel valleys, has a safe yield of 140 MCM/yr; the western, or Yarkon–Tanninim, basin, which also recharges in the hills of the West Bank but discharges westwards towards the Mediterranean coast in Israel, has a safe yield of 320 MCM/yr; the eastern basin, which is made up of five separate catchment areas in the West Bank, all of which flow east toward the Jordan Valley, has a combined safe yield of 125 MCM/yr.

The coastal aquifer, another major groundwater source in Israel but without hydrologic connection to those listed above, provides a safe yield of about 280 MCM/yr. The Gaza aquifer, with connection to the coastal aquifer, provides an additional yield of 60 MCM/yr.

Groundwater replenishment within Jordan totals about 270 MCM/yr in 12 different aquifers, mostly in the Zarqa, Yarmuk, and Jordan catchments (Ghezawi 1991; M. Bilbeisi in Garber and Salameh 1992).

It should be kept in mind that these streamflow and groundwater recharge values are for *average* annual values in the natural system. The actual amounts are highly variable and depend both on seasonal fluctuations (75 per cent of precipitation falls during the four winter months) and on annual variations in rainfall, which can be as high as 25–40 per cent (Stanhill and Rapaport 1988). Furthermore, the natural system has been dramatically altered by large-scale diversion projects, as is discussed later.

Current water use (see tables 2.2 and 2.3)

Israel has a renewable annual water supply of approximately 1,600 MCM/yr. Of this, 60 per cent is groundwater and 40 per cent is surface water, almost entirely from the Jordan River system. Its water budget is augmented by about 200 MCM/yr from waste-water reclamation and non-renewable groundwater. The 1,800 MCM/yr total is allocated to agriculture (73 per cent), personal consumption (22 per cent), and industrial use (5 per cent). Israel irrigates 66 per cent of its cropland, and has a population of 4.2 million and an annual population growth rate of 1.6 per cent (excluding immigration) (Postel 1989a; State of Israel, Comptroller 1990).

The 800,000 Palestinians on the West Bank consume about 115 MCM/yr, 90 per cent of which is groundwater. Of this total, about 90 MCM (78 per cent) is for irrigation and the rest is for personal use.

Table 2.2 **Population projections for countries around the Jordan River watershed: Populations and growth rates (without immigration)**[a]

Entity	1991 Population	Annual growth rate (%)	Extrapolated 2020 population
Israel	4,800,000	1.6	8,850,000
Jordan	3,600,000	3.5	9,760,000
West Bank	900,000	3.4	2,370,000
Gaza	600,000	3.4	1,580,000

Sources: World Resources Institute (1991); Bank of Israel (1991) (Soviet immigrants); Heller (1983) (West Bank Immigrants).

a. Immigration: Israel anticipates 1 million additional Soviet Jews over the next 10 years; Jordan is absorbing 300,000 refugees from the Gulf War; the West Bank might absorb 600,000 Palestinian refugees in the context of ''right of return.''

Table 2.3 **Current water use and availability**

	Water budget/Natural potential (MCM/yr)	Percentage to Agr/Dom/Ind[a]
Israel[b]	1800/1600	73/22/5
Jordan[c]	870/870	85/10/5
West Bank	115/115	78/22/–
Gaza[d]	95/60	85/15/–

Sources: World Resources Institute (1991); Israel: Naff and Matson (1984), State of Israel (1988); Jordan: Garber and Salameh (1992); West Bank and Gaza: Kahan (1987).

a. Water in the region is allocated between agriculture (Agr), domestic use (Dom), and industry (Ind), with by far the largest share going to the former.

b. Israeli natural potential of about 1600 MCM/yr is augmented through waste-water reuse, some desalination, and, until 1991, a 200 MCM annual groundwater overdraft.

c. Jordan's budget includes 170 MCM/yr of planned use of fossil (non-renewable) aquifers.

d. Gaza budget includes approximately 35 MCM/yr aquifer overdraft which is leading to serious problems of salt-water intrusion.

The 70,000 Israeli settlers use an additional 35 MCM, 95 per cent of which is for agriculture (Kahan 1987, 113). The residents of the West Bank, Arab and Jewish, irrigate 6 per cent of the cultivatable land and have a population growth rate of approximately 3 per cent (Postel 1989a, 14).

Gaza, with a population of about 600,000 growing at 3.4 per cent annually, is probably in the most desperate situation hydrographically. Although the Gazans are completely dependent on the 60 MCM/yr of annual groundwater recharge, they currently use approximately 95 MCM/yr. The difference between annual supply and use is

made up by overpumping in the shallow coastal aquifer, resulting in dangerous salt-water intrusion of existing wells and ever-decreasing per capita water availability (already the lowest in the region).

Jordan has a total renewable annual water supply of 700 MCM, of which 50 per cent is surface water (mostly from the Yarmuk River). These sources above are augmented by about 170 MCM non-renewable groundwater per year. Of the total water budget of 870 MCM/yr, 85 per cent is allocated for agriculture, 10 per cent for personal consumption, and 5 per cent for industrial use. Jordan irrigates 10 per cent of its cropland and has a population of 3.3 million, which is growing at a rate of 3.5 per cent per year (Postel 1989a; Garber and Salameh 1992).

Lebanon and Syria are relatively minor consumers of water from the Jordan River, with the former using about 35 MCM/yr from the Hasbani and the latter about 250 MCM/yr from the Yarmuk, each for local irrigation projects near the respective headwaters. Their major sources are the Litani and Euphrates rivers, respectively. The Litani, with an average flow of 700 MCM/yr, lies wholly within Lebanon but, because it flows to within seven kilometres of the Hasbani, it has been included in several planned diversion schemes in conjunction with the Jordan system. Lebanon irrigates 29 per cent of its cropland, and has a population of 2.6 million, and an annual rate of population growth of 2.1 per cent. Syria irrigates 11 per cent of its cropland, and has a population of 10 million, which is growing at a rate of 3.8 per cent per year (Postel 1989a).

History – Water conflict and cooperation

From the origins of civilization in the Middle East, the limits and fluctuations of water resources have played a role in shaping political forces and national boundaries. Water availability helped to determine both where and how people lived, and influenced the way in which they related to each other. Issues of water conflict and cooperation have become especially intense with the growth of nationalist feelings and populations of the twentieth century. These issues are also relevant to current conflict – particularly between Israel, Jordan, and the Palestinians on the West Bank and Gaza – but they may offer new opportunities for dialogue as well.

As I describe the relationship between the water resources and political events in the region, it should be kept firmly in mind that nothing described here happened in a political vacuum. Of all the

myriad of geopolitical and strategic forces surrounding each of these developments, only those relating water resources to conflict or cooperation have been extracted for examination in this work.

The emergence of agriculture and nationalism

Living as they do in a transition zone between Mediterranean subtropical and arid climates, the people in and around the Jordan River watershed have always been aware of the limits imposed by scarce water resources. Settlements sprang up in fertile valleys or near large, permanent wells, and trade routes were established from oasis to oasis. In ancient times, cycles of weather patterns occasionally had profound effects on the course of history. Recent research suggests that climatic changes 10,000 years ago, which caused the average weather patterns around the Dead Sea to become warmer and drier, may have been an important factor in the birth of agriculture (Hole and McCorriston, as reported in the *New York Times*, 2 April 1991). The Natufians of the Jordan Valley, it has been suggested, found that by planting wild cereals they could overcome the increasing summertime food shortages of a drying climate.

It is also becoming increasingly accepted that a similar climatic drying around 4,000 years ago was responsible for the movement of groups of pastoralists from the marginal lands of the Syrian and Jordanian steppes as well as the Negev and Sinai deserts, because the marginal land no longer provided enough feed for their herds, into the more fertile coastal areas of the eastern Mediterranean. Together, as these groups shifted from sheep herding to agriculture, they coalesced into a political/religious entity later to become known as the Israelites.[2]

Even in biblical times, variations in water supply had their impact on the region's history. It was drought, for example, that drove Jacob and his family to Egypt, an event that led to years of slavery and, finally, to the consolidation of the Israelite tribes 400 years later (Genesis 41). Even then, the waters of the Jordan were occasionally associated with military strategy as, for instance, when Joshua directed his priests to stem the river's flow with the power of the Ark of the Covenant while he and his army marched across the dry riverbed to attack Jericho (Joshua 4).

2. Summarized in lectures at the University of Wisconsin, Madison, by Anson Rainey, 2 February 1992, and by Lawrence Sinclair, 18 March 1992.

National changes are not restricted to a drying climate. In an exhaustive study of the relationship between the ancient peoples of the Middle East and their water, Arye Issar (1990) suggests that favourable climatic conditions, with rainfall in the Negev 50 per cent greater than today's, may have contributed to the success of several national entities in the region from about 200 B.C.E. to 400 C.E.[3] This was a period in which the Roman Empire included much of the Middle East, the monastic Dead Sea sect (possibly the Essenes) thrived around the area of Qumran and, further south, the Nabateans extended their hold over the spice trade routes from Arabia to the ports along the Mediterranean coast. Before the twentieth century, the previously greatest population between the Jordan and the Mediterranean probably was reached during that period as well – about one million people during Byzantine rule (fifth century C.E.) (Broshi 1979) (see appendix I, map 6)

The Nabateans, with cities across the Negev Desert and a stunning capital at Petra, were particularly adept at intensively managing each drop from the rare rain events of their arid territory (Issar 1990, 178–181). Their methods, referred to as ''water harvesting,'' included diverting storm water to their fields and terracing and cultivating ephemeral stream beds. By collecting rocks from the surrounding hillsides into piles, they were also able simultaneously to induce dew out of the night air with the cooler rocks and to increase run-off by ''smoothing out'' the hill slopes. These techniques are currently studied for applicability to today's marginal lands. Nevertheless, Issar argues, these practices would not have been enough for stable agricultural returns without the more humid climate that he postulates.[4]

Issar concludes his study with the intriguing speculation that, once the climate again began to become drier in the fifth to seventh centuries C.E., the inhabitants of the ever-increasingly desiccated Arabian Peninsula may have found incentive to search for a more hospitable environment, resulting in the Moslem expansion across the Middle East, North Africa, and into Spain:

3. B.C.E.: Before the Common Era; C.E.: Common Era.
4. In this claim, Issar is coming full circle in a long-standing debate on the fall of these empires in the fifth through the seventh centuries C. E. Many explorers to Palestine at the end of the nineteenth century put the blame for the centuries-old desertification in the region on a desiccation of the climate. Research of the 1920s and 1930s claimed that the blame lay rather on the indigenous population, for allowing centuries of overgrazing. Issar (1990) covers the pros and cons of each argument in detail.

> Was this burning religious zeal of the Moslems made fiercer by the droughts which struck the northern and central parts of their peninsula? Did this drying up also weaken the countries of the Fertile Crescent guarding what was left of the Roman Empire . . . ? (Issar 1990, 188)

In the subsequent centuries, the inhabitants of the region and the conquering nations that came and went have lived mostly within the limits of their water resources, using combinations of surface water and well water for survival and livelihood (Beaumont 1991, 1). But just as changing amounts of water availability in the Middle East may have contributed to the formation of both the Jewish and Arab nations millennia ago, conflicting interpretations of how to overcome those limits have also been a factor in competition and conflict as their respective nationalisms began to re-emerge on the same soil in the twentieth century. Lessons from the details of these conflicts are used later in this work to inform strategies for conflict resolution.

Pre-1923: The shaping of modern nations

Even before modern Jewish nationalism, known now as Zionism, began to be formulated at the end of the nineteenth century, the longings for a ''return to Zion'' were occasionally given practical outlets, sometimes aided by Christians who saw an ingathering of the Jewish exiles as a necessary precondition to the Biblical ''end days,'' the preordained series of events that would lead to the ''second coming''. Much Jewish settlement activity centred around modernizing local agricultural practices in Palestine. The British Society for the Promotion of Jewish Agricultural Labour in the Holy Land, for example, was headed in the 1850s by the British Consul to Jerusalem and his wife, and was marginally successful in establishing land reclamation on a small scale, including an irrigation project and ''Abraham's Vineyard.'' The Consul also submitted a detailed scheme to the British Foreign Secretary ''to persuade Jews in a large body to settle here as agriculturalists on the soil . . . in partnership with the Arab peasantry'' (Tuchman 1956, 219). ''As the word 'persuade' indicates,'' Barbara Tuchman points out, ''the time was still not ripe.''

However, by the latter half of the nineteenth century, Jewish immigration to Palestine was beginning in earnest. Land was purchased for farms, colonies, and settlements centring around the towns of Safed and Jaffa, and in the Judaean Hills and Galilee. Financing for these endeavours came initially from such wealthy diaspora families as the

Montefiores and Rothschilds. Eventually, however, sufficient people were involved, both in funding and in immigration, for organizations such as Chovevei Zion (Lovers of Zion) and, later, the World Zionist Organization and the Jewish National Fund, to be established to streamline fundraising and to give political structure to the movement (Sacher 1916, 138–142).

In the twentieth century, as the developing nationalisms of both Arabs and Jews become more clearly defined, and with subsequent population pressures accelerated by immigration, water has continued to be a critical strategic resource.

When, after the first Zionist Congress in Basle in 1897, the idea of creating a Jewish State in Palestine (which by then had been under Ottoman rule for 400 years) began to crystallize in the plans of European Jewry, Theodore Herzl, considered to be the father of modern Zionism, travelled to the region to assess the practical possibilities. In Jerusalem, Herzl met the German Kaiser, whose influence with the Ottoman Sultan he sought to enlist. Barbara Tuchman describes the meeting in 1896 outside the Mikveh Israel colony:

> The Kaiser rode up, guarded by Turkish outriders, reined in his horse, shook hands with Herzl to the awe of the crowd, remarked on the heat, pronounced Palestine a land with a future, ''but it needs water, plenty of water,'' shook hands again, and rode off. (Tuchman 1956, 291)

Frustrated by the lack of enthusiasm on the part of the Turks for Jewish settlement, Herzl turned to the British, whose control of Egypt extended into the northern Sinai Peninsula. In 1902, Herzl suggested to Joseph Chamberlain, the British Colonial Secretary, that Jewish colonization and massive irrigation of the territory around El-Arish, in the northern Sinai Peninsula, would create a ''buffer state'' between Egypt and Turkey, helping to protect British interests in the Suez Canal (Ra'anan 1955, 36–37). Although Chamberlain was supportive, Lord Cromer, head of the Anglo-Egyptian Administration in Cairo, was sceptical of the chances for success of Jewish colonization and wary of intimidating the Turks, with whom the legal boundaries in the area were unclear. Cromer finally vetoed the project in 1903, claiming that Nile water, which would be necessary for irrigation, could not be spared.

Even without commitments for independent nations, both Jewish and Arab populations began to swell in turn-of-the-century Palestine, the former in waves of immigration from Yemen as well as from Europe, and the latter attracted to new regional prosperity

from other parts of the Arab world (Sachar 1969; McCarthy 1990). According to Justin McCarthy (1990), Palestine contained 340,000 people in 1878 and 722,000 by 1915 (see appendix I, maps 7 and 8).

During World War I, as it became clear that the Ottoman Empire was crumbling, the heirs apparent began to jockey for positions of favour with the inhabitants of the region. The French had inroads with the Maronite Catholics of Lebanon and therefore focused on the northern territories of Lebanon and Syria. The British, meanwhile, began to seek coalition with the Arabs from Palestine and Arabia – whose military assistance against the Turks they desired – and with the Jews of Palestine, both for military assistance and for the political support of diaspora Jewry (Ra'anan 1955).

As the course of the war became clear, French and British, Arabs and Jews, all began to refine their territorial interests; the location of the region's scarce water resources was a critical factor in the decision-making process of each party.

A detailed description of the lengthy process that ultimately led to the final determination of boundaries for the French and British mandates, which, in turn, informed the borders of modern Lebanon, Syria, Jordan, and Israel, is beyond the scope of this work, but can be found in the works of Ra'anan (1955), Sachar (1969; 1979; 1987b), Hof (1985), and Fromkin (1989). However, since the roots of subsequent water conflicts lie in the delineation of modern borders, it is important to examine in some detail the process and results, as well as the motives of each of the actors involved. The following outline of events leading up to the Anglo-French Convention in 1923 emphasizes only certain decisions, and is based on the works mentioned above. The interested reader is referred to that literature for more detail (see maps 9–12).

1913. French and Lebanese discussed the creation of a ''Greater Lebanon'' under French control, which would include the Beka'a Valley and the *vilayet* of Beirut, and which included northern Palestine (Ra'anan 1955, 72).

22 March 1915. T.E. Lawrence wrote to London from Cairo suggesting that he ''pull them [the Arab tribes] all together and roll up Syria by way of the Hejaz in the name of the Sharif [Hussein] ... and biff the French out of all hope of Syria'' (Ra'anan 1955, 64).

May 1915. The ''Damascus Protocol'' was drafted in Syria by secret Arab nationalist organizations insisting on independence for the Hejaz, Iraq, Syria, and Palestine, in exchange for assisting the British. In

July, Emir Hussein of the Hejaz communicated these demands to the British High Commissioner in Egypt, Sir Henry McMahon. In October, McMahon finally agreed, but insisted that certain areas had to be excluded because of British or French interests, namely ''the country west of Aleppo, Hams, Hama and Damascus,'' leaving unclear what the status of Palestine was to be (Ra'anan 1955, 65).

9 March 1916. The Sykes–Picot Agreement was signed between the British and the French, dividing the Middle East into regions that would be designated as French (including Lebanon and the northern Galilee), French-influence (Syria), British (Egypt, Iraq, and the port of Haifa/Acre), British-influence (northern Saudi Arabia and Jordan), and international (the remainder of Palestine) (Ra'anan 1955, 68).

The spheres of influence of the Sykes–Picot Agreement would have left the watersheds in the region divided in a particularly convoluted manner: the Litani and the Jordan headwaters to just south of the Huleh region would be French; the Sea of Galilee would be divided between international and French zones; the Yarmuk Valley would be split between British and French; and the lower stem of the Jordan would be international on the west bank and British on the east.

Because of these divisions, and because there is no mention of water *per se* in the literature on these negotiations, I suggest that other factors, such as the locations of rail and oil lines, holy places, and political debts and alliances, took precedence and that water resources was not an issue to this point in the border demarcation process (see Ra'anan 1955 and Fromkin 1989 for thorough discussions of these other factors). After the Sykes–Picot Agreement, however, and as the outcome of the war began to become clear, each entity with national claims in the region increasingly included water resources in its geographic reasoning, particularly after the end of World War I in 1918.

7 February 1917. Disturbed by rumours of the still-secret Franco-British agreement, Zionist leaders met Sir Mark Sykes to express opposition to condominium or internationalization of Palestine in favour of a British Protectorate; they also insisted on full rights of Jewish immigration and that Jews in Palestine be recognized as a nation (Memorandum of Meeting, in Sachar 1987b, vol. 8).

2 November 1917. The Balfour Declaration was approved by the British Cabinet:

> His Majesty's Government view with favour the establishment in Palestine of a national home for the Jewish people, and will use their best endeavours to facilitate the achievement of this object, it being clearly understood that nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities in Palestine, or the rights and political status enjoyed by Jews in any other country. (Reproduced in Sachar 1987b, vol. 8)

Conflicting interpretations of what was meant by ''national home,'' or even by ''Palestine'' (at the time including both sides of the Jordan River), and the apparent contradiction between ''facilitating this object'' and ''not prejudicing the . . . rights of existing non-Jewish communities,'' would lead to contention for years to come.

September–December, 1918. Because of British conquests in Palestine, the British no longer felt overly obligated to the French and new political interests began to be incorporated in the delineation of borders. Although they did not accede totally to Zionist requests, the British did deviate from the Sykes–Picot line and adopted the biblical ''Dan to Beersheba'' for Palestine, as based on a map of ''Palestine under David and Solomon'' (Hof 1985, 11), in negotiations with the French over the temporary boundaries of ''Occupied Enemy Territorial Administrations (OETA),'' but held open the possibility that

> Whatever the administrative sub-divisions, we must recover for Palestine, be it Hebrew or Arab, the boundaries up to the Litani on the coast, and across to Banias, the old Dan, or Huleh in the interior. (Lord Curzon, cited in Ingrams 1972, 49)

French Premier Georges Clemenceau agreed that Palestine, defined at the time in the temporary borders of OETA, should be exclusively British (Hof 1985, 7) (see appendix I, map 10).

1919. With the war over, and as preparations for the Paris peace talks began at Versailles in early 1919, border requirements were again refined by each side, as follows.

Zionist position

The Zionists began to formulate their desired boundaries for the ''national home,'' to be determined by three criteria – historic, strategic, and economic considerations (Zionist publications cited in Ra'anan 1955, 86).

Historic concerns coincided roughly with British allusions to the

biblical ''Dan to Beersheba.'' These were considered to be minimum requirements, which had to be supplemented with territory that would allow military and economic security. Military security required desert areas to the south and east as well as the Beka'a Valley, a gateway in the north between the Lebanon Mountains and Mount Hermon.

Economic security was defined by water resources. The entire Zionist programme of immigration and settlement required water for large-scale irrigation and, in a land with no fossil fuels, for hydropower. The plans were ''completely dependent'' on the acquisition of ''the headwaters of the Jordan, the Litani River, the snows of Hermon, the Yarmuk and its tributaries, and the Jabbok'' (Ra'anan 1955, 87).

In a flurry of communication between world Zionist leaders, the aspects of historic, strategic, and economic security became increasingly linked with the Jordan headwaters. These leaders of diverse backgrounds (including Chaim Weizmann, a British chemist whose wartime contribution of the gunpowder-refining process to the Allies granted him a certain status among British decision makers; Aaron Aaronsohn, a Palestine-born agriculturalist who had undertaken intelligence operations on Turkish troop movements for the British; and Louis Brandeis, a US Supreme Court Justice) each became demographer, cartographer, hydrologist, and strategist, in preparation for the Peace Conference.

The guiding force in refining the thinking on the necessary boundaries was Aaron Aaronsohn. He was in charge of an agricultural experimental station at Atlit on the Mediterranean coast, where his research focused on weather-resistant crops and dry-farming techniques. Convinced that the modern agricultural practices that would fuel Jewish immigration were incompatible with ''the slothful, brutish Ottoman regime'' (Sachar 1979, 103), he concluded that Zionist settlement objectives required alliance with the incoming Allied Forces. Aaronsohn initiated contact with the British to establish a Jewish spy network in Palestine, which would report on Turkish positions and troop movements. Perhaps because of his training both in agriculture and in security matters, he became the first to delineate boundary requirements specifically with regard to future water needs. Aaronsohn's ''The Boundaries of Palestine'' (27 January 1919, unpublished, Zionist Archives), drafted in less than a day, argued that

> In Palestine, like in any other country of arid and semi-arid character, animal and plant life and, therefore, the whole economic life directly depends

on the available water supply. It is, therefore, of vital importance not only to secure all water resources already feeding the country, but also to insure the possession of whatever can conserve and increase these water – and eventually power – resources. The main water resources of Palestine come from the North, from the two mighty mountain-masses – the Lebanon range, and the Hermon ...

The boundary of Palestine in the North and in the North East is thus dictated by the extension of the Hermon range and its water basins. The only scientific and economic correct lines of delineation are the water-sheds.

Aaronsohn then described the proposed boundaries in detail, as delineated by the local watersheds. He acknowledged that, with the exception of the Litani, the Lebanon range sends no important water source towards Palestine and ''cannot, therefore, be claimed to be a 'Spring of Life' to the country.'' It is the Hermon, he argued, that is ''the real 'Father of Waters' and cannot be severed from it without striking at the very root of its economic life.''

Returning to the Litani, however, Aaronsohn suggested that

[it] is of vital importance to northern Palestine both as a supply of water and of power. Unfortunately its springs lie in the Lebanon. Some kind of international agreement is essential in order that the Litani may be fully utilised for the development of North Palestine and the Lebanon.

Aaronsohn's rationale and boundary proposals were adopted by the official Zionist delegation to the Peace Conference, led by Chaim Weizmann. The ''Boundaries'' section of the ''Statement of the Zionist Organization Regarding Palestine,'' which paraphrased Aaronson's proposals, read, in part (see appendix II for the complete text):

The economic life of Palestine, like that of every other semi-arid country depends on the available water supply. It is therefore, of vital importance not only to secure all water resources already feeding the country, but also to be able to conserve and control them at their sources.

The Hermon is Palestine's real ''Father of Waters'' and cannot be severed from it without striking at the very root of its economic life ... Some international arrangement must be made whereby the riparian rights of the people dwelling south of the Litani River may be fully protected. Properly cared for these head waters can be made to serve in the development of the Lebanon as well as of Palestine. (Proposals dated 3 February 1919, Weizmann Letters 1968, appendix II)

Interestingly, Aaronsohn thought his ideas had been badly mangled in the Proposals, perhaps because he was not included in the final

drafting. In an angry letter to Weizmann, he complained that the draft was ''*a disgrace and a calamity*'' (emphasis Aaronsohn's), and expressed shock that, for one of the delegates, ''a 'watershed' is the same as a 'thalweg.' Incredible, but true'' (unpublished letter, 16 February 1919, Weizmann Archives).

In June 1919 Aaronsohn died in a plane crash (at the time deemed by the Zionists ''mysterious'') on his way to the Peace Conference and the Zionist proposals were submitted without revision. Nevertheless, the importance of the region's water resources remained embedded in the thinking of the Zionist establishment. ''So far as the northern boundary is concerned,'' wrote Chaim Weizmann later that year, ''the guiding consideration with us has been economic, and 'economic' in this connection means 'water supply' '' (18 September 1919, Weizmann Letters, 1968).

Arab position

The Arab delegation to the Peace Conference was led by the Emir Feisal, younger son of Emir Hussein of the Hejaz. Working with T.E. Lawrence, Hussein and his sons had led Arab irregulars against the Turks in Arabia and eastern Palestine. After the war, Feisal had developed a relationship with Chaim Weizmann as both prepared for the Peace Conference. After a meeting in 1918, Feisal said in an interview

> The two main branches of the Semitic family, Arabs and Jews, understand one another, and I hope that as a result of interchange of ideas at the Peace Conference, which will be guided by ideals of self-determination and nationality, each nation will make definite progress towards the realization of its aspirations. (Cited in Esco Foundation 1947, 139)

Feisal also initially expressed support for Jewish immigration to Palestine, in part because he saw it as useful for his own nationalist aspirations. At a banquet given in his honour by Lord Rothschild in 1918, he pointed out that ''no state could be built up in the Near East without borrowing from the ideas, knowledge and experience of Europe, and the Jews were the intermediaries who could best translate European experience to suit Arab life'' (Esco Foundation 1947, 140).

In a meeting later that year, Feisal tried to enlist Weizmann's support against French policies in Syria. Weizmann in turn outlined Zionist aspirations and ''asserted his respect for Arab communal rights'' (Sachar 1969, 385). The two also agreed that all water and

farm boundary questions should be settled directly between the two parties.

Feisal and Weizmann formalized their understanding to support each other's national ambitions on 3 January 1919, in a document which expressed mutual friendship and recognition of the Balfour Declaration, and stated that

> All necessary measures shall be taken to encourage and stimulate immigration of Jews into Palestine on a large scale, and as quickly as possible to settle Jewish immigrants upon the land through closer settlement and intensive cultivation of the soil. In taking such measures the Arab peasant and tenant farmers shall be protected in their rights, and shall be assisted in forwarding their economic development. (Original reproduced in Weizmann Letters, 1968)

These undertakings were (Feisal hand-wrote in the margin) provided that Arab requests were granted. ''If changes are made,'' he wrote, ''I cannot be answerable for failure to carry out this agreement.''

The Arab requests were spelled out in a memorandum dated 1 January 1919. Because the territory in question was so large (including Syria, Mesopotamia, and the Arabian Peninsula), geographically diverse and, for the most part well watered, it is not surprising that water resources played little part in the Arab deliberations. On the basis of a combination of level of development and ethnic considerations, Feisal requested the following (Esco Foundation, 1947):

1. That Syria, agriculturally and industrially advanced, and considered politically developed, should be allowed to manage her own affairs;
2. That Mesopotamia, ''underdeveloped and thinly inhabited by semi-nomadic peoples, would have to be buttressed … by a great foreign power,'' but governed by Arabs chosen by the ''selective rather than the elective principle'';
3. That the Hejaz and Arabian Peninsula, mainly a tribal area suited to patriarchal conditions, should retain its complete independence.

Two areas were specifically excluded: these were Lebanon, ''because the majority of the inhabitants were Christian,'' and which had its own delegates, and Palestine which, because of its ''universal character was left to one side for mutual consideration of all parties interested'' (Esco Foundation 1947, 138).

Once testimony had been heard at Versailles, as the peace talks continued, culminating at San Remo in 1920, the decisions were left to

the British and the French as to where the boundaries between their mandates would be drawn.

The French supported the Lebanese claim that the ''historic and natural'' boundaries of Greater Lebanon should include the sources of the Jordan River (Sachar 1979, 117), including the Galilee region. They claimed that the Litani was needed for development in Lebanon, whereas the snows of the Hermon provided water for Damascus.

In 1919, the British first suggested the ''Meinertzhagen Line'' as a boundary. This line, which was based chiefly on British security requirements, was similar in the north to that in the Zionist proposals, and was rejected by the French for similar reasons. In September the British put forward the compromise ''Deauville Proposal,'' which granted Palestine less territory than the Zionists sought but which still included the southern bank of the Litani and the Banias headwaters. At the time, Banias was thought (incorrectly) to be the biblical Dan, thereby allowing the British to remain true to their claim of Palestine ''from Dan to Beersheba'' (Hof 1985, 9) (see appendix I, map 11, for the area of dispute between French and British claims). Finally, to meet French objections as far as possible, the British proposed a border running north from Acre to the Litani bend, then east to Mount Hermon, which would increase Lebanese territory but leave the headwaters in Palestine (Ra'anan 1955, 123).

Although the French rejected each of these proposals, Phillipe Berthelot, the Foreign Minister and negotiator to an Anglo-French conference on the Middle East in December 1919, suggested that, although Prime Minister Clemenceau insisted on the Sykes–Picot line, he was prepared

> ... to agree that one-third of the waterpower of the waters flowing from Mount Hermon southwards into the Palestine of the Sykes–Picot agreement should be allotted to the Zionists under an economic arrangement with France. The French could do no more than this. (Cited in Ra'anan 1955, 125)

At a meeting on 17 February 1920, the British, represented by Prime Minister David Lloyd George, suggested that ''all Jews were unanimously agreed that the sources of Hermon and the head-waters of Jordan were vital to the existence ... of Palestine'' (Ra'anan 1955, 128). Without these headwaters, Lloyd George argued, the Mandate for Palestine would be a ''heavy burden'' for Britain. If France could not concede the point, he argued, United States President Wilson might be asked to arbitrate.

Berthelot responded that ''the snows of Hermon dominated the town of Damascus and could not be excluded from Syria, nor could the waters of the Litani, which irrigated the most fertile regions of Syria.'' But he did suggest that the claims to the Jordan might be more admissible and that, while France could not concede a frontier following the watersheds of the Syrian and Palestinian rivers, ''some arrangement might be made for the joint use of the waters in question'' (Ra'anan 1955, 129).

As to United States mediation, the French refused, claiming that ''President Wilson was entirely guided by Judge Brandeis, who held very decided views.'' Brandeis had, in fact, sent a telegram to the conference, endorsed by President Wilson, which read in part, that ''rational northern and eastern boundaries are indispensable to a self-sustaining community and economic development of the country. North Palestine must include the Litani River watersheds, and the Hermon on the east … Less than this would produce mutilation of the promised home'' (unpublished telegram, 16 February 1920, Zionist Archives).

Lloyd George and Berthelot finally fell back on ''from Dan to Beersheba,'' as described in an atlas written by Adam Smith, a Scottish theological professor, where ancient Samaria only brushes against the Litani, and has a boundary on the west coast more southern even than the Sykes–Picot line (Hof 1985, 11).

In June 1920, France agreed to a compromise: Palestine's northern boundary should be a line drawn from Ras en-Naqura to a point on the Jordan just north of Metulla and Banias-Dan, and then to the northern shore of Lake Hula, running from there along the Jordan, down the middle of the Sea of Galilee to the Yarmuk, where it would meet the Sykes–Picot line. Although these borders included all existing Jewish settlements within Palestine, most of the water resources would remain in Syria (Ra'anan 1955, 133).

At the San Remo Conference in April 1920, agreement was reached where Great Britain was granted the mandates to Palestine and Mesopotamia, and France received the mandate for Syria (including Lebanon). During the remainder of the year, last-minute appeals were made both by the British and by the Zionists for the inclusion of the Litani in Palestine or, at the least, for the right to divert a portion of the river into the Jordan basin for hydropower. The French refused, offering a bleak picture of the future without an agreement and suggested (referring to British and Zionist ambiguity as to what was meant by a ''national home''), ''Vous barbotterez si

vous le voulez, mais vous ne barbotterez pas à nos frais''[5] (Butler and Bury 1958, vol. VIII, p. 387).

On 4 December 1920, a final agreement was reached in principle on the boundary issue, which addressed, mainly, French and British rights to railways and oil pipelines, and incorporated the French proposal for the northern boundaries of six months earlier. The French delegation did promise that the Jewish settlements would have free use of the waters of the Upper Jordan and the Yarmuk, although they would remain in French hands (Ra'anan 1955, 136). The Litani was excluded from this arrangement. Article 8 of the Franco-British Convention, therefore, included a call for a joint committee to examine the irrigation and hydroelectric potential of the Upper Jordan and Yarmuk ''after the needs of the territories under French Mandate,'' and added that

> In connection with this examination the French government will give its representatives the most liberal instructions for the employment of the surplus of these waters for the benefit of Palestine. (Cited in Hof 1985, 14)

The final boundaries between the French and British mandates, which later became the borders between Israel, Lebanon, Syria, and Jordan, were worked out by an Anglo-French commission set up to trace the frontier on the spot. Their results were submitted in February 1922 and signed by the British and French governments in March 1923 (Ra'anan 1955; Hof 1985). The frontier would run from Ras en-Naqura inland in an easterly direction along the watershed between the rivers flowing into the Jordan and into the Litani; the line was then to turn sharply north to include in Palestine a ''finger'' of territory near Metulla and the eastern sources of the Jordan.

Rather than include the Banias spring within Palestine, as in the French proposal of six months earlier, the border ran parallel to, and 100 m south of, the existing path from Metullah to the Banias (see appendix I, map 12). The French insisted on inclusion of this road in its entirety to facilitate east–west transportation and communication within its mandate. This northern border meant that the entire Litani and the Jordan headwaters of the Ayoun and Hasbani would originate in Lebanon before flowing into Palestine. The Banias spring, meanwhile, would originate and flow for 100 m in Syrian territory, then into Palestine. As Palestine had a promise of water use, and also access to the Banias Heights, a small hill that over-

5. ''You will flounder if you like, but you will not flounder at our expense.''

looked the spring, the fact that the actual spring lay outside the boundaries was not of immediate concern. Of the headwaters of the Jordan, however, only the Dan spring remained entirely within Palestine.

From Banias, the border turned south towards the Sea of Galilee, along the foothills of the Golan Heights, parallel and just east (sometimes within 50 m) of the Huleh Lake and the Jordan River. Rather than passing through the middle of the Sea of Galilee, the border ran just east of its shores (even if the level were to rise because of a proposed dam), leaving the entire lake, the town of El-Hama, and a small triangle just south of the Jordan's outflow, within the territory of Palestine. These latter two were already included in Zionist plans for water diversion and hydroelectricity generation. These changes were beneficial to Palestine's hydrostrategic positioning and, although they were made mainly for administrative reasons, "to make customs inspection easier," it was also expressed that the development plans should proceed without international complication (Ra'anan 1955, 138, 143). Nevertheless, according to the agreement, fishing and navigation rights on the lake were retained by the inhabitants of Syria.

At the Yarmuk, the border went eastward along the river, meeting the Sykes–Picot line, into the Syrian desert and south of the Jebel Druze.

The final agreement made no mention of joint access to French-controlled waters.

Although the location of water resources had been an important, sometimes overriding, issue with some of the actors involved in determining the boundaries of these territories, it is clear in the outcome that other issues took precedence over the need for unified water basin development. These other factors ranged from the geostrategic (the location of roads and oil pipelines), to political alliances and relationships between British, French, Jews, and Arabs, to how well versed one or another negotiator was in biblical geography. The final boundaries are the result of competing needs and abilities of each of the people and entities involved in the negotiations. Because of limited land and resources, no one political entity could achieve all of its economic, historic, and strategic requirements.

The international frontiers of Palestine provided the external framework within which the Arab and Jewish national movements strove for nation-

hood. Because the boundaries had been drawn in a way unfavourable to Palestine, they ensured a bitter conflict, by making it impossible to arrive at a compromise solution on the lines of a clear territorial separation between the two nations. (Ra'anan 1955, 141)

The results sowed friction for generations. For Palestine,

by failing to approximate any natural geographic frontiers, the borders left the country perennially exposed to armed invasion. This heritage of economic and military vulnerability was to curse the Palestine mandate, and later the entire Middle East, for decades to come. (Sachar 1979, 117)

1923–1948: Nationalism, immigration, and "economic absorptive capacity"

Once the formidable process of border delineation between the British and French Mandates was complete, it was left to these powers to decide how best to balance their own national goals with those of the local populations. Between the World Wars, both powers relinquished increasing control in favour of the new nations of the region, but the process of allowing the region to turn inward was not without its difficulties. Conflicting national claims, ambiguities over historic promises, and, more to our point, discrepant claims as to how many people the land of Palestine could absorb, based on its land and water resources, each added to the strife of the process of nation-building (see tables 2.4 and 2.5).

The delineation of Mandate boundaries was only the first step in the 20-year process of withdrawal of British and French from the Middle East. Although each wanted to be influential in its respective mandated territory, it was clear that local national aspirations demanded local leadership. This was brought home to both the British and French when, in March 1920, the General Syrian Congress proclaimed a full and undivided independence of Syria, including Palestine; named the Emir Feisal as their constitutional king; and announced "the termination of the present occupying military governments" (Sachar 1969, 274).

Although the French pushed Feisal out of Syria later that year (he was named King of Iraq in 1921 by the British), both Syria and Mesopotamia were granted provisional independence, subject to mandatory control, at the San Remo Conference in 1920 (Sachar 1969, 279). By 1921, Feisal's brother Abdullah was installed by the British as Emir of Transjordan, which was separated from the rest of Palestine

Table 2.4 **Population of Paletine, 1922–1942**[a,b]

Year	Total	Moslems		Jews		Christians		Others	
		(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)
1922 Census	752,048	589,177	78.34	83,790	11.14	71,464	9.50	7,617	1.01
1931 Census	1,033,314	759,700	73.52	174,606	16.90	88,907	8.60	10,101	0.98
1931[c]	1,036,339	761,922	73.52	175,138	16.90	89,134	8 60	10,145	0.98
1932	1,073,827	778,803	72.52	192,137	17.90	92,520	8.61	10,367	0.97
1933	1,140,941	798,506	69.99	234,967	20.59	96,791	8.48	10,677	0.94
1934	1,210,554	814,379	67,27	282,975	23.38	102,407	8.46	10,793	0.89
1935	1,308,112	836,688	63.96	355,157	27.15	105,236	8.04	11,031	0.85
1936	1,366,692	862,730	63.13	384,078	28.10	108,506	7.94	11,378	0.83
1937	1,401,794	883,446	63.02	395,836	28.24	110,869	7.91	11,643	0.83
1938	1,435,285	900,250	62.72	411,222	28.65	111,974	7.80	11,839	0.83
1939	1,501,698	927,133	61.74	445,457	29.66	116,958	7.79	12,150	0.81
1940	1,544,530	947,846	61.37	463,535	30.01	120,587	7.81	12,562	0.81
1941	1,585,500	973,104	61.38	474,102	29.90	125,413	7.91	12,881	0.81
1942	1,620,005	995,292	61.44	484,408	29.90	127,184	7.85	13,121	0.81

Source: Esco Foundation (1947).

a. Exclusive of members of His Majesty's Forces (Breat Britain).

b. Adapted from table, "Estimated Population of Palestine," *Statistical Abstract of Palestine 1943*, p. 2.

c. The figures for 1931 and following years are as of 31 December of each year.

Table 2.5 **Recorded immigration and emigration, Palestine, 1930–1939**

Year or period	Immigration			Emigration			Net immigration		
	Jews	Non-Jews	Total	Jews	Non-Jews	Total	Jews	Non-Jews	Total
1930	4,944	1,489	6,433	1,679	1,324	3,003	3,265	165	3,430
1931	4,075	1,458	5,533	666	680	1,346	3,409	778	4,187
1932	9,553	1,736	11,289	x[a]	x	x	9,553	1,736	11,289
1933	30,327	1,650	31,977	x	x	x	30,327	1,650	31,977
1934	42,359	1,784	44,143	x	x	x	42,359	1,784	44,143
1935	61,854	2,293	64,147	396	387	783	61,458	1,906	63,364
1936	29,727	1,944	31,671	773	405	1,178	28,954	1,539	30,493
1937	10,536	1,939	12,475	889	639	1,528	9,647	1,300	10,947
1938	12,868	2,395	15,263	1,095	716	1,811	11,773	1,679	13,452
1939	16,405	2,028	18,433	1,019	977	1,996	15,386	1,051	16,437
Total:	222,648	18,716	241,364	6,517	5,128	11,645	216,131	13,588	229,719

Source: Esco Foundation (1947).
a. "x" indicates that emigration was not reported.

at the Jordan River. Transjordan declared its independence on 15 May 1923, but remained linked to Britain until that country's mandate ended in 1946. Similarly, Lebanon became a republic independent from Syria in 1926, but gained full independence only in 1946, along with Syria, when British forces ousted the French after World War II.

Meanwhile, in Palestine, which after Transjordan's separation in 1922 referred only to the territory from the Jordan River to the Mediterranean, tensions began mounting between the local Arab and Jewish populations, increasingly resulting in violence. The process had been foretold in prescient detail, if with an overly optimistic timetable, in 1919 in a letter from Richard Meinertzhagen, newly appointed Political Officer in Palestine, to Prime Minister Lloyd George:

> In fifty years time both Jew and Arab will be obsessed with nationalism … Nationalism prefers self-government, however dishonest and inefficient, to government by foreigners however efficient and beneficial … Jewish and Arab sovereignty must clash. The Jew, if his immigration programme succeeds, must expand and that can only be accomplished at the expense of the Arab who will do his utmost to check the growth and power of a Jewish Palestine. That means bloodshed. (25 March 1919, Sachar 1987, vol. IX, 293)

The British, caught in their effort to balance their conflicting promises to Arabs and Jews, as stipulated in the Balfour Declaration, increasingly blamed Zionist settlement policies, particularly immigration and land purchases, for the troubles.

In April 1920, even as the peace talks were in progress, riots broke out during the Nebi Musa festival in Jerusalem, during which several Jews and Arabs were killed and several hundred wounded (Sachar 1969, 392). In subsequent hearings on the actions of the British police, officers of the military government insisted that Zionist provocation alone had inflamed the Arab rioters. The Zionists, in turn, accused the British of complicity with Arab nationalists, despite warnings from intelligence sources of the potential outcome. Richard Meinertzhagen, by then a colonel and Chief Intelligence Officer in Cairo, took the witness stand to endorse fully the Zionist claims, ''to the astonishment and indignation of the British authorities'' (Sachar 1969, 393). One result of the investigation was that, four days after the Mandate was awarded to Britain at San Remo, the military gov-

ernment in Palestine was dismantled in favour of a civil administration.

Nevertheless, tensions between Arabs and Jews increased. On May Day 1921, a group of Jewish Communists marched through Arab Jaffa. Local Arabs, incensed and incited by nationalists, rioted and looted Jewish stores. One principal target was the Zionist immigration depot, where 13 newcomers were stabbed to death (Sachar 1969, 398). During the week, as rioting spread throughout the country, a total of 47 Jews and 48 Arabs were killed.

This time, though a commission of inquiry found that the Arabs were unquestionably the aggressors, ''the feeling against the Jews was too genuine, too widespread and too intense to be accounted for in a superficial manner'' (cited in Sachar 1969, 399). As a result, the Civil Administration for the first time imposed a ban on Jewish immigration. Although the ban was lifted by July 1921, rigid controls were imposed, including the necessity for a guarantee of employment for each immigrant (Sachar 1969, 396).

In part because of this strife, Sir Herbert Samuel, the High Commissioner in Palestine, wrote in June 1922 a White Paper (a formal policy statement), which was meant as a definition of the British interpretation of the Balfour Declaration and the Mandate. Although supporting the principle of a Jewish national home, what became known as the Churchill White Paper (named for Winston Churchill, at the time Colonial Secretary) restricted the interpretation of a ''national home,'' geographically excluding the territory east of the Jordan River; politically, by defining it in terms of ''development of the existing community''; and numerically, limiting future immigration to ''the economic capacity of the country'' (Sachar 1979, 127).

Two ideological seeds were planted in the Churchill White Paper that would have far-reaching implications. First, in calling for ''undisturbed national development,'' for both Arabs and Jews, the Paper advanced the principle that two nations could develop separately in Palestine. Over the years, this idea would recur and be refined as a two-state solution, or ''partition.'' Second, the White Paper would be the first, but hardly the last, document linking Arab–Jewish tensions with ''economic absorptive capacity.'' This theme, too, would reappear in later British policy, as is examined below.

Disappointed in the Paper but wary of losing British support altogether, the Zionist Executive signed the document. In contrast, objecting to any concept of a Jewish National Home in Palestine, and

arguing that ''the numbers of the Jewish community [then about 80,000 people] … had already exceeded the capacity of the country to absorb new arrivals'' (cited in Esco Foundation 1947, 479), the Palestine Arab Delegation rejected the document in its entirety. The Arab view, as presented to the League of Nations in 1928, was that a constitutional government, proportional to the local population before immigration began (about nine to one, Arabs to Jews), should be implemented (Esco Foundation 1947, 479).

By the end of the 1920s – a period of worldwide depression and, in Palestine, several years of below-normal precipitation – peak unemployment led to a concerted effort of national development on the part of the Zionists. Projects included road-building, irrigation, and land amelioration. Two major concessions were acquired from the British government – one for potash works at the Dead Sea (Weizmann Letters 1968, vol. XIV, 151), and the other for a hydropower facility at the confluence of the Yarmuk and Jordan rivers (Rutenberg Concession, appendix I in Simon and Stein 1923). Though Rutenberg's dam was destroyed in the 1948 war, Israel has occasionally argued for greater allocation of Yarmuk water on the basis of Rutenberg's 70-year concession, granted in 1926 (Naff and Matson 1984, 30).

Most contentious, however, was the Zionist policy of large-scale land purchases, notably along the Mediterranean coast, and in the Jezreel and Beisan valleys (Ruppin 1936, 182–190; ''The Beisan Lands in Palestine: Government Statement of Policy,'' October 1929, unpublished).

In August 1929, tensions over Jewish access to the Western Wall in Jerusalem degraded into a week of Arab rioting throughout Palestine. In Hebron 66 Jews were killed and, five days later, another 45 Jews were killed in Safed. By the end of the week, 133 Jews had been killed, mostly by Arab rioters, as had 116 Arabs, mostly by British police (Weizmann Letters 1968, vol. XIV, xii).

The British commission of inquiry distinguished, in its Shaw Commission Report of March 1930, between immediate causes of the outbreak, including the Western Wall dispute and inadequate deployment of police and military forces, and the fundamental cause – Arab opposition to Jewish immigration and land settlement (Esco Foundation 1947, 624–629).

Granting that Jewish development ''has conferred material benefits upon Palestine in which the Arab people share,'' the commission charged that,

> In the matter of immigration there has been a serious departure by the Jewish authorities from the doctrine … that immigration should be regulated by the economic capacity of Palestine to absorb new arrivals. (Esco Foundation 1947, 625)

The commission called for a clearly defined policy regarding Jewish immigration ''with consultation of non-Jewish interests'' (Esco Foundation 1947, 637). Land purchases were curtailed and immigration restricted, pending a survey of Palestine's agricultural potential.

Such a survey was contained in the Hope Simpson Report of 22 August 1930, which concluded that, after allowing for Jewish land holdings and potential Arab agricultural growth, remaining cultivatable lands in Palestine were ''insufficient to maintain a decent standard of life for the country's Arab rural population'' (Esco Foundation 1947, 637). The Report called for reduction or suspension of immigration if it adversely affected the Arab population, but suggested that, with an active policy of agricultural development, an additional 20,000 Jewish families could be settled.

The restrictive elements of the Report were emphasized in a formal statement of policy, known as the Passfield White Paper, submitted on 20 October 1930. The White Paper affirmed Hope Simpson's conclusions that no margin of land was available for immigrants and recommended that state-owned land be made available for landless Arabs.

Several points of dispute were raised by the Report. One was a most basic disagreement over data collection. An air survey suggested that there was about 40 per cent less cultivatable land available than the government's own land survey had previously described (Esco Foundation 1947, 637). Ruppin (1936, 206) suggested that, as the photographs were taken in June or July, when most grains were already harvested, mistakes in interpretation were likely. Ambiguities were also raised over the whole process of land acquisitions. Because land was often bought from absentee landowners, the legal rights of those who actually worked the land were occasionally tenuous. Equally vague was the status of some state lands, which either had been Turkish state land before the war, or was land for which no records existed. Because of these facts, and because the Zionists tried to compensate these squatters, although not legally required to do so, it was possible that there was some truth to both the Arab claim that 100,000 cultivators had been dispossessed and the Zionist claim that Zionist settlement had not dispossessed the

fellahin from their lands (Weizmann Letters 1968, vol. XIV, xxvii, xxx).

However, the most divisive issue raised in the White Paper, and one that is still not resolved today, was the question of how many people the land (and water) resources of the country could absorb. A flurry of pointed Zionist criticism followed publication of the Paper, which raised several objections to the British method of defining economic absorptive capacity (for example, Weizmann to Lloyd George, unpublished letter, 27 March 1930, Ruppin 1936, and Weizmann Letters 1968, vol. XIV).

The Zionists pointed out that, when the issue of absorptive capacity was first raised in the Churchill White Paper in 1922, Transjordan was still a part of Palestine. By ''lopping off'' a vast and underpopulated area, and an area where Jews were being offered large tracts of land, the absorptive capacity had been reduced to the detriment of Jewish settlement (Weizmann to Lloyd George, in Weizmann Letters 1968, vol. XIV, 253). Furthermore, it was argued, industrial development was dismissed by the Report as impractical (Esco Foundation 1947, 641), as was agriculture in the area around Be'er Sheva in the desert south, which lacked an adequate supply of water.

Criticism of the lack of consideration of the potential for movement of water resources and intensive cultivation came not only from the Zionists, who had already initiated several irrigation schemes throughout Palestine, but also from within the British government itself. A 1931 report by Lewis French, Director of Development for the government of Palestine, states,

> It is noteworthy that until comparatively recent times the vast importance of the water problem has not been fully appreciated by the Administration. (French 1931, 21)

The potential for increasing intensification of both land and water use was at the heart of Zionist criticism. The Hope Simpson Report had defined cultivatable land as land ''which is actually cultivated or can be brought under cultivation by the application of the labour and financial resources of the average Palestinian cultivator'' (cited in Ruppin 1936, 208). Arthur Ruppin (1936, 207–208), at the time Director of the Jewish National Fund, suggested that, to be fair, an expansion of the definition of uncultivated land was possible:

1. Uncultivated land which can be cultivated even with the present-day methods of the *fellahin*.

2. Land which is uncultivated but can be used for the planting of trees.
3. Land which is not being worked because of insufficient rainfall, but which could easily be worked if water could be obtained from the ground, or pumped up from nearby rivers and used for irrigation. This is the case in the Jordan valley and in some sections of Southern Palestine.
4. Land which is unworked but which could be made cultivable if large improvement schemes, which need time and capital, were instituted, e.g. swamp areas, like the Huleh.
5. Land which for the time being cannot be profitably cultivated.

The above guidelines became a framework for the methods the Zionists would employ to increase the land's absorptive capacity over the following decades, as the projects suggested were slowly implemented. On the basis of these guidelines, Chaim Weizmann argued to the British that, unless obstructed, ''we shall be able to put at least 50,000 additional families on the land, without the least injustice to its present occupants'' (Weizmann to Lloyd George, 27 March 1930, Weizmann Letters 1968, vol. XIV, 253)[6] (see appendix I, map 13).

The British government responded to Zionist complaints about the Passfield White Paper in the form of a letter from Prime Minister Ramsay MacDonald to Chaim Weizmann, dated 13 February 1931. Although not equal to the Paper in the level of legality, the MacDonald Letter was issued as an official interpretation of the White Paper. The letter reiterated the Mandate's obligation to ''facilitate Jewish immigration and to encourage close settlement by Jews on the land,'' and suggested that State lands be made available to both Jews and Arabs (cited in Weizmann Letters 1968, vol. XV, xv). The letter reaffirmed the government's right to control immigration, as well as the link between immigration and economic absorptive capacity.

The Zionists regarded the letter as a restoration of the status quo ante, while the Arabs, who had greeted the limitations of the Passfield White Paper with satisfaction, called the MacDonald Letter ''a black frame for the White Paper'' (cited in Weizmann Letters 1968, vol. XV, xvi).

In 1993, Adolph Hitler and his Nationalist Socialists came to power in Germany, and immigration, still tightly controlled by the British,

6. This was in contrast to Hope Simpson's estimate of 20,000 families. Ten years later, as agriculture and water-use techniques developed, Weizmann would double his estimate to 100,000 families. Lowdermilk (1944) claimed that Palestine could absorb a total of about 5.2 million people. The current population west of the Jordan River is approximately 6 million.

took on new urgency for the Jews in Palestine. That year alone, 25 per cent of the permitted 40,000 immigrants were from Germany, with an additional 15,000 arriving by the middle of 1935 (Report of the Central [Zionist] Bureau reprinted in Weizmann Letters 1968, vol. BI, 44). Seeking to expand available land for the newcomers, Chaim Weizmann entered into negotiations for land in Syria (around Lake Huleh and on the eastern shore of the Sea of Galilee) and was told by the French Director of the Bank of Syria that the whole southern belt of Lebanon, from the Palestine border to Beirut, was for sale and badly in need of development. The French High Commissioner, Henri de Jeuvenel, vetoed the sale (Weizmann to Warburg, 5 November 1933, Weizmann Letters 1968, vol. XVI, 118).

The Arabs of Palestine, alarmed at the fervour of Jewish immigration, charged that the government policies were ''paving the road for driving the nation away from its homeland for foreigners to supersede it'' (Esco Foundation 1947, 768). Finally, in 1936, the tensions ignited in an intensified re-enactment of the violence and policy reviews of 1922 and 1929. On 25 April 1936, the Mufti of Jerusalem, Haj Amin al-Husseini, established an Arab Higher Committee, which proclaimed a general strike throughout the country, demanded the cessation of Jewish immigration and of land sales to Jews, and called for a ''National Representative Government.'' The strike quickly turned to violence and finally to armed rebellion against both the British and the Jews, as irregulars began to arrive from neighbouring countries in the name of ''Committees for the Defence of Palestine'' (Sachar 1979, 200). By July 1936, with more than 300 dead, the Iraqi Foreign Minister, Nuri es-Said, managed to negotiate an end to the uprising. The British, for their part, promised a Royal Commission of Inquiry.

During what became known as the Peel Commission investigations of 1936 and 1937, Arabs and Jews reiterated their now-familar claims. Haj Amin al-Husseini testified that the 400,000 Jews in Palestine were more than the country could absorb (Sachar 1979, 203). He suggested the abandonment of the ''experiment'' of the Jewish national home, and a cessation of Jewish immigration and land sales to the Jews (Esco Foundation 1947, 815). Chaim Weizmann, testifying for the Zionists, and backed by a recent survey of Palestine's water resources (see Bein 1971, 277–278 for details), argued that there was room for 100,000 Jewish farming families even without the Negev, and suggested an emphasis on agricultural and industrial develop-

ment as a means of reconciling Jewish and Arab interests (Esco Foundation 1947, 813).

When the findings of the Peel Commission were issued in July 1937, it became apparent that dramatic shifts in British policy were in the offing. The shift in thinking had been hinted at during testimony, when some of those testifying had been asked, hypothetically, of the feasibility of ''two areas developing the possibility of self-government'' (cited in Weizmann Letters 1968, vol. XVI, xxiv). The thinking of the Commission was described by Peel (1937, 767, 772) as follows:

> We came generally to the conclusion as regards immigration, that economic absorptive capacity, though useful as a test, is really not sufficient, and that such matters as psychological and social effect and the impact of the new population on the old must also be considered ...
>
> It seemed to us impossible to carry on in the country under the existing Mandate and with its limitations, and we felt that the only way to arrive at a final settlement of the matter was to divide the country into Jewish and Arab areas which would make it possible at once to give them a degree of self-government ... We should be able to give to the Jews all the dignity of a State, instead of merely a Jewish National Home ... There would be no limit on Jewish immigration except what the Jews themselves think ought to be applied ... The Arab grievances, the Arab hostilities, the Arab fear of the Jews would be at once turned into other channels.

The only feasible solution to conflicting promises and needs, the Commission concluded, lay in abandoning the concept of economic absorptive capacity in favour of dividing Palestine into two self-governing communities. Perhaps neither side would be fully satisfied, but both would come to realize that ''the drawbacks of Partition are outweighed by its advantages. For if it offers neither party all it wants, it offers each what it wants most, namely freedom and security'' (cited in Sachar 1979, 204).

Palestine and Transjordan would be divided into three: a Jewish state along the coast and in the Galilee, an Arab state comprising the rest of Palestine and Transjordan, and a permanent British enclave around Jerusalem with a corridor to the sea and British bases along the Sea of Galilee and in the Gulf of Aqaba (Sachar 1979, 305) (see appendix I, map 14).

Although the form and feasibility of partition would undergo many variations and set-backs between 1936 and 1948, the process towards statehood gained inevitably.

After the Peel Commission Report, the Arab revolt, begun in 1936,

gained momentum, as did Jewish settlement. The Jewish Agency, feeling that partition was imminent, set out on an intensive settlement programme, building 55 farm communities between 1936 and 1939 (Sachar 1979, 216). The emphasis for site location was in the northern Galilee, to reinforce the projected boundaries and to guarantee the inclusion of what Jordan headwaters were left from the Mandate process.

In response to Arab resistance, a report on partition, the Woodhead Report of 1938, suggested modifications to the borders of the two projected states. The report recommended two partition plans as alternatives to the Peel plan (see appendix I, maps 15–17). The modifications were due mostly to the mixed ethnic make-up that would have resulted from the Peel recommendations. The Woodhead Report also included a section on limitations that scarce water resources placed on the possibility of population resettlement – the first British policy paper specifically naming water as a factor limiting policy objectives in Palestine (Woodhead 1939).

A blow to Zionist plans came later in May 1939, in the form of the MacDonald White Paper. This report, a total reversal of British policy, called for a single state in Palestine, west of the Jordan River, governed by Arabs and Jews in proportion to their population (but specifying that Jews should not exceed one-third of the population), immigration based on the economic absorptive capacity but limited to 75,000 for a five-year interim period, and a prohibition of land transfers to Jews in parts of the country (Esco Foundation 1947, 901–908) (see appendix I, map 18).

Palestine's Jews reacted with shock and anger, particularly in light of exacerbating conditions for European Jewry. An oath was read in synagogues and public meetings:

> The Jewish population proclaims before the world that this treacherous policy will not be tolerated. The Jewish population will fight it to the uttermost, and will spare no sacrifice to frustrate and defeat it … The *Yishuv* [Jewish administrative body] will neither recognize nor admit any callous restriction of Jewish immigration into its land. (Cited in Esco Foundation 1947, 909)

Arabs also rejected the Paper, which was surprising as it seems to be an agreement to each of the demands made during prior testimony. The statement of the Arab Higher Committee read, in part:

> The ultimate decision as to the fate of a people depends on its own will, not on White or Black Papers. Palestine will be independent within the Arab union and will remain Arab forever. (Cited in Esco Foundation 1947, 908)

With a return in the MacDonald White Paper to the legitimacy of the concept of economic absorptive capacity, focus on the water resources of Palestine gained in importance. The Ionides Plan, published in Amman in 1939 by the British Director of Development for the Transjordanian government, supported the Arab claim that the region's water resources were inadequate for Jewish immigration. Ionides recommended that the waters of the Jordan River be used for irrigation within the watershed, that floodwaters from the Yarmuk be stored in the Sea of Galilee, and that a canal be dug along the East Ghor parallel to the Jordan River to use Yarmuk water for irrigation (Hosh and Isaac 1992, 3).

On 3 September 1939, three and a half months after the MacDonald White Paper was issued, with the sworn enmity of both Palestine's Arabs and Jews, Britain declared war on the Axis powers.

Throughout World War II, the Zionists, while supporting Britain against Germany, set out on a campaign of resistance and illegal immigration within Palestine. Even in the face of increasingly desperate Jewish refugees, the British immigration quotas held, enforced by a naval blockade along the Palestine coast. Appeals for exceptions, including one to absorb an additional 10,000 Jewish children from central Europe, were denied (Sachar 1979, 219). By the end of World War II, and the terminal date of the White Paper interim period, 50,000 legal and illegal immigrants had been admitted to Palestine – 25,000 less than had been agreed to.

With the end of World War II, as the magnitude of destruction of European Jewry became apparent, and as the British showed no sign of relaxing immigration quotas, the Zionists began a campaign of open resistance against the British. As tensions increased, the British made an offer in 1946 to repudiate the MacDonald White Paper and allow 100,000 immigrants into Palestine immediately, and to remove restrictions on land purchases – in exchange for the Jewish population turning in their arms. This demand was deemed impossible by the Zionists, who argued that, in the event of British evacuation, the Zionists would be left defenceless (Weizmann Letters 1968, vol. XXII, xxi).

Facing increasing opposition to their presence on the part of both Arabs and Jews, the British began to look to other powers, first to the United States and finally to the newly created United Nations, for assistance with the problem of Palestine. Partition of Palestine into Jewish and Arab states increasingly became the most advocated op-

tion, first in an Anglo-American plan in 1946, and later, when Britain ceded the Mandate to the United Nations, in the UN Partition Plan of 1947 (see appendix I, map 19).

The Zionist position on whether partition should occur and, if so, what the minimum territorial requirement would be for a viable Jewish State, was increasingly influenced by Walter Clay Lowdermilk. Lowdermilk, director of the US Soil Conservation Service, published in 1944 *Palestine, Land of Promise* at the commission of the Jewish Agency. In contrast to the Ionides Plan of 1939, Lowdermilk asserted that proper water management would generate resources for four million Jewish refugees in addition to the 1.8 million Arabs and Jews living in Palestine at the time. He advocated regional water management, based on the Tennessee Valley Authority (TVA), to develop irrigation on both banks of the Jordan River and in the Negev Desert, and building a canal from the Mediterranean to the Dead Sea to generate hydropower and replenish the diverted fresh water (Naff and Matson 1984, 32).

Referring to Lowdermilk's work, a 1945 *aide-mémoire* on Palestine described Zionist reservations on partition:

> With the sea in the West, the Jordan and the Power and Potash concessions in the East, the chief water resources in the North, and the main land-reserves in the South, any partition scheme seems bound to disrupt the country's economic frame, and wreck the chances of large-scale development. (6 April 1945, cited in Weizmann Letters 1968, vol. XXII, 299)

At the same time, a 1944 study, ''The Water Resources of Palestine,'' undertaken by Mekorot, the national water company for Jewish Palestine, described an ''All-Palestine Project,'' for irrigation and hydroelectric development. The study included frontier adjustments that would be desirable for a basin-wide development scheme in Palestine. It was suggested that the Mandate border be moved upstream where it met the Hasbani, Dan, and Banias headwaters to allow for more effective drainage; eastward along Lake Hula to leave room for a conduit on the east side of the lake; and upstream along the Yarmuk to include an area of about 80 km^2 of Transjordan to develop a series of impoundments along the river (Mekorot 1944). It should be noted that, although the report included plans to bring Litani water into the Jordan watershed, it was assumed that agreement would have to be reached with the Lebanese government to do so. Lebanese territory was not included in the list of desirable frontier adjustments.

In the case of partition, it became clear to the Zionists that, at a minimum, three areas were needed for a viable Jewish state: these were the Galilee region with the Jordan headwaters, the coastal zone with the population centres, and the Negev Desert, to absorb "the ingathering of the exiles."

On 2 February 1947, Great Britain officially turned the fate of Palestine over to the United Nations. The UN Special Committee on Palestine recommended partition of Palestine into two states, but included a vehicle for joint economic development, "especially in respect of irrigation, land reclamation, and soil conservation."

The Jewish state included the areas described above, and the Arab state included the remainder of Palestine, based on population centres. Jerusalem was to be an international city, and the Jewish state would pay a £4 million annual stipend to the Arab state to reflect the more advanced agricultural and industrial position of the former (UN Resolution on the Partition of Palestine 1947, chap. 4). The General Assembly approved the Partition Plan on 29 November 1947.

Though the Jewish Agency reluctantly accepted partition, the Arab states rejected it outright and, when the British pulled out of Palestine in May 1948, Egypt, Jordan, Iraq, Syria, Lebanon, and Saudi Arabia went to war against the new state of Israel.

1948–1964: Unilateral development and the Johnston negotiations

Once the borders of the new states of the Middle East had been defined in the war of 1948, each country began to develop its own water resources unilaterally. The legacy of the Mandates, and of the war itself, was a Jordan River divided in a manner in which conflict over water resource development was inevitable. The shooting that did break out in the 1950s led, however, to two years of some of the most intense negotiations ever between Arabs and Israelis – the Johnston negotiations.

During the 1948 war, keeping the three zones described above as necessary for a viable Jewish state – the Galilee region with the Jordan headwaters, the coastal zone with the population centres, and the Negev Desert to absorb anticipated immigration – became the focus for the Israeli war effort.

Other than these general emphases, water resources played only a minor role in the strategic thinking of the combatants.

Since 1934, the bulk of Jerusalem's water had been piped from Rosh Ha'ayin, 60 km to the west and 800 m lower in elevation. On 7 May 1948, as part of a general siege of Jewish Jerusalem, the Arab forces had cut this pipeline. The Jewish population of Jerusalem, who had dug, cleaned, and filled cisterns in preparation for the war, were rationed to 10 litres per capita per day – 1 litre for drinking and 9 litres for cooking and sanitary needs. Two separate Israeli operations focused on retaking Rosh Ha'ayin on 11 July. By laying a circuitous pipeline route, using pipes abandoned from a previous project, around to the secret Burma Road, which the Israelis were building to circumvent the siege, water reached Jerusalem by the end of July (U. Dvir in Broshi 1977, 224–235).

The Israelis lost three other strategic points along waterways, though, and the repercussions would be felt through 1967 (see appendix I, maps 20 and 21). During the Mandate negotiations, the French had denied the Zionists the Banias spring because an access road that they needed crossed the waterway about 100 m downstream. However, to guarantee access to the water, a hill overlooking the stream had been included in Palestine. This hill was lost to the Syrians during fighting in 1948, as was El-Hama, a crucial access point to the Yarmuk River (Sachar 1979). Finally, although the Israeli army had occupied a strip of Lebanese territory along the elbow of the Litani, they pulled back to the Mandate borders as part of an armistice agreement, in the unfulfilled hope of gaining a peace treaty with Lebanon (Hof 1985, 31).

As a result of the 1948 war, the Jordan River was even more divided than it had been under the Mandates. The Hasbani rose in Lebanon with the Wazzani, a major spring of the Hasbani, situated only a few kilometres north of the Israeli border. The Banias flowed for five kilometres in Syrian territory before crossing into Israel. The Dan rose and remained within Israeli territory. The confluence of the three, the Jordan River, flowed along the Israeli–Syrian border, often through the demilitarized zone, until it reached the Sea of Galilee. The Sea lay wholly in Israel, with the Syrian border 10 m from the eastern coast. The Yarmuk rose in Syria, then became the Syrian–Jordanian border until its confluence with the Jordan. South of the Sea of Galilee, the Jordan River formed first the Israeli–Syrian border, then the Israeli–Jordanian border below the confluence with the

Yarmuk, finally flowing wholly into Jordanian territory and the Dead Sea, which was about one-quarter Israeli and three-quarters Jordanian.

The immediate demographic repercussions of the 1948 war were dramatic shifts of population throughout the region. The concept of economic absorptive capacity quietly disappeared as Israel and Jordan each absorbed hundreds of thousands of refugees and immigrants. Israel absorbed much of the remnants of European Jewry, many of whom had been kept in Cypriot refugee camps by the British since World War II, as well as the 700,000 Jews from Arab countries who emigrated after Israel's declaration of independence. The Israeli Jewish population increased from 650,000 in 1948 to 1.6 million in 1952 (Naff and Matson 1984, 34).

Jordan was also greatly affected by refugee immigration. Of the 700,000–900,000 Palestinian refugees of the war, 450,000 went to Jordan and the West Bank, which Jordan annexed in 1950. This influx and annexation increased Jordan's population by 80 per cent to 1.85 million (Naff and Matson 1984, 34).

Even as the dust was settling, Syria approached Israel with a secret offer which, for the first time, linked three topics that would define the negotiating issues for the coming decades – peace, refugee resettlement, and water. Colonel Hosni Zaim took control of Syria in a US-sponsored military coup in April 1949, with a promise that he would do ''something constructive'' about the Arab–Israeli problem. That month, he sent a secret message to Israeli Prime Minister David Ben-Gurion, offering to sign a separate peace agreement, establish a joint militia, and settle 300,000 Palestinian refugees in Syrian territory, in exchange for some ''minor border changes'' along the ceasefire line and half of the Sea of Galilee (Shalev 1989). Ben-Gurion was reluctant to make such an agreement and signed a limited armistice instead. Less than a year later, Zaim was overthrown.

In 1951, several states announced unilateral plans for the Jordan watershed. Arab states began to discuss organized exploitation of two northern sources of the Jordan – the Hasbani and the Banias (Stevens 1965, 38). The Israelis made public their All-Israel Plan, based on James Hays's idea of a ''TVA on the Jordan,'' which in turn was based on the Lowdermilk proposals. The All-Israel Plan included the draining of Huleh Lake and swamps, diversion of the northern Jordan River, and construction of a carrier to the coastal plain and Negev Desert – the first out-of-basin transfer for the watershed (Naff and Matson 1984, 35).

Jordan announced a plan to irrigate the East Ghor of the Jordan Valley by tapping the Yarmuk (Stevens 1965, 39). At Jordan's announcement, Israel closed the gates of an existing dam south of the Sea of Galilee and began draining the Huleh swamps, which lay within the demilitarized zone with Syria. These actions led to a series of border skirmishes between Israel and Syria, which escalated over the summer of 1951 and prompted Israeli Foreign Minister Moshe Sharrett to declare clearly that ''Our soldiers in the north are defending the Jordan water sources so that water may be brought to the farmers of the Negev'' (Stevens 1965, 39).

In March 1953, Jordan and the UN Relief and Works Agency for Palestine Refugees (UNRWA) signed an agreement to begin implementing the Bunger Plan, which called for a dam at Maqarin on the Yarmuk River with a storage capacity of 480 MCM, and a diversion dam at Addassiyah that would direct gravity flow along the East Ghor of the Jordan Valley. The water would open land for irrigation, provide power for Syria and Jordan, and offer resettlement for 100,000 Palestinian refugees. In June 1953, Jordan and Syria agreed to share the Yarmuk but Israel protested that its riparian rights – rights commonly recognized as being due to entities that border a waterway – were not being recognized (Naff and Matson 1984, 38).

In July 1953, Israel began construction on the intake of its National Water Carrier at Gesher B'not Ya'akov, north of the Sea of Galilee and in the demilitarized zone. Syria deployed its armed forces along the border (Davis et al. 1980, 3, 8), and artillery units opened fire on the construction and engineering sites (Cooley 1984, 3, 10). Syria also protested to the United Nations and, though a 1954 resolution for the resumption of work by Israel carried a majority, the USSR vetoed the resolution. The Israelis then moved the intake to its current site at Eshed Kinrot on the north-western shore of the Sea of Galilee (Garbell 1965, 30).

This was a doubly costly move for Israel. First, as mentioned earlier, water salinity is much higher in the lake than in the upper Jordan. The initial water pumped in 1964 was actually unsuitable for some agriculture. Since that time, Israel has diverted saline springs away from the lake and filtered carrier water through artificial recharge to ease this problem (Stevens 1965, 9). Second, the water from B'not Ya'akov would have flowed to the Negev by gravity alone. Instead, 450 MCM/yr is currently pumped a height of 250 m before it starts its 240 km journey southward (State of Israel 1988, 136).

Against this tense background, President Dwight Eisenhower sent his special envoy Eric Johnston to the Middle East in October 1953 to try to mediate a comprehensive settlement of the Jordan River system allocations (Main 1953). Johnston's initial proposals were based on a study carried out by Charles Main and the TVA at the request of UNRWA to develop the area's water resources and to provide for refugee resettlement. The TVA addressed the problem with the regional approach that Lowdermilk had advocated a decade earlier. As Gordon Clapp, chairman of the TVA, wrote in his letter of presentation, ''the report describes the elements of an efficient arrangement of water supply within the watershed of the Jordan River System. It does not consider political factors or attempt to set this system into the national boundaries now prevailing'' (Main 1953). This apolitical, basin-wide approach produced not only the thorough technical report that was to be the basis of two years of negotiations, but also stunning oversize maps that delineate only one border – that of the Jordan River watershed (see appendix I, maps 22 and 23).

The Main Plan had, of course, other motives on the part of the United States, and advantages other than the technical details:

> The plan, designed to tempt the Arabs into at least limited cooperation with the Israelis, was a third-rate idea with at least a second-rate chance of success because it had a first-rate negotiator, Eric Johnston, to advocate it. Its only advantage was that it made sense. (Copeland 1969, 109)

The major features of the Main Plan included small dams on the Hasbani, Dan, and Banias; a medium-size (175 MCM storage) dam at Maqarin; additional storage in the Sea of Galilee; and gravity-flow canals down both sides of the Jordan Valley. The Main Plan excluded the Litani and described only in-basin use of the Jordan River water, although it concedes that ''it is recognized that each of these countries may have different ideas about the specific areas within their boundaries to which these waters might be directed'' (Main 1953). Preliminary allocations gave Israel 394 MCM/yr, Jordan 774 MCM/yr, and Syria 45 MCM/yr (see table 2.6).

Israel responded to the Main proposal with the Cotton Plan, which incorporated many of Lowdermilk's ideas. This plan called for inclusion of the Litani, out-of-basin transfers to the coastal plain and the Negev, and the use of the Sea of Galilee as the main storage facility, thereby diluting its salinity. It allocated Israel 1,290 MCM/yr (including 400 MCM/yr from the Litani), Jordan 575 MCM/yr, Syria 30 MCM/yr, and Lebanon 450 MCM/yr.

Table 2.6 **Johnston negotiations, 1953–1955: water allocations to riparians of Jordan River system**

	Allocation (MCM/yr)				
Plan/Source[a]	Lebanon	Syria	Jordan	Israel	Total
Main Plan	nil	45	774	394	1213
Arab Plan	35	132	698	182	1047
Cotton Plan	450.7	30	575	1290	2345.7
Unified (Johnston) Plan					
Hasbani	35				35
Banias		20			20
Jordan (main stream)		22	100	375[b]	497[b]
Yarmuk		90	377	25	492
Side wadis			243		243
Total Unified Plan	35	132	720	400[b]	1287[b]

Source: Naff and Matson (1984).

a. The Cotton Plan included the Litani as part of the Jordan River system. Different plans allocated different amounts in accordance with differing estimates of the resources of the system. One major variable in the reporting of the planned allocations is the amount of groundwater included in the estimates.

b. According to the compromise "Gardiner Formula," the share to Israel from the main stream of the Jordan was defined as the "residue" after the other co-riparians had received their shares. This would vary from year to year, but was expected to average 375 MCM.

In 1954, representatives from Lebanon, Syria, Jordan, and Egypt established the Arab League Technical Committee under Egyptian leadership and formulated the "Arab Plan." It reaffirmed in-basin use, rejected storage in the Sea of Galilee, which lies wholly in Israel, and excluded the Litani. The Arab representatives also objected to the refugee resettlement as a goal. The Arab Plan's principal difference from the Main Plan was in the water allocated to each state: Israel was to receive 182 MCM/yr, Jordan 698 MCM/yr, Syria 132 MCM/yr, and Lebanon 35 MCM/yr, in addition to keeping all of the Litani.

Johnston worked until the end of 1955 to reconcile these proposals in a Unified Plan amenable to all of the states involved. His dealings were bolstered by a US offer to fund two-thirds of the development costs, and given a boost when a land survey of Jordan suggested that that country needed less water for its future needs than was previously thought.

Johnston addressed the objections of both sides, and accomplished no small degree of compromise, although his neglect of groundwater

issues would later prove an important oversight. Though they had not met face to face for these negotiations, all states agreed on the need for a regional approach. Israel no longer insisted on integration of the Litani and the Arabs agreed to allow out-of-basin transfer. The Arabs objected, but finally agreed, to storage at both the Maqarin Dam and the Sea of Galilee, as long as neither side would have physical control over the share available to the other. Israel objected, but finally agreed, to international supervision of withdrawals and construction. Allocations under the Unified Plan, later known as the Johnston Plan, included 400 MCM/yr to Israel, 720 MCM/yr to Jordan, 132 MCM/yr to Syria, and 35 MCM/yr to Lebanon (unpublished summaries, US Department of State 1955, 1956).

The technical committees from both sides accepted the Unified Plan, and the Israeli Cabinet approved it without vote in July 1955. President Nasser of Egypt became an active advocate because Johnston's proposals seemed to deal with the Arab–Israeli conflict and the Palestinian problem simultaneously. Among other proposals, Johnston envisioned the diversion of Nile water to the western Sinai Desert to resettle two million Palestinian refugees. President Sadat would make this offer again 22 years later on his historic trip to Jerusalem in 1977.

Despite the forward momentum, in October 1955 the Arab League Council decided not to accept the plan, and the momentum died out. In a 1955 letter lobbying against acceptance of the plan, the Arab Higher Committee for Palestine explained part of the underlying reluctance to enter into agreement:

> The scheme is another step made by imperialists and Zionists to attain their ends, territorial expansion in the heart of the Arab homeland, under the attractive guise of ''economic interests.'' (Cited in Medzini 1976, 487)

Although the agreement was never ratified, both sides have generally adhered to the technical details and allocations, even while proceeding with unilateral development. Agreement was encouraged by the United States, which promised funding for future water development projects only as long as the Johnston allocations were adhered to (Wishart 1990). Since that time to the present, Israeli and Jordanian water officials have met two or three times a year at so-called ''Picnic Table talks'' at the confluence of the Jordan and Yarmuk rivers to discuss flow rates and allocations.

However, as individual projects progressed, and hydrologic limits began to be approached, the pressures quickly went from possible cooperation to impending conflict.

1964–1982: ''Water Wars'' and territorial adjustments

As each state developed unilaterally, their plans began to overlap (see appendix I, maps 4 and 24). The resulting tensions helped lead to a cycle of conflict, which, exacerbated by other disputes, in turn led to war in 1967. Water also emerged as one possible strategic issue in the war in Lebanon in 1982.

A 1963 agreement between Jordanian King Hussein and Ya'akov Herzog, envoy to Israeli Prime Minister Levi Eshkol, had spelled out an agreement on the allocation of the Jordan River water in return for Israeli acquiescence to US tank sales to Jordan (Kershner 1990, 11). By 1964, Israel had completed enough of its National Water Carrier for actual diversions from the Jordan River basin to the coastal plain and the Negev to be imminent. Although Jordan was also about to begin extracting Yarmuk water for its East Ghor Canal, it was the Israeli diversion that prompted President Nasser to call for the First Arab Summit in January 1964, including heads of state from the region and North Africa, specifically to discuss a joint strategy on water.

The options presented to the Summit were to complain to the United Nations, to divert the upper Jordan tributaries into Arab states (as had been discussed by Syria and Jordan since 1953), or to go to war (Schmida 1983, 19). A military assessment revealed that the Arabs were unprepared for this last option and might be incapable of defending their own river diversions, should they proceed (Stevens 1965, 76). However, the decision to divert the rivers prevailed at a Second Summit in September 1964, and the states agreed to finance a Headwater Diversion project in Lebanon and Syria and to help Jordan build a dam on the Yarmuk. They also made tentative military plans to defend the diversion project (Shemesh 1988, 38).

A two-stage plan, the first full formula for a campaign against Israel, was laid out:

> The first stage would involve the diversion of the sources of the Jordan River and the establishment of an effective Arab defense force through the strengthening of the Arab armies. The building up of this (United Arab Command) force would take two and a half to three years, until late 1967 to early 1968. During this period, there would be no full-scale war with Israel.
>
> The second stage would see, ''. . . the liberation of Palestine from imperialism and Zionism.'' The commander-in-chief of the United Arab Command was ordered to prepare a detailed military plan for Israel's destruction

which was approved at the Third (September 1965) Arab Summit. (Shemesh 1988, 39)

The Arab Diversion had its roots in a 1953 agreement between Syria and Jordan for the allocation of water diverted from the Hasbani and/or the Banias into a proposed dam on the Yarmuk. Syria would get three-quarters of the hydropower produced at a dam at Adassiye, and Jordan would get the water, ''instead of it going to the Mediterranean, the Dead Sea, or the Jews'' (interview, Haddad, November 1991).

An additional strategy was decided upon at the First Summit. The delegates agreed to establish a Palestinian entity to ''carry the banner of Arab Palestine'' (Stevens 1965, 76), and to mobilize the Palestinians themselves for the eventual ''liberation of Palestine'' (Shemesh 1988, 37). Yasir Arafat later combined this Palestine Liberation Army with his own Fatah and other groups to form the Palestine Liberation Organization (Cooley 1984, 15). Given its roots, it is not surprising that the nascent PLO's first action was an unsuccessful attempt to sabotage the Israeli National Water Carrier on 31 December 1964. As one associate of Arafat's put it, ''The water issue was the crucial one. We considered our impact on this to be the crucial test of our war with Israel'' (Dr Nabil al-Shath, cited in Cooley 1984, 15).

In 1964, Israel began withdrawing 320 MCM/yr of Jordan water for its National Water Carrier, and Jordan completed a major phase of its East Ghor Canal (Inbar and Maos 1984, 21). In 1965, the Arab states began construction of their Headwater Diversion Plan to prevent the Jordan headwaters from reaching Israel. The plan was to divert the Hasbani into the Litani in Lebanon and the Banias into the Yarmuk, where it would be impounded for Jordan and Syria by a dam at Mukheiba. The diversion was possible, in part, because of the two strips of land, at the Banias Heights and at el-Hama next to the Yarmuk, which Israel had lost in the fighting in 1948. The plan, to be financed by Saudi Arabia and Egypt, was technically difficult and economically inefficient, with water to be pumped as high as 350 m. The diversion would divert up to 125 MCM/yr, cut by 35 per cent the installed capacity of the Israeli Carrier, and increase the salinity in Lake Kinneret by 60 ppm (United States Central Intelligence Agency 1962; Inbar and Maos 1984, 22; Naff and Matson 1984, 43).

Although a 1964 US State Department memorandum concluded that the Arab Diversion seemed ''unlikely to cause large-scale hostilities'' (US Department of State memorandum 1964), Israel declared

the impending diversion as an ''infringement of its sovereign rights'' (Naff and Matson 1984, 44). To a visiting US delegation, Israeli Prime Minister Levi Eshkol declared that ''Israel was not trigger-happy, but if it came to it, we would have to fight for our waters'' (US Department of State memorandum 1965).

The United States had supported the Israeli Water Carrier within the Johnston allocations and had both opposed the All-Arab Diversion and expressed doubt that it would be completed – Lebanon had stopped work on the diversion project in July 1965 (Hof 1985, 36). It was made clear to Israel, however, that the United States ''would oppose you if you take preemptive action'' (US Department of State memorandum 1965). Nevertheless, in March, May, and August of 1965, the Israeli army attacked the diversion works in Syria. Partly because of the US warning, however, Israel tried to avoid a full-scale war, using long-range ''sniping'' with tanks rather than calling for artillery or the air force. This represented a new doctrine for the Israeli Tank Corps, which would lead to important lessons for the impending war (Argaman 1990) (see appendix I, map 25).

These events set off what has been called ''a prolonged chain reaction of border violence that linked directly to the events that led to the (June 1967) war'' (Professor Nadav Safran, cited in Cooley 1984, 16). Border incidents continued between Israel and Syria, finally triggering air battles in July 1966, and April 1967.

Even as tensions were leading to the following week's outbreak of the Six-Day War, the US Departments of Interior and State convened an ''International Conference on Water for Peace'' in Washington, D.C., during 23–31 May 1967. Building on advances in nuclear energy and the possibility of inexpensive nuclear desalination, President Johnson had, in 1965, announced a ''massive, cooperative, international effort to find solutions for Man's water problems, which he dubbed the Water-for-Peace Program'' (cited in Skolnikoff 1967, 157). In the 1967 Conference, there were 6,400 participants from 94 countries, including Israel, Egypt (then the ''United Arab Republic''), Jordan, Yemen, and Saudi Arabia (United States Departments of Interior and State 1967).

In the same month, President Nasser, who had earlier formed the ''United Arab Republic'' with Syria, demanded the withdrawal of UN forces from the Sinai, announced a blockade of the Gulf of Aqaba, cutting off the Israeli port of Eilat, and declared that ''the armies of Egypt, Jordan, Syria, and Lebanon are poised on the borders of Israel.'' On 5 June, Israel attacked the airfields of Egypt, Jordan,

Iraq, and Syria. Six days later, the war was over and Israel gained possession of the Golan Heights from Syria, the West Bank from Jordan, and Gaza and the Sinai Peninsula from Egypt.

Aside from territorial gains and obvious improvements in geostrategic positioning, Israel had also greatly improved its ''hydrostrategic'' position (see appendix I, map 4). With the Golan Heights, it now held all of the headwaters of the Jordan, with the exception of a section of the Hasbani, and a commanding position over much of the Yarmuk, together making the Headwater Diversion impossible. The Mukheiba Dam was destroyed and the Maqarin Dam abandoned. The West Bank not only provided riparian access to the entire length of the Jordan River but also overlay three major aquifers, two of which Israel had been tapping into from its side of the Green Line since 1955 (Garbell 1965, 30). Jordan had once planned to transport 70–150 MCM/yr from the Yarmuk River to the West Bank; these plans, too, were abandoned.

In the wake of the 1967 war, former President Eisenhower, who, 10 years earlier, had sent Eric Johnston to the Middle East to negotiate a regional water plan, made public a new cooperation scheme that he, former Atomic Energy Commissioner Lewis Strauss, and Alvin Weinberg, Director of the Oak Ridge National Laboratories, had formulated and which they called simply ''A Proposal for Our Time.'' Their plan called for three nuclear desalination plants – one each on the Mediterranean coast in Egypt and Israel, and one on the Gulf of Aqaba in Jordan – producing a combined output of about 1,400 MCM of fresh water a year (roughly the usable flow of the entire Jordan River) as well as ''an enormous amount'' of electric power (Oak Ridge National Laboratories, Summary Report 1971; Strauss 1967).

Recently declassified documents show that an additional site was considered, at Gaza (Oak Ridge National Laboratories, Gaza Area 1970). At this site, a major consideration was the possibility of refugee resettlement, although sections of the report dealing with that aspect were excised from declassification (see appendix I, map 26).

As Eisenhower saw it, the availability of these new sources of energy and water would make possible entire ''agro-industrial complexes,'' making an additional 4,500 km^2 of barren land arable, and providing work and agriculture to help settle more than a million Arab refugees (Eisenhower 1968). The project, which would cost about US$1,000 million (in 1967 terms), would be funded by an international corporation set up for the purpose, and be supervised by the

International Atomic Energy Agency. Moreover, Eisenhower predicted that

> ... the collaboration of Arab and Jew in a practical and profitable enterprise of this magnitude might well be the first, long step toward a permanent peace. (Eisenhower 1968, 77)

In the summer of 1967, Eisenhower communicated his project to President Lyndon Johnson. On 28 July, the State Department announced the appointment of an interim Director of Water for Peace (Strauss 1967, 1008). On 14 August 1967, Senator Howard Baker from Tennessee introduced Senate Resolution 155, which read, in part:

> Whereas the security and national interest of the United States require that there be a stable and durable peace in the Middle East; and the greatest bar to a long term settlement of the differences between the Arab and Israeli people is the chronic shortage of fresh water, useful work, and an adequate food supply;
>
> Be it resolved that ... (providing) large quantities of fresh water to both Arab and Israeli territories and, thereby, will result in –
>
> 1) new jobs for the many refugees; 2) an enormous increase in the agricultural productivity of existing wastelands; 3) a broad base for cooperation between the Israeli and Arab Governments; and 4) a further demonstration of the United States efforts to find peaceful solutions to areas of conflict.

The resolution was approved unanimously by the US Senate Foreign Relations Committee and adopted without dissent by the Senate. The project was studied in detail over the course of the next five years by a technical group made up of Arabs, Israelis, and Americans centred at the Oak Ridge National Laboratories. Although joint US–Israeli studies on nuclear desalination dating back to 1964 had looked promising (US Department of State memorandum, 14 December 1977, unpublished), the ''Proposal for Our Time'' eventually faltered on economic grounds, along with the dangers of introducing nuclear technology to the region, but the effort was finally called off because of political resistance. Nevertheless, two years of cooperative research in Oak Ridge, Tennessee, along with lessons learned during the Johnston negotiations 12 years earlier, showed that, on the technical level at least, cooperation over regional water resources and planning was possible. The Agro-Industrial Complex, which was to be the last attempt at region-wide water cooperation, was finally shelved in the early 1970s. Even after diplomatic ties were established between Egypt and Israel in 1977, an invitation was sent in

1980 by Israeli nuclear scientists to their Egyptian counterparts to renew the research effort. The response was, in effect, ''Not yet. Let's wait for closer ties.''

As the 1960s came to a close, the PLO mounted an intensive guerrilla campaign against Israeli settlements in the Jordan Valley. Israeli retaliation raids led to occasional conflict with Jordanian and Iraqi troops stationed in the eastern part of the valley. In April–May 1969, Israeli water authorities measured the Jordan River's base flow to be 686 mm below its average for that period. Suspicion that Jordan was over-diverting the Yarmuk may have combined with Israel's policy of holding the host country partly responsible for Palestinian attacks and led to two Israeli raids in June and August 1969, to destroy one of the most vulnerable targets in Jordan – the East Ghor Canal. The political rationale was that damage to the country's irrigation would pressure King Hussein into action against the PLO.

At the same time, the Jordanian Army, which saw too much latitude in PLO behaviour in Jordan, was putting pressure on the King in the same direction. Secret negotiations in 1969–1970 between Israel and Jordan, mediated by the United States, led to an agreement. Israel was persuaded that the drop in Jordan base flow was natural and Jordan would be allowed to repair the Canal. In exchange, Jordan agreed to adhere to the Johnston Plan allocations and ''pledged to terminate PLO activity in Jordan'' (Naff and Matson 1984, 55). In ''Black September'' 1970, the Jordanian Army expelled the PLO from Jordan. Estimates of the number of Palestinians killed in the process are as high as 5,000.

After the expulsion of the PLO, Jordan set out on a two-stage Jordan Valley Development Plan with Crown Prince Hassan, the King's 23-year-old Oxford-educated brother, taking charge (Cooley 1984, 19). The first stage, which included a small ''King Talal Dam'' on the Zarqa River, new irrigation networking, and catchments on several wadis, was built during the late 1970s, partially with US financing.

During the war between Israel and the combined forces of Egypt and Syria in 1973, water played only an incidental strategic role. Touring the Golan Heights with the then Water Commissioner Menahem Cantor in the fall of 1973, Defence Minister Moshe Dayan expressed concern that Israel's development of small-scale dams on the Golan Heights was proceeding so slowly. Dayan saw the strate-

gic potential of these dams as tank barricades against Syrian forces. Cantor cited budget limitations, and was given encouragement and budget to proceed more quickly. Dayan was scheduled to tour the sites again on Sunday 7 October, but the war broke out on the previous day. It is unclear how the dams performed in their strategic function (interview, Menahem Cantor, November 1991).

In the mid-1970s, water rationing in large Jordanian cities such as Amman and Irbid pointed to the need for a major water project. The 1975 ''seven year plan'' included ''Stage II'' – the revived concept of a large (486 MCM storage) dam on the Yarmuk at Maqarin. The dam would store winter run-off to provide irrigation water to the Jordan Valley, 20 MW of hydropower, and a more even downstream base flow year-round. The total cost of the project, as estimated in 1979, was US$1,000 million (S. Taubenblatt in Starr and Stoll 1988, 48).

The Carter administration became interested in the plan and in 1980 pledged a US$9 million USAID loan for development in addition to US$10 million that had previously been allocated. Also in 1980, Congress committed US$150 million over three years to the plan on one condition – that Israel, Jordan, and Syria resolve their riparian problems before funds would be appropriated. The dam would straddle the Syria–Jordan border and relations between those countries had been deteriorating throughout the 1970s. Downstream, Israel asked for an increase in its Yarmuk allotment from 23 MCM/yr to 40 MCM/yr, as well as an additional 140 MCM/yr for the West Bank (Davis et al. 1980, 11; Kahhaleh 1981, 46).

In 1977, Jordanian water officials approached their Israeli counterparts through US intermediaries and requested a high-level meeting to discuss rebuilding the low dam at Mukheiba. One meeting was held that year in a Zurich hotel with three ministerial-level representatives from each side present. Israeli representatives expressed approval of the dam, the northern side of which would abut on Israeli territory – a more even year-round flow would benefit both sides – and agreed to further discussion on this and other regional water planning issues (unpublished minutes, 6 May 1977). In elections that year, however, the Israeli government shifted from Labour- to Likud-led for the first time, and the new ministers did not pursue the dialogue with the Jordanians. Direct ministerial negotiations were not held again on water issues except for a brief meeting in Jericho in 1985, although the ''Picnic Table talks,'' on allocations of the Yarmuk River, continued at the technical level.

Water-related conflict between Jordan and Israel came close to

breaking out two years later. In July of the drought year 1979, Jordan sought American mediation to gain Israeli permission to service the intake of the East Ghor Canal, which had been silting up. Days after having cleared the intake, Jordan charged the Israelis with replacing the rocks so that more water would flow downstream, and brought military forces up to the cease-fire line. The Israelis responded by mobilizing their own forces in the area. An armed conflict was averted only with urgent American mediation.

According to the Israeli officer responsible for that sector at the time, although initial preparations took on the scale of a full military operation, the discussions that followed the stand-off felt less formal. If, for example, an Israeli negotiator wanted to contact his Jordanian counterpart, he would simply shout across the river to the Jordanian forces and a meeting, usually taking place on the rocks in midstream, would be arranged (interview, October 1991).

Philip Habib was sent to the region in 1980 by the US State Department to help mediate an agreement. Although Habib was able to gain consensus on the concept of the dam, on separating the question of the Yarmuk from that of West Bank allocations, and on the difficult question of summer flow allocations – 25 MCM would flow to Israel during the summer months – negotiations ran into difficulties regarding the winter flow allocations, and final ratification was never reached. The plan was indefinitely postponed late that year, but has very recently been revived by Jordan and Syria as the ''Unity Dam.''

One other conflict between Israel and Jordan was solved by technology and hydrology, rather than by the military. In 1983, a Jordanian well along the Yarmuk just across the border from Israel struck water with such force that a drilling rig 400 m high was toppled. Initial output of the well was close to 700 m^3/h. Hoping that the aquifer was hydrologically connected on both sides of the Yarmuk, but fearing that, if it were, the Jordanians would deplete Israel's share, Israel launched its own drilling operation on its side of the river. Both sides would be disappointed: it turned out that the aquifers were not intricately connected, and the Israeli well produced only 200 m^3/h, while the Jordanian well quickly lost most of its head and today produces only about one-third of its assumed capacity (press reports, February 1983; interview, Elias Salameh, November 1991).

Meanwhile, tensions were being somewhat reduced along other borders. In 1978, Egypt and Israel signed the Camp David peace accords – the first between Israel and an Arab country. At a meeting in

September 1979 with Israeli newspaper editors, President Anwar Sadat discussed plans for a pipeline to bring Nile water to the recently returned Sinai Peninsula. ''Once we bring it to Sinai,'' he asked, ''why should we not bring some of this water to the Negev?'' (Spector and Gruen 1980, 10). The offer was reiterated and elaborated upon in discussions with Prime Minister Menachem Begin in 1981. Israel would be provided with 365 MCM/yr in exchange for ''solution of the Palestinian problem and the liberation of Jerusalem'' (R. Krishna in Starr and Stoll 1988, 32).

The offer was immediately rejected by almost all parties concerned. Prime Minister Begin objected to the quid pro quo, stressing that Israel would not trade its sovereignty over a unified Jerusalem for economic gain. Nationalists on both sides were also opposed to the idea: Egyptians did not want to share this vital resource with Israel, and Israelis did not like the idea of being vulnerable to upstream control. Israeli Agriculture Minister Ariel Sharon is quoted as saying ''I would hate to be in a situation in which the Egyptians could close our taps whenever they wished'' (Spector and Gruen 1980, 10).

Interestingly, the strongest opposition to the offer came from another region entirely. Ethiopia, 2,500 km up river, charged that Egypt was misusing its share of Nile water. In a sharp retort, President Sadat warned against Ethiopian action:

> We do not need permission from Ethiopia or the Soviet Union to divert our Nile water … If Ethiopia takes any action to block the Nile waters, there will be no alternative for us but to use force. Tampering with the rights of a nation to water is tampering with its life and a decision to go to war on this score is indisputable in the international community''. (R. Krishna in Starr and Stoll 1988, 33–34)

President Sadat was assassinated in 1981. Although technical and economic details of a Nile River diversion have since been developed (see, for example, Kally 1989; Dinar and Wolf 1991), the plan was never implemented except for a small irrigation diversion into the western Sinai.

In 1982, Israel for the second time mounted an operation against the PLO in Lebanon. The first time, during ''Operation Litani'' four years earlier, Israel had stopped its advance at the Litani River and, before withdrawing, had turned over portions of southern Lebanon to the South Lebanon Army under the command of Major Sa'ad Haddad. Haddad was reportedly to protect Israeli interests in the region, par-

ticularly defending against attempted Palestinian incursions through the area to Israel. In addition, the militia is reported to have protected the Jordan headwaters of the Hasbani by closing some local wells and preventing the digging of others. As a result, some or all of the 35 MCM allocated to Lebanon in the Johnston Plan now flows to Israel (Naff and Matson 1984, 49).

Israelis involved in these issues contest these reports. Israeli hydrologic records, for example, show that the flow of the Hasbani into Israel exceeded the average flow only three times in the last 10 years, during particularly wet years (stream gaugings, Israel Hydrologic Survey 1981–1991). More to the point, an officer in Israel's Northern Command, who dealt with Haddad extensively, claims that the Lebanese major made perfectly clear to the Israelis that ''We will cooperate with you, but there are two subjects which are taboo – our land and our water'' (interview, October 1991). Nevertheless, the then Chief of Staff Ezer Weizman (Chaim Weizmann's nephew) was berated by a member of the Knesset after the operation for not seizing the Litani: ''Your uncle knew at the time the historic significance of the Litani,'' M.K. Cohen shouted (cited in Hof 1985, 24).

In the 1982 operation, the Litani was again the initially stated objective, but, by July, Israeli forces had surrounded Beirut. This war, as in 1967, had clear military and political objectives, and water may, again, have played a minor role.

The Litani River has a natural flow of about 700 MCM/yr. A dam at Qir'awn in the Beka'a Valley and irrigation and hydropower diversions completed in the mid-1960s reduce the lower Litani flow to 300–400 MCM/yr (Kolars 1992). This lower section, flowing within kilometres of the Hasbani and the Israeli border, historically had presented the possibilities of diversions in conjunction with the Jordan system. The Israeli Cotton Plan and the Arab Headwaters Diversion Plan envisioned water diverted into and out of the Jordan basin, respectively. In fact, even before 1982, Israel had carried out seismic studies and received intelligence reports on the feasibility of a Litani diversion (Naff and Matson 1984, 76). These reports concluded that a diversion would be economically unattractive and, in any event, would be politically infeasible until cooperation could be developed with Lebanon (interviews, Haim Paldi, October 1991; Menahem Cantor, November 1991).

After the invasion was launched by the then Defence Minister Ariel Sharon, a ''water hawk'' who had frequently spoken of seizing

the Litani, Israel captured the Qir'awn Dam and brought hydrographic charts and technical documents relating to the Litani and its installations back to Israel (Cooley 1984, 22).

During the years of Israeli occupation from 1982 to 1985, several analysts developed and elaborated on a ''hydraulic imperative'' theory, which described water as *the* motivator for Israeli conquests, both recently, in Lebanon, and earlier, in the West Bank and Golan Heights (see, for example, Davis et al. 1980; Kahhaleh 1981; Stauffer 1982; Cooley 1984). The speculations for likely Israeli actions in Lebanon by proponents of this theory ranged from a simple diversion of the 100 MCM/yr available at the lower Litani to elaborate conjectures of a permanent occupation of the entire Beka'a Valley south of the Beirut–Damascus Highway, which (according to Stauffer 1982), along with a hypothetical destruction of the Qir'awn Dam and Marhaba Diversion Tunnel and forced depopulation of southern Lebanon, would allow diversion of the entire 700 MCM/yr flow of the river into Israel.

More is mentioned in a later section about this ''hydraulic imperative'' theory, which has already been critiqued on political, technical, and economic grounds (Naff and Matson 1984, 75–80; Wishart 1989, 14). The strongest rebuttal, however, at least with regard to Lebanon, comes from the fact that, despite method, more than eight years of opportunity, and (given a serious drought since the mid-1980s) ample motive, the Israelis are not now diverting the Litani River. However, the ''Security Zone'' that Israel retains since its withdrawal does still include the most likely diversion point at Taibeih. Moreover, former Technology Minister Yuval Ne'eman has mentioned in the past that, if the Lebanese ever cared to sell some of the Litani waters, ''we could make good use of them in the Northern Galilee'' (Cooley 1984, 25).

In the meantime, the opposite is true. Cut off from their water supply partly because of strained relations with Beirut, the villagers of Bint Jbil and five other villages in central southern Lebanon approached the Israelis for help in 1985. Israel, which since 1979 has had a ''good fence'' policy of influencing the residents of southern Lebanon in its favour with a combination of military and humanitarian aid, responded to the request for water by building a pipeline from a pump at Shtula, on the Israeli side of the border. Since that time, an average of 50,000 m^3/month has flowed from Israel into Lebanon (Mekorot maps; interview, Avner Turgeman, December 1991).

Israel, the West Bank, and Gaza

Ever since the 1973 war, the regional conflict focus has shifted from being Israeli–Arab to Israeli–Palestinian. This is true regarding water conflicts, as well. In fact, while earlier periods were marked by major water projects and region-wide water conflicts, this most recent period has mostly been one of internal adjustments within each state to optimize existing water resources. Israeli water policy, however, also includes territory and populations under military occupation, the final status of which has yet to be determined. Because of the hydrography of these areas, the focus has also shifted from a surface water to a groundwater conflict (see appendix I, maps 4 and 5).

As mentioned earlier, Israel took control of the West Bank in 1967, including the recharge areas for aquifers that flow west and northwest into Israel (at about 320 MCM/yr and 140 MCM/yr, respectively) and east to the Jordan Valley (about 125 MCM/yr) (Kahan 1987, 21). The entire renewable recharge of these first two aquifers is already being exploited and the recharge of the third is close to being depleted as well. Because any overpumping would result in salt-water intrusion into Israeli wells, Palestinian water usage has been severely limited by the Israeli authorities.

In 28 years of occupation, a growing West Bank population, along with burgeoning Jewish settlements, has increased the burden on the limited groundwater supply, resulting in an exacerbation of already tense political relations. Palestinians have objected strenuously to Israeli control of local water resources and to settlement development, which they see as being at their territorial and hydrologic expense (see, for example, Davis et al. 1980; Dillman 1989; Zarour and Isaac 1992).

In 1967, Israel nationalized all West Bank water and limits were placed on the amount withdrawn from each existing well. Since that time, the only permits for new Palestinian wells that have been granted are for domestic needs. Agricultural usage was capped at 1968 levels and all subsequent extension of land under irrigation has been through increased efficiency (Richardson 1984). At the same time, 17 wells were drilled to provide water to the new Israeli settlements. Some Palestinian wells were undercut and became desiccated, notably at al-Auja and Bardala, because of the deeper, more powerful Israeli wells (Dillman 1989, 56–57). Of the 47 MCM/yr pumped in the mountain area, 14 MCM/yr, or 30 per cent, goes to the Jewish

settlements. The eastern aquifer, which flows into the Jordan Valley, is the only one not being overexploited, but Palestinians have not been allowed to expand their water resources in this region either (Dillman 1989, 57). Currently, a total of 150 MCM/yr is consumed by its residents – 115 MCM/yr by Palestinians and 35 MCM/yr by Jews.

Israelis argue that Palestinian agriculture can expand using water saved through more efficient agricultural practices. For example, modern methods of irrigation have helped Palestinian farmers in the Jiftlik Valley to increase vegetable production tenfold without significantly increasing water needs (Rymon and Or 1989). They argue further that any limits imposed on pumping have depended on the situation of each aquifer at the time that the permit was requested – not on whether the applicants were Arabs or Jews – and that, with only one exception, desiccated Palestinian wells have been supplied with alternate sources (Info Briefing 1986; interviews, Zeev Golani, October 1991; Shmuel Cantor, December 1991).

One factor exacerbating tensions between the sides is that legal ownership of water originating on the West Bank (and consequent drilling rights) is still under dispute. Under pre-1967 Jordanian law, water on the West Bank had been considered a private resource and, although approval for any irrigation schemes was required from the Department of Irrigation and Water, permission was routinely granted (Dillman 1989, 52). Under the law, each landowner in the West Bank had the right to drill a well on his land, although the government had final authority to distribute permits and to determine pumping limits and allocations. After the 1967 war, one of the first Israeli Military Orders enacted was one necessitating permission from an area commander to operate a water installation (IDF Military Order 158, cited in Dillman 1989, 53). The following year, Military Order 291 brought all surface and groundwater under public ownership to be managed by Israeli water authorities in conjunction with the Israeli hydrologic network (Dillman 1989, 52). Technically, Israeli authorities did not significantly alter the structure of groundwater law in the territories, retaining the wording of Jordanian law, but transferring final authority from the Kingdom of Jordan to the Israeli military administration. In practice, however, day-to-day operations became increasingly controlled by the Israeli Water Commissioner to the point where, today, almost all water is metered, limited, priced, and allocated by that body.

Israeli authorities viewed these actions as defensive, of a sort. Hy-

drogeologically, Israel is down-gradient of the West Bank aquifers. In essence, groundwater flows (albeit extremely slowly) from the recharge areas and upland aquifers of the West Bank down to those on the Israeli side of the Green Line on its way to the sea. Israel had been tapping up to 270 MCM/yr of this groundwater from its side of the Green Line since 1955 (Garbell 1965, 30). Any uncontrolled, extensive groundwater development in the newly occupied territories would threaten these coastal wells with salt-water intrusion from the sea, causing serious damage (Jaffee Center 1989, 200).

With about 30 per cent of Israeli water originating on the West Bank, the Israelis perceive the necessity to limit groundwater exploitation in these territories in order to protect the resources themselves, and their wells from salt-water intrusion. To this end, they have even imported surface water from the National Water Carrier to the Ramallah and Hebron hill region for Arab domestic use, rather than allowing additional drilling (Spector and Gruen 1980, 10). Further, four or five Israeli settlements built in the late 1970s around Elkanna, near the Green Line, may have been sited to guarantee continued Israeli control of some of the contested water (State of Israel memoranda June 1977; Pedhatzor 1989).

Palestinians have objected to this increasing control and integration into the Israeli grid. Legal arguments often refer, at least in part, to the Fourth Geneva Convention's discussion of territories under military occupation (see, for example, Dillman 1989; El-Hindi 1990). In principle, it is argued, the resources of occupied territory cannot be exported for the benefit of the occupying power. Israeli authorities reject these arguments, usually claiming that the Convention is not applicable to the West Bank or Gaza because the powers these territories were wrested from were not, themselves, legitimate rulers (El-Hindi 1990). Egypt was itself a military occupier of Gaza, and only Britain and Pakistan recognized Jordan's 1950 annexation of the West Bank. In addition, it is pointed out that the water that Israel uses is not being exported but, rather, flows naturally seaward, and, because Israel has been pumping that water since 1955, it has ''prior appropriation'' (''first in time, first in right'') rights to the water.

Although Jordan gave up all claims to the West Bank in 1988 in favour of the ''State of Palestine,'' Jordanian water from the Yarmuk is still the most likely source of surface water for the area, with Jordan still ''owing'' the West Bank 70–150 MCM/yr from the Johnston proposals. During the Maqarin Dam negotiations and subsequently,

the Israelis have urged construction of the project and the sharing of water resources with the West Bank and, naturally, Israel, ''in the context of regional agreement and cooperation'' (cited in Richardson 1984, 122).

It is clear that Israel would hope to keep control over some water usage in the West Bank, even in the event of Palestinian autonomy. When talks were held under the auspices of Camp David, the Israeli Committee determined that

> ... the water resources of the State of Israel inside the Green Line originate in the West Bank and that incorrect application of drilling in the West Bank could salinize the water reservoirs of the State of Israel ... The State of Israel must continue to control the water resources in the territories, both because of the danger to water reserve inside the Green Line and because (otherwise) it would be impossible to establish new settlements in these territories. (Cited in Davis et al. 1980, 4)

Although this position softened somewhat with negotiations to where, in 1980, Israel proposed a joint water committee of Israeli and Palestinian representatives, they made it very clear that ''all decisions would have to be unanimous'' (Spector and Gruen 1980, 11). As late as 1989, however, an official goal of the Israeli government has been

> ... to prepare legal and political bases which will guarantee Israeli control and administration of water resources in Judea and Samaria, regardless of the future political status of these areas. (State of Israel, cabinet minutes, 14 May 1989)

On 15 September 1993, the Declaration of Principles on Interim Self-Government Arrangements was signed between Palestinians and Israeli, which defined Palestinian autonomy and the redeployment of Israeli forces out of Gaza and Jericho. Among other issues, the Declaration of Principles called for the creation of a Palestinian Water Administration Authority. Moreover, the first item in Annex III, on cooperation in economic and development programmes, included a focus on

> ... cooperation in the field of water, including a Water Development Program prepared by experts from both sides, which will also specify the mode of cooperation in the management of water resources in the West Bank and Gaza Strip, and will include proposals for studies and plans on water rights of each party, as well as on the equitable utilization of joint water resources for implementation in and beyond the interim period.

Annex IV describes regional development programmes for cooperation including:

– The development of a joint Israeli–Palestinian–Jordanian Plan for coordinated exploitation of the Dead Sea area;
– The Mediterranean Sea (Gaza)–Dead Sea Canal;
– Regional desalination and other water development projects;
– A regional plan for agricultural development, including a coordinated regional effort for the prevention of desertification.

The Declaration of Principles also included a description of the mechanisms by which disputes might be resolved. Article XV describes these mechanisms:

1. Disputes arising out of the application or interpretation of this Declaration of Principles, or any subsequent agreements pertaining to the interim period, shall be resolved by negotiations through a Joint Liaison Committee to be established.
2. Disputes which cannot be settled by negotiations may be resolved by a mechanism of conciliation to be agreed upon by the parties.
3. The parties may agree to submit to arbitration disputes relating to the interim period, which cannot be settled through conciliation. To this end, upon the agreement of both parties, the parties will establish an Arbitration Committee.

Eventually, the final political and hydrographic status of this region will have to be determined. Aside from politics or nationalisms, hydrologic reasoning would seem to dictate that this determination should be done sooner rather than later. As one UN report notes,

> The present integration of the basic water services in the occupied territories with those of Israel is about to lead to the complete dependence of the former services on those of Israel and will eventually make the separation of the two very costly and difficult. (Cited in Dillman 1989, 63)

1982–Present: Hydrologic limits and peacemaking

By the mid-1980s, each of the countries riparian to the Jordan River began to approach its hydrologic limits, and the potential for either conflict or cooperation took on new urgency, both in the region and abroad.

The fundamental tenet of ecologic systems is ''Everything is connected to everything else'' (Holling 1978, 26). An addendum, for those dependent on a watershed approaching the limits of available

water, might be ''Everything you do will affect someone else.'' As the riparians to the Jordan River watershed began to run out of hydrologic room to manoeuvre, this tenet became increasingly apparent.

In 1985, plans for a deep well near Herodian in the West Bank were made public. This project, funded by an American fundamentalist Christian group, would have brought 18 MCM/yr to both Arabs and Jews on the West Bank. Wary that the size and depth of the project might undercut their wells, some Palestinians had international pressure brought to bear on the Israelis and Americans involved, and the project was halted (Caponera 1991).

Meanwhile, the Syrians, who had lost access to the Banias springs in 1967, began a series of small impoundment dams on the headwaters of the Yarmuk in its territory in the late 1970s. By August 1988, 20 dams were in place with a combined capacity of 156 MCM/yr (Sofer and Kliot 1988, 19) (see appendix I, map 27). That capacity has since grown to 27 dams with a combined storage of about 250 MCM/yr (Gruen 1991, 24; interview, Shmuel Cantor, December 1991). According to George Gruen (1991, 24), the Syrians have plans to expand this storage to 366 MCM/yr by 2010. These Syrian impoundments are in contradiction to their 1953 agreement with Jordan, which allocates seven-eighths of the water of the Yarmuk to Jordan in exchange for two-thirds of the hydropower from the planned Maqarin Dam (Caponera 1991, 10).

Because the Maqarin, or Unity, Dam was never built, winter runoff, most of which Jordan cannot now capture for use in its East Ghor Canal, flows almost unimpeded downstream to Israel. This situation has allowed Israel to use more than the 25 MCM/yr allocated to it from the Yarmuk by the Johnston accords.

Against this backdrop, Jordan in 1989 approached the US Department of State for help in resolving the dispute. Ambassador Richard Armitage was dispatched to the region in September 1989 to resume secret indirect mediation between Jordan and Israel where Philip Habib had left off a decade earlier. The points raised during the following year were as follows:

– Both sides agreed that 25 MCM/yr would be made available to Israel during the summer months, but disagreed as to whether any additional water would be specifically earmarked for Israel during the winter months.
– The overall viability of a dam was also open to question – the Israelis still thought that the Sea of Galilee ought to be used

as a regional reservoir, and both sides questioned what effects ongoing development by Syria at the headwaters of the Yarmuk would have on the dam's viability. Since the State Department had no mandate to approach Syria, their input was missing from the mediation.

– Israel eventually wanted a formal agreement with Jordan, a step that would have been politically difficult for the Jordanians at the time.

By fall of 1990, agreement seemed to be taking shape, by which Israel agreed to the concept of the dam, and discussions on a formal document and winter flow allocations could continue during construction, estimated to take more than five years. Two issues held up any agreement: first, the lack of Syrian input left questions of the future of the river unresolved, a point noted by both sides during the mediations; second, the outbreak of the Gulf War in 1991 overwhelmed other regional issues, finally pre-empting talks on the Yarmuk. The issue has not been brought up again until recently in the context of the Arab–Israeli peace negotiations. Agreement on this issue is a prerequisite to building the Unity Dam. The World Bank has agreed to help finance the project only if all of the riparians agree to the technical details.

With these developments during the 1980s, the United States, which had initiated both the Johnston negotiations in the 1950s and the water-for-peace process during the 1960s, became convinced anew of water's potential for conflict. By the end of the 1980s, comprehensive studies on the strategic aspects of water in the Middle East and the potential for conflict had been conducted by the US Defense Intelligence Agency (Naff and Matson 1984), the Center for Strategic and International Studies (Starr and Stoll 1987; 1988), and the Israeli Foreign Ministry (Sofer and Kliot 1988); in addition, the House of Representatives Subcommittee on Europe and the Middle East had held a hearing on Middle East water issues (US Department of State, House of Representatives, June 1990). Each concluded not only that the water resources of the region had great potential for conflict but also that, of the Middle East water basins, the Jordan presented the most likely flashpoint.

In the thinking of the Defense Intelligence Agency:

> Water ignores artificial political boundaries; in an undeveloped environment it flows according to the terrain. When man – in order to make better use of water for himself – changes the natural distribution system, he also changes traditional use patterns. This can be extremely disruptive and upsetting to

other riparian users. The result is often political conflict if not outright military action. Military factors are often the de facto determinants in resolving riparian relationships in the Middle East. (Personal communication, 3 July, 1991)

By 1991, several events combined to shift the emphasis on the potential for ''hydroconflict'' to the potential for ''hydrocooperation.''

The first event was natural. Three years of below-average rainfall in the Jordan basin caused a dramatic tightening in the water management practices of each of the riparians, including rationing, cutbacks to agriculture by as much as 30 per cent, and restructuring of water pricing and allocations. Although these steps placed short-term hardships on those affected, they also showed that, for years of normal rainfall, there was still some flexibility in the system. Most water decision makers agree that these steps, particularly regarding pricing practices and allocations to agriculture, were long overdue.

The next series of events were geopolitical in nature. The Gulf War in 1990 and the collapse of the Soviet Union caused a realignment of political alliances in the Middle East that finally made possible the first public face-to-face peace talks between Arabs and Israelis, in Madrid on 30 October 1991.

While the region was still in the throes of drought, water was mentioned as a motivating factor for the talks. Jordan, as has been mentioned, is squeezed hydrologically between two neighbours attempting to reinterpret prior agreements, but otherwise has no major territorial disputes with Israel. A researcher at the Middle East Studies Center in Amman therefore suggested that ''Jordan is being pushed to the peace talks because of water'' (interview, Mohammed Ma'ali, November 1991). Mohammed Beni Hani, the head of Jordan's water authority, is one of Jordan's 12 delegates to the peace talks. At the opening ceremonies in Madrid, Dr Haidar Abdel-Shafi, the head of the Palestinian delegation, included in his opening remarks a call for ''the return of Palestinian land and its life-giving waters.''

During the bilateral negotiations between Israel and each of its neighbours, it was agreed that a second track be established for multilateral negotiations on five subjects deemed ''regional.'' These subjects included ecology, energy, economic cooperation, arms reduction, and – water resources.

With the opening of peace talks, the emphasis in international arenas quickly went from the potential for conflict over water to its potential as a vehicle for cooperation. Seminars and conferences

were held throughout the early 1990s in the United States, Canada, Europe, and the Middle East on the possibilities for cooperation over water resources. The World Bank held a seminar on the topic, as did the US Department of State, and the Center for Foreign Affairs. Increasingly, both Arab and Israeli academics and policy makers have taken part together in these conferences.

Nevertheless, old patterns have been slow in changing. As part of the Global Water Summit Initiative, Joyce Starr, who two years earlier had organized a ''water summit'' for African states, attempted a similar summit in the Middle East, scheduled for November 1991. Despite early signs of participation on the part of several states in the region, and despite official invitations to 50 countries, including 22 Arab nations, from Turkish President Turgut Özal, Syria refused to attend if Israel were invited, and called for other Arab countries to follow its position. The US State Department suggested that, if Israel were not invited, the United States would not attend either. Faced with this impasse, the summit was finally cancelled (press reports, August–November 1991).

In Israel, at the same time, the Jaffee Center for Strategic Studies of Tel Aviv University asked two researchers (Yehoshua Schwartz, the director of Tahal, Israel's water planning agency, and Aharon Zohar, also at Tahal at the time) to undertake a study of the regional hydrostrategic situation and the potential for regional cooperation. The result, a 300-page document entitled *Water in the Middle East: Solutions to Water Problems in the Context of Arrangements between Israel and the Arabs* (Schwartz and Zohar 1991), was one of the most comprehensive studies of its kind. It examined a number of possible scenarios for regional water development, including possible arrangements between Israel and Jordan, Syria, Lebanon, Egypt, Turkey, Saudi Arabia, Iraq, and the Palestinians on the West Bank and in Gaza. Scenarios were included both for regional cooperation and for its absence. Evaluations included hydrologic, political, legal, and ideological constraints. The impacts of potential global climatic change were also considered. The study showed, in the words of Joseph Alpher, the Director of the Jaffee Center, ''the potential beauty of multilateral negotiations'' (interview, Joseph Alpher, December 1991).

Some of the findings of the study contradicted government policies at the time, however. In the sections on possible arrangements between Israel and the Palestinians, and between Israel and Syria, maps of the West Bank and Golan Heights included lines to which Israel might relinquish control of the water resources in each area,

without overly endangering its own water supply. The line in the West Bank, which was based on studies dating back to the late 1970s (as is discussed in the next section and in chapter 4), suggested that Israel might, with legal and political guarantees, turn control of the water resources of more than two-thirds of the West Bank over to Palestinian authorities without threatening Israel's water sources from the Yarkon–Taninim (western mountain) aquifer (see appendix I, map 29). These maps contradicted the position of the Ministry of Agriculture, headed by Rafael Eitan of the right-wing Tzomet party. The Ministry's position was that, to protect Israel from threats to both the quantity and quality of its water, Israel had to retain political control over the entire West Bank. (The apparent contradictions in these positions are examined later in this chapter and in chapter 4.)

On 12 December, 1991, 70 copies of the report were sent throughout Israel for review, including copies to the Ministry of Agriculture. Calling the maps mentioned above "an outline for retreat," Rafael Eitan and Dan Zaslavsky (whom Eitan had recently appointed Water Commissioner) insisted on a recall of the review copies and a delay in the release of the report. In January 1992, the Israeli military censor backed the position of the Ministry of Agriculture and, citing sensitivity of the report's findings, censored the report in its entirety (interviews, Yehosua Schwartz, October 1991; Joseph Alpher, Aharon Zohar, December 1991; personal communication, Aharon Zohar, January 1992).

Entrenched positions notwithstanding, the two sides have continued to move towards cooperation with increasing momentum. In Jerusalem, the Israel/Palestine Center for Research and Information (IPCRI) began holding round-table discussions and simulated negotiations on water in December 1990. In October 1992, IPCRI cosponsored, with the Hebrew University of Jerusalem and the Applied Research Institute in Bethlehem, the "First Israeli/Palestinian International Conference on Water."

On a larger scale, the first round of multilateral negotiations on water were held in Vienna in May 1992. At that meeting, each party agreed to compile a programme for regional development, which would then be examined in the United States for any commonalities that could be exploited to induce cooperation. This same approach is being taken by the World Bank, which commissioned similar studies from the states in the region. In conjunction with the peace talks, less-public and less-official dialogues, called the "Track 2 talks," have been held between Israelis and Arabs in the United States.

These breakthroughs in water talks may have repercussions on negotiations on other topics as well. In the words of Munther Haddadin, a Jordanian delegate, ''Water seems to be leading the Peace Talks.''

As in 1919, the peace talks of the 1990s have included the mutual impact of water on political decision-making. Seventy years of regional water development, however, have both heightened the political stakes of water issues and left less hydrologic room for manoeuvrability. However, given that an important political precedent has been set in Madrid – public face-to-face negotiations, the lack of which has precluded explicit cooperation in the past – and given the lessons learned through 70 years of ''hydrodiplomacy,'' a new potential for regional planning and cooperation may have been reached. One can hope that, after 70 years, the lessons have been learned.

Hydroconspiracy theories: The ''hydraulic imperative,'' and ''hydronationalism''

As mentioned in the introduction to this section on history, I have culled instances of water-related conflict and cooperation from the vast geopolitical forces at work in the region. If one were not wary of this fact, and in view of the extensive history of the linkage between Middle East water resources and strategic thinking, it would not be difficult to develop and ''prove'' a theory citing water as *the* motivating factor for regional conflict. Two historic themes that have found favour among some authors in academic literature and the popular press do just that. Both themes, the ''hydraulic imperative,'' (''Israel's territorial conquests have actually been quests for greater water resources'') and that of ''hydronationalism'' (''Israeli water security depends on retention of the entire West Bank and Golan Heights in perpetuity''), are described and critiqued more fully below.

The hydraulic imperative

Proponents of a ''hydraulic imperative'' theory – which describes the quest for water resources as *the* motivator for Israeli military conquests, both in Lebanon in 1979 and 1982 and earlier, on the Golan Heights and West Bank in 1967 – usually point to some combination of the following to support their argument for Lebanon (see, for example, Davis et al. 1980; Stauffer 1982; Schmida 1983; Stork 1983; Cooley 1984; Dillman 1989):

1. Early Zionist lobbyists and planners, from Chaim Weizmann at the Paris Peace Conference in 1919, through the Hays and Cotton plans of the 1940s and 1950s, have advocated inclusion of either the Litani River in Israeli borders or of Litani water into the Jordan watershed.
2. The 1979 Litani Operation left Major Sa'ad Haddad to protect Israeli interests in southern Lebanon. Along with helping to prevent terrorist incursions, the South Lebanon Army is reported to have protected the Hasbani headwaters and the likely area for a Litani diversion project.
3. In the early stages of the 1982 war in Lebanon, Israel ''captured the Qir'awn Dam and seized all hydrographic charts and technical documents relating to the Litani and its installations.'' After Israeli withdrawal from the country, the ''Security Zone'' still leaves Israel in control of the area from Taibe and slightly north where a water diversion could be effected.

Particularly during the years of Israeli occupation from 1982 to 1985, several analysts developed and elaborated on the ''hydraulic imperative'' theory. The speculations for likely Israeli actions in Lebanon by proponents of this theory ranged from a simple diversion of the 100 MCM/yr available at the lower Litani to elaborate conjectures of a permanent occupation of the entire Beka'a Valley south of the Beirut–Damascus Highway, which, along with a hypothetical destruction of the Qir'awn Dam and Marhaba Diversion Tunnel and forced depopulation of southern Lebanon, would allow diversion of the entire 700 MCM/yr flow of the river into Israel.

Many have been convinced that Israel is, in fact, diverting water from the Litani into Israel. According to John Cooley, ''It was small wonder that the first Israeli diversion plans for the Litani have come into being'' (cited in Sofer 1991, 6). More recently, Fred Pearce (1991, 39) described tensions in southern Lebanon, ''where Israel is widely reported to be diverting the flow of the River Litani south into Israel,'' and Thomas Naff, who had sharply critiqued the hydraulic imperative in his 1984 study (Naff and Matson 1984, 75–80), has noted that

> Although water may not have been the prime impetus behind the Israel acquisition of territory, as the ''hydraulic imperative'' alleges, it seems perhaps the main factor determining its retention of that territory. (Frey and Naff 1985, 76)

Professor Naff testified to Congress in 1990 that ''owing to serious shortages, Israel is presently conducting a large-scale operation of

trucking water to Israel from the Litani River …'' (US House of Representatives 1990, 24). He has since modified the contention to ''water, it seems, was instead trucked to units of the Israeli-supported Lebanese Army of South Lebanon in the 'security zone' and, perhaps, to some Shi'i villages in the same area as a reward for their cooperation'' (Naff 1992, 6). Lebanese diplomats, however, on hearing the original charges, were prepared to bring the matter to a UN Security Council resolution against Israel (press reports, September 1990).

Building retroactively on the Lebanon experience, Israel's conquests in 1967 also were included in the ''imperative.'' It is clear that tensions between Israel and Syria over water since 1964 had contributed to the developments leading to fighting in 1967, that Israel was approaching its hydrologic limits, and that it made tremendous hydrostrategic gains in the war itself. Making the link between the three, it has now become common to claim that water resources were one of the strategic goals for Israel during the war. Many of the authors cited above make such claims, as does Peter Beaumont:

> To avoid each of the states (Lebanon and Syria) controlling their own water resources, Israel invaded southern Lebanon and the Golan Heights of Syria in 1967. The pretext given was strategic reasons, but the control of the water resources of the area seems a more compelling and realistic reason. (Beaumont 1991, 8)

One might expand a conspiracy theory, if one were so inclined, to include information that has not yet appeared in the literature. For example, one might include the taking, by Israeli forces in the 1967 war, of the Awali town of Ghajar, at the junction of borders between Lebanon, Syria, and Israel. Ghajar had no strategic importance in the military sense in that it neither contained combatants nor was situated in a strategic position, but it does directly overlook the Wazzani springs, which contribute 20–25 MCM/yr to the Hasbani's total annual flow of 125 MCM/yr. During dry summer months, the Wazzani is the only flowing source of the Hasbani. Ghajar was the site of the projected dams for the 1964 Arab Diversion.

Moreover, after the 1979 ''Operation Litani,'' engineers from Mekorot developed plans to divert from 5 to 10 MCM/yr from the Wazzani springs for irrigation in Shi'ite southern Lebanon and in Israel. To allow the project to flow on gravity alone, a slight northward modification of the Israeli–Lebanese border was considered

(Khativ and Khativ 1988; interviews, Haim Paldi, Avner Turgeman, October 1991).

One might add the backgrounds in both water and security issues of many Israeli policy makers, dating back to the 1920s, as proof of a deep-rooted plan linking the two: Aaron Aaronsohn, who formulated Zionist borders for the 1919 peace talks, was both an agriculturalist and a spy against the Turks for the British; Levi Eshkol, Prime Minister during the 1967 war, was one of the founders of Mekorot, the Israeli water company; Moshe Dayan, Defence Minister during the war, was Agricultural Minister immediately beforehand; Ariel Sharon, Defence Minister during the Lebanon war, was also a Minister of Agriculture; Rafael Eitan, a recent Minister of Agriculture, is a retired Army Chief of Staff; and Nahum Admoni, current Director of Mekorot, is the retired Director of the Mossad, Israel's secret service. One would have to add, however, that in a country where every citizen does military service, ex-generals are found in any number of civilian roles, including those of the Mayor of Tel Aviv and the Director of the Archaeological Service.

As mentioned earlier, the hydraulic imperative has been critiqued for political and technical weaknesses by Naff and Matson (1984, 75–80), as well as on economic grounds by Wishart (1989, 14). Nevertheless, because a thorough analysis of the region's options for the future depends in part on a clear understanding of what has happened in the past, it is worth investigating the theory in greater detail. To examine the validity of the hydraulic imperative, two questions must be answered: was the location of water resources a factor in the military strategy of Israel in 1967, 1978, or 1982, and is Israel now diverting water from the Litani River?

MILITARY STRATEGY AND HYDROSTRATEGY. It is occasionally difficult to distinguish between military strategy, defined concisely by one officer as "from where are they shooting and from where will we shoot back," and hydrostrategy, the influence of the location of water resources on strategic thinking. A river, for example, is also an ideal barrier against tanks and troop movements, and, as clear landmarks, rivers often delineate borders. High ridges, ideal for military positioning, are also often local watershed boundaries. Nevertheless, by examining the strategic decision-making of those involved in a particular event, some distinctions can be made.

In the events leading up to the 1967 war, it has already been noted in some detail how conflict over water resources between Syria and Israel contributed to tensions leading to the fighting. The war itself, however, started in the south, with Egypt expelling the UN forces in the Sinai and blocking Israeli shipping to Eilat. The Sinai Desert was the first front when war broke out on 5 June 1967, with the straits of Sharm-el-Sheikh the primary objective.

The hydrostrategic points over which Israel gained control during the war were on the West Bank, including the recharge zones of several aquifers, some of which Israel had been tapping into since the 1950s; on the Golan Heights, including the Banias springs, which Syria had attempted to divert in 1965; and, further south, at El-Hama and at an overlook on the proposed site of the Maqarin Dam (the former was controlled by Jordan, and the latter by Syria).

Before the war, and even in its first days, Israel had agreed not to engage in combat with Jordan, as long as Jordan did not attack. However, Jordan did launch several artillery barrages in the first days of the war, which opened up the West Bank as the second front (Sachar 1979).

Finally, despite attacks from Syria, Defence Minister Moshe Dayan was extremely reluctant to launch an attack on the Golan Heights because of the presence of Soviet advisers, and the consequent danger of widening the conflict (Slater 1991). For the first three days of the war, Dayan held off arguments from several of his advisers, including the Commanding Officer of the Northern Command, David Elazar, to launch an attack on the Golan Heights. Finally, a delegation from the northern settlements, which had often experienced Syrian sniping and artillery barrages, travelled to Tel Aviv to ask Dayan to take the Heights to guarantee their security. Only then, on 9 June, did Israeli forces launch an attack against Syria (Slater 1991, 277).

In the taking of the Golan Heights, the water sources mentioned above were incidental conquests as Israeli forces moved as far east as Kuneitra (see appendix I, map 28). Below the Heights, Israeli troops stopped directly outside Ghajar. They reportedly did this because, on Israeli maps, Ghajar was Lebanese territory, and Israel did not want to involve Lebanon in the war. Ghajar, it turned out, was Syrian – it had been misplaced on 1943 British maps. As Ghajar had been cut off from the rest of Syria during the war, a delegation had travelled to Beirut to ask to be annexed: Lebanon was not interested. Three months after the war, another delegation travelled to

Israel and asked that the village become Israeli; only then did Israeli control extend north through Ghajar (Khativ and Khativ 1988; interview, Gamal Khativ, October 1991). Only the village itself was included, however, and most of its agricultural land remained in Syria. Mekorot engineers did install a three-inch pipe for drinking-water for the villagers from the Wazzani springs, which, although literally a stone's throw from the village, was left under Lebanese control (interviews, Gamal Khativ, Haim Paldi, October 1991).

Extensive literature exists on the detailed decision-making on the events before, during, and after the 1967 war. What is noticeable in a search for references to water resources, either as strategic targets, or even as a subject for propaganda by either side, is the almost complete absence of such references. In *International Documents on Palestine, 1967*, a compilation of documents, statements, and speeches by Israelis, Arabs, Americans, and Soviets for all of 1967, the only reference to water is in a document submitted by Israel to the United Nations after the war, which includes mention of the successful resumption of water works in Jerusalem (Institute for Palestine Studies 1970, 327). In *Decisions in Israel's Foreign Policy*, Michael Brecher (1974) includes chapters on both ''Jordan Waters,'' and ''The Six Day War,'' but mentions no link. In a detailed study of the roots of the 1967 war, Walter Laqueur mentions that ''in 1967, [water] was not among the major causes of Arab–Israeli conflict, certainly not one of the immediate reasons for hostilities'' (Laqueur 1967, 50). Stein and Tanter (1980) do not mention water at all.

The same absence of documentation is true for Israeli reasons for launching operations in Lebanon in 1978 and 1982 (see, for example, MacBride 1983). As noted previously, Israel's ally in southern Lebanon, Major Sa'ad Haddad, had made clear to Israel in 1979 that water was a taboo subject. It was Haddad, too, who quashed Israel's plans in 1979 for a diversion of the Wazzani springs. Both Major-General Avraham Tamir, who helped to outline Israel's strategic needs in 1967 and in 1982, and an officer who acted as the liaison officer between Israeli and South Lebanese forces, have described in detail the military strategy of both the 1967 war and of the 1982 war in Lebanon, the former participant in his book *A Soldier in Search of Peace* (1988), and both in interviews (October and December, 1991). Again, mention of water is conspicuously absent, although the liaison officer acknowledges that plans were investigated, but never used, to cut water to Beirut to enforce a siege. Furthermore, although Israeli

studies have been conducted on the possibility of integrating the Litani and Jordan watersheds, each concludes that such a project can proceed only with international (especially Lebanese) assent.

It should also be noted that, immediately after the wars in 1967 and 1982, strategic needs (none of which related to water) were spelled out by the Israeli government; these needs, if met, would result in Israeli withdrawal from occupied territory. According to Moshe Dayan, the Golan Heights were negotiable even without a peace treaty and, with such a treaty, so was the rest of the territory captured in 1967, except East Jerusalem (Slater 1991, 286–290). The same strategy of holding conquered land as an inducement to peace talks was followed immediately after the 1982 war in Lebanon. In 1983, an Israeli–Lebanese agreement was signed that called for an Israeli withdrawal from all of Lebanon. The agreement was abrogated in 1984, however, and consequently Israel justifies its continued presence in the ''security zone'' (Tamir 1988).

Althought the official line of the Israel Army Spokesman is that ''water is a political issue, not military'' (personal communication, August 1991), the Israeli army planning branch, which Tamir developed, does have one officer whose responsibilities include evaluating the strategic importance of water resources. Both the officer with those responsibilities during the 1982 war and Tamir insist that water was not, even incidentally, a factor in the war. When pressed on the subject, Tamir replied:

> Why go to war over water? For the price of one week's fighting, you could build five desalination plants. No loss of life, no international pressure, and a reliable supply you don't have to defend in hostile territory. (Interview, December 1991)

DOES LITANI WATER REACH ISRAEL? While one of the most difficult tasks is to prove the absence of something, an extensive search for any evidence of a diversion or trucking operation has turned up nothing to suggest that any Litani water enters Israel at the time of waiting. My search took the following tracks.

First, it is clear that Zionist and Israeli plans for regional development have often investigated the possibility of integrating the Litani and Jordan basins. However, since 1944, all of these plans have concluded that such integration would be impossible without Lebanese approval. To gain such approval, some plans have included provisions for an exchange of hydropower for water, or even buying ex-

cess water outright. Recent studies also question the economics of a diversion: with 300 MCM/yr available below the Qir'awn Dam, only 100 MCM/yr would be available for export after considering the needs of southern Lebanon.

It should be mentioned that both Syria and Jordan have also expressed interest recently in diverting or buying Litani water. In fact, because of the proximity of the two watersheds – one with water surplus, the other overextended – it is hardly surprising that any number of plans have been put forward to integrate the two watersheds since a British plan first proposed the idea in 1918 (Dane and Benton 1918). The Lebanese position was (and continues to be) that rights to Lebanese water should be retained for future Lebanese development.

Second, reports of a secret diversion tunnel were investigated by UN forces, as well as by members of the international press, to no avail (Sofer 1991). Satellite photos (LANDSAT and SPOT), air photographs (Israeli Air Force), Mekorot maps, and field investigations (June 1987; June, October, December 1991), all show only the two water pipelines previously mentioned crossing the Lebanon–Israel border – a 3-inch pipe to the town of Ghajar and a 10-inch pipe from Israel into the Lebanese village of R'meish.

Third, hydrologic records show neither any unaccountable water in the Israeli water budget after 1978 nor any increases in the average flows of the Ayun or the Hasbani, the most likely carrier streams for a diversion. Because of three years of drought, on 14 October 1991 the Israeli Water Commissioner asked the Knesset to allow pumping of the Sea of Galilee below the legal ''Red Line,'' the legal water level below which the entire lake is in danger of becoming saline. On the same day, a field investigation showed that both the Ayun and the Hasbani above the Wazzani springs were dry.

Fourth, a hypothetical trucking operation is even more difficult to prove or disprove. Both officials in Mekorot (interview, Avner Turgeman, October 1991) and Israeli officers responsible for southern Lebanon acknowledge that witnesses may have seen Israeli military water trucks in southern Lebanon. Each has suggested that the most likely explanation is that the trucks were carrying drinking water from Israel for Israeli troops stationed in the ''security zone.'' Israeli military code, they point out, insists that soldiers drink water only from official collection points, all of which are in Israel.

An officer who has acted as liaison officer between Israeli and South Lebanon forces doubts that anyone saw Israeli trucks filling at

the Litani, pointing out that the 20-ton ''Rios'' that are used to carry water could not make the grade of the military road that leads away from the Litani, if the trucks were full (interview, October 1991). Sofer (1991, 7) has calculated that a cubic metre of water trucked from the Litani into Israel would cost about US$4–US$10, compared with about US$1.50 for a cubic metre of desalinated water.

Hydronationalism

The use of water resources to bolster political claims has not been restricted to questioning Israel's motives towards its neighbours. Nationalists within Israel have also claimed water as an overriding incentive for their political ends.

In August 1990, the Israeli Ministry of Agriculture, headed by Rafael Eitan of the right-wing Tzomet party, took out full-page advertisements in the international press, subheaded ''The Question of Water – Some Dry Facts.'' The advertisement described the hydrologic relationship between Israel and the West Bank and emphasized the danger to both water quantity and quality of territorial compromise. The advertisement concluded that Israeli control over the entire West Bank was necessary to protect Israeli water sources:

> It is important to realize that the claim to continued Israeli control over Judea and Samaria is not based on extremist fanaticism or religious mysticism but on a rational, healthy and reasonable survival instinct.

Attacked for using Ministry funds for political purposes, the Ministry issued a five-page position paper expanding on the hydrologic argument and suggesting that Eitan was within his rights to publish the advertisement (see appendix III).

The questions raised by the incident go beyond the validity of the advertisement or the position paper, but rather point to one primary issue: how much of the territory over which Israel took control in 1967 will it view as necessary to retain to guarantee its water supplies? Although not as prevalent in the academic literature as the ''hydraulic imperative,'' Israeli proponents of holding West Bank territory to control Israeli water resources are prevalent and cross political boundaries, as explored previously in this work in the section on Israel, the West Bank, and Gaza. In order to allow for greater flexibility in negotiations, as is described in chapter 4, it is worth investigating the hydrologic validity of the claim.

As mentioned above, and in the previous section on history, several points have been identified by Israel historically as strategically

important to its hydrologic security. On the Golan Heights, these include the Banias springs, El-Hama, and some strategic overlooks over the Yarmuk River and the Sea of Galilee. The West Bank is somewhat more convoluted.

As mentioned earlier, Israel has been tapping into the Yarkon–Taninim, or western mountain, aquifer since 1955. It also relies on two other aquifers that recharge on the West Bank – the north-east and the eastern mountain aquifers; the former discharges into the Jezreel Valley and the latter into the Jordan Valley. The three aquifers combine to provide about 30 per cent of Israel's water supply.

The claims of the Ministry of Agriculture cloud the issue somewhat by combining the three aquifers into one political argument. It is clear from examining hydrogeologic maps (e.g. Goldschmidt and Jacobs 1958; Weinberger 1991), for example, that, provided with an alternate source of water, Israel might be able to relinquish control over most of the eastern mountain aquifer without endangering its supply on the west side of the Judaean hills.

The western mountain aquifer is a more complex case, however, and most of the quotations used in the Ministry's position paper refer to this problem. Again, a historical perspective might be useful. In 1977, as Israeli Prime Minister Begin was preparing for negotiations with Egyptian President Anwar Sadat, he asked the then Water Commissioner Menahem Cantor to provide him with a map of Israeli water usage from water originating on the West Bank (see appendix I, map 29) and to provide guidelines as to where Israel might relinquish control, if protecting Israel's water resources were the only consideration.

Because of the disparate depths to water for the western mountain aquifer in the coastal plain and in the Judaean hills (about 60 m in the plain, 150–200 m in the foothills, and 700–800 m in the hills) (Goldschmidt and Jacobs 1958; Weinberger 1991), and the resulting differences in the cost of drilling and pumping wells in these areas, Cantor concluded that a ''red line'' could be drawn, beyond which Israel should not relinquish control, north to south, following roughly the 100–200 mm contour line. This still left control over water on about two-thirds of the West Bank open for negotiations.

Some settlement plans for the late 1970s referred in part to this line, and about five settlements around Elkanna were reportedly sited in part to guarantee continued Israeli control of the water resources on its side of this ''red line'' (Pedhatzor 1989; State of Israel memoranda, April–June 1977) (see appendix I, map 30).

Israeli water planners still refer to this ''red line'' as a frame of reference (interviews, Zeev Golani, October 1991; Shmuel Cantor, December 1991), and inclusion of a discussion along similar lines was one of the reasons for the censorship of the 1991 Jaffee Center Study by the Minister of Agriculture, as mentioned earlier.

Conclusions

My purpose in this discussion has not been to enter into the fray of political charges on either side. Rather, I feel that it is helpful to agree on a common history before planning for the future. Furthermore, as I examine, later in this work, a series of possible negotiating scenarios, it is important to examine the hydrologic facts behind the bargaining position for each entity. I therefore offer some conclusions regarding the ''hydroconspiracy'' theories of each side.

First, water resources were not a factor in Israeli strategic planning in the hostilities of 1967, 1978, or 1982. By this I mean that the decision to go to war, and strategic decisions made during the fighting (including which territory it was necessary to capture), were not influenced by water scarcity or the location of water resources. The location of water resources was not considered to constitute a strategic position (except in the purely military sense), nor was it a factor in retaining territory immediately after the hostilities. In the mid-1970s, however, a narrow band of the West Bank did begin to be claimed as crucial to retain for hydrologic reasons. This is true also of the Banias springs, El-Hama, and some strategic overlooks on the Golan Heights.

Second, there is no evidence that Israel is diverting any water from the Litani River, either by pipe or by truck. In fact, since 1985, when central southern Lebanon lost its own water supply, an average of 50,000 m^3/month has been piped into that region from wells in northern Israel.

Third, the claim that Israel requires the entire West Bank for its water security is not hydrologically sound. Israeli technical and government officials have, since the mid-1970s, developed a ''red line'' informed by the watershed boundary and population centres, as well as by security needs, beyond which Israel probably would not withdraw control of the water resources, even in the event of an exchange of ''land for peace.'' This amounts to a narrow band of the most western part of the West Bank, drawn approximately along the 100–200 m contour line (see appendix I, map 29).

Conclusions: Historic summary and lessons for the future

In 1876, John Wesley Powell, the leader of the first organized expedition down the Colorado River, submitted his *Report on the Lands of the Arid Region of the United States* to Congress. Among his observations on US settlement policies in the desert south-west was his belief, as described by Marc Reisner, that

> state boundaries were often nonsensical . . . In the West, where the one thing that really mattered was water, states should logically be formed around watersheds . . . To divide the West any other way was to sow the future with rivalries, jealousies, and bitter squabbles whose fruits would contribute solely to the nourishment of lawyers. (Reisner 1968, 49)

The same might belatedly be said about the national boundaries of the Middle East. The difference, of course, is that, in that region, conflicts between states have deep historical roots and are more often settled on the battlefield than in the courtroom.

The Jordan River watershed, with all its competing national and economic pressures, provides a clear example of the strategic importance of water as a scarce resource. What follows is a brief summary of the history of water conflict and cooperation between the riparians of the Jordan River, as presented in previous pages.

1915–1926. As the Ottoman Empire crumbled, the location of water resources, particularly the headwaters of the Jordan River, helped to influence the boundaries of the French and British Mandates, later the borders between Israel, Lebanon, Syria, and Jordan.

1930s and 1940s. As populations and economies grew against hydrologic limits, so, too, grew the dangers of conflict over water. In the 1930s and 1940s water was a focus of several reports that tried to determine the economic absorptive capacity of the land. These reports influenced British, Arab, and Jewish attitudes and policies towards immigration and land settlement.

1948–1953. Unilateral development, occasionally infringing on demilitarized zones, led to brief armed conflict between Syrians and Israelis.

1953–1955. Johnston negotiations. Eric Johnston, special envoy to US President Eisenhower, worked for two years to hammer out a water-sharing agreement between the riparians of the Jordan River. Although unratified for political reasons, the allocations agreed to by Arab and Israeli technical committees have generally held, with

recognized modifications. Moreover, both Israel and Jordan agreed to send technical representatives to regular ''Picnic Table talks'' to determine day-to-day hydrologic operations. These talks, named for the site at the confluence of the Yarmuk and Jordan rivers where the meetings reportedly take place, have proved fruitful over the years in reducing minor tensions.

1964–1967. ''Water Wars.'' Beginning with the Arab decision to build an All-Arab diversion of the Jordan headwaters to preclude the Israeli National Water Carrier, and ending three years later when Israeli tank and air strikes halted construction on the diversion, this was a period of the most direct water-related conflict.

May 1967. Even as tensions were leading to the following week's outbreak of the Six-Day War, the US Departments of Interior and State convened an ''International Conference on Water for Peace'' in Washington, D.C., which attracted 6,400 participants from 94 countries, including Israel, Egypt (then the UAR), Jordan, Yemen, and Saudi Arabia.

June 1967. The Six-Day War changed regional riparian positioning. Israel acquired two of the three Jordan River headwaters, riparian access to the entire river, and the recharge zone for mountain aquifers that currently constitutes about 40 per cent of Israel's freshwater supply. Israel also destroyed the ''All-Arab'' diversion scheme of the Jordan headwaters, which would have reduced Israeli water by 35 per cent.

6 May 1977. Only ministerial-level meeting between Jordanians and Israelis to discuss joint watershed planning.

June 1982. The Israeli war in Lebanon reportedly had a minor hydrologic component.

1980s. Philip Habib helped to renegotiate Johnston allocations based on political and demographic changes, and tried to reach arrangement over ''Unity Dam.''

1967–Present. Ownership and management conflicts between Israel/West Bank, Israel/Gaza, Israel/Jordan, and Jordan/Syria.

1989–1990. Richard Armitage led US State Department indirect mediations to reach arrangement over ''Unity Dam.''

1991–Present. Impetus towards cooperation grows as regional peace talks develop.

Again, it should be kept firmly in mind that none of the events described above in this historical section happened in a political vacuum. Of all the geopolitical and strategic forces surrounding each

of these events, only those relating water resources to strategic decision-making have been culled for inspection in this work. However, in an analysis of this sort, one must be careful of overzealous reductionism. It is not being suggested that water is the prime motivator in the history of the people of the Jordan River watershed, nor even that water, of itself, has been the cause of conflict. In a section on ''hydroconspiracy'' theories, I examined two theories, ''the hydraulic imperative'' and ''hydronationalism,'' and found both lacking in hydrologic (and therefore in political) legitimacy.

My contention is only as follows:

1. That water, as a strategic resource, has played a larger role in regional conflict than is generally known;
2. That water issues have precipitated some conflict and added to existing tensions in the region;
3. That occasionally, water issues have led to dialogue and attempts at cooperation.

If emphasis is placed on easing regional water tensions, some breathing space might be gained, allowing for more complex political and historical difficulties to be negotiated. In fact, because the water problems to be solved involve all of the parties at conflict, and because these issues are so fundamental, the search for regional solutions may actually be used as a tool to facilitate cooperation. It has been shown that people who will not talk together about history or politics do, when their lives and economies depend on it, talk about water.

Before proceeding to examine possible solutions to the Middle East water conflict, we might look to history for lessons that may be applicable to the future. The above discussion of regional hydropolitics offers several lessons that could be useful in helping to formulate options for solutions to water-induced tensions, as follows:

1. *Observation*: The link between water resources and political alternatives is inextricable, with water scarcity leading directly both to heightened political tensions and to opportunities for cooperation. *Implication*: For negotiations for a political settlement to be successful, they will also have to address solutions to the water conflict. Similarly, workable solutions to the problems of regional water shortage should also address the constraints posed by regional politics.
2. *Observation*: Water has historically been a factor in Middle East population distribution, including some border considerations.

Implication: Successful negotiations over Jewish immigration or Palestinian ''right of return'' will have to incorporate the hydrologic limitations of the region.

3. *Observation*: No dispute between Arabs and Israelis, on water or on any other issue, has ever been resolved without third-party (usually United States) sponsorship and active participation.

and

4. *Observation*: The better a state's ''hydrostrategic'' position, the less interest it has in reaching a water-sharing agreement.
   Implication: Strong third-party involvement will be necessary for successful negotiations. The United States, or other sponsor of negotiations, should be prepared with a comprehensive strategy to induce cooperation, with particular emphasis on the upstream riparians.
5. *Observation*: Projects of limited and implicit cooperation have been successful even in advance of political solutions between the parties involved (e.g. Picnic Table talks, water-for-peace process). Nevertheless, explicit cooperation (e.g. Maqarin Dam), has not preceded political relations.

and

6. *Observation*: The more complex a proposal is technically, the more complex it is politically.
   Implication: In the context of regional talks, progress in negotiations over water resources may encourage dialogue on other, more contentious, issues. While water continues to ''lead'' the peace talks, projects to induce cooperation can be designed in a stepwise fashion beginning with ''small and doable,'' and leading to ever-increasing integration, always remaining on the cutting edge of political relations.
7 *Observation*: The two conditions at the core of political viability of watersharing are *equity* of the agreement or project (that is, how much each participant gets), and *control* by each party of its own primary water sources (or, where it comes from, and whose hand is on the tap).
   Implication: These two contentious issues will have to be addressed fairly early in negotiations. Unless a water-sharing agreement is worked out, with each party having its historic as well as future needs addressed, any negotiations over intricate cooperative projects will be building on accumulated ill will.

If one accepts that conflict can come about in part because of scarce water resources, and understands that, as populations and

economies continue to grow against hydrologic limits, so do the dangers, the logical question is, ''What is to be done?'' In the following chapter, I survey the literature of several disciplines to develop an interdisciplinary model for evaluating water basin development and international water conflicts. In chapter 4, I use the model developed in chapter 3, and incorporate the guidelines from history outlined above, to suggest a process of ever-increasing cooperation for development of the Jordan River watershed.

3

Towards an interdisciplinary approach to water basin analysis and the resolution of international water disputes

Till taught by pain, men know not water's worth.
—Byron

Introduction

In chapter 2, I presented the hydropolitical background of the Jordan River watershed, which has been described as "having witnessed more severe international conflict over water than any other river system in the Middle East" (E. Anderson in Starr and Stoll 1988, 10). I concluded the chapter with the question "What is to be done?" In this chapter, I develop a framework to try to answer that question.

Just as natural water flow ignores international boundaries, so, too, does the evaluation of water resources transcend the analysis of any single discipline. Water, by nature, necessitates an interdisciplinary analysis. Through its physical components, we measure the quantity, quality, and variability of water sources. Because we need to develop an infrastructure to harness water for human use – storage and delivery systems, for example – an engineering component should be incorporated into the analysis. Furthermore, because water can be owned, bought, sold, and traded, its analysis takes on legal, economic, and political aspects as well. Finally, because water is a resource that, when scarce, can induce both conflict and cooperation, water can become a subject for alternative dispute resolution (ADR).

After a short description of the particular nature of international water conflict, and of water as a unique strategic resource, this chap-

ter explores separately how each of several disciplines treats water as a resource and as a subject of conflict. The disciplines offered are the physical sciences, law, political science, economics, game theory, and ADR.

In the final section, ''An Interdisciplinary Approach to Water Basin Analysis and Conflict Resolution,'' I try to bring together lessons learned through each discipline in a single framework for evaluation. The technical and policy options that might be proposed for any watershed are listed, and a method for evaluating each option, dependent on three measures of viability – technical, economic, and political – is described. In chapter 4, I apply this ''interdisciplinary approach'' specifically to the Jordan River watershed.

The nature of water conflicts

As a nation reaches and surpasses its hydrologic limits, impetus toward either international conflict or cooperation may increase. For the purposes of this work, I define ''competition'' as two or more entities, one or more of which perceives a goal as being blocked by another entity (what Frey [1992] refers to as an ''issue''). If power is exerted to overcome the perceived blockage, I refer to this as ''conflict.'' If there is coordination of behaviour among entities to realize at least some common goals, I (after Frey 1992) refer to this as ''cooperation.'' The strategies one might employ to further any of these ends are discussed in later sections. To understand how this competition/cooperation dichotomy may diverge, however, we should delve briefly into the nature of water conflict.

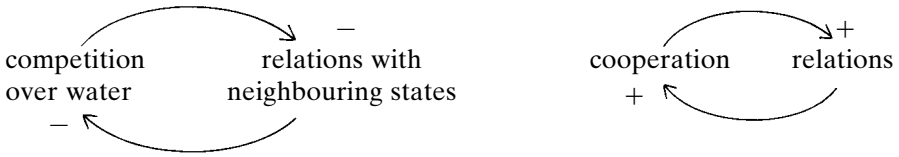
To begin with, we might draw parallels between evolution and conflict resolution to see what lessons nature may provide. As species evolve, they become more efficient in their use of the scarce resources they need for survival. If the resource becomes more scarce, the species must either become adept at competing with other species, or it must learn to cooperate and develop symbiotic relationships in order to survive. Maruyama (1963), in his discussion of the ''second cybernetics,'' gives the case of a moth and its predator as an example of resource competition, which, itself, becomes more efficient as the interspecies deviation amplifies – that is, as the differences between them are enhanced. The moth develops better camouflage to avoid its predator, which in turn becomes more adept at discovering the moth's camouflage.

Competition seems to be the more common strategy in human re-

source conflicts, and, as in nature, once the path towards competition is chosen, Maruyama's ''deviation-amplification'' would tend to increase.

On the other hand, nature provides lessons in cooperation, as well. A rain-forest plant that hosts an ant population, for example, secretes a glucose-rich liquid on which the ants thrive and they, in turn, trim back other plants and vines that compete for sunlight with their host. Such true examples of symbiosis may seem rare, unless one considers that each individual in nature is made up of single cells, which cooperate to achieve the most efficient distribution of scarce resources within that individual.

As in nature, human conflict over resources at its most basic level can be dealt with through either competition or cooperation. Returning to the lessons of cybernetics, both options might be seen as positive feedback loops regarding relations with neighbouring states, in that each aspect reinforces the other:



however, only the latter case can truly be seen as ''positive.'' Competition begets ill will, which increases competition, while, conversely, cooperation encourages better relations, thus creating an environment conducive to increased cooperation.

The choice between ever-increasing conflict or cooperation in hydropolitics is discussed by Frey (1992). Frey cites the ''Catastrophe Theory'' of sociology (E. Zeeman, cited in Frey 1992), which describes how small changes in a social structure, once begun, can develop and increase quickly, much like the effects of resonating sound waves amplifying to shatter a wineglass:

> The tension and threat (of transnational water shortage) can apparently be resolved either by sharply escalating the conflict or by accepting the necessity of some form of cooperation. Dire conditions promote cooperation, but those same conditions also make severe conflict more likely. (Frey 1992)

How salient is water as an issue of conflict? Maslow (1954) categorizes and ranks basic human needs according to their level of motivating behaviour. From inner to outer, these are (1) physiological needs, (2) safety needs, (3) belongingness and love, (4) esteem, and (5) self-

actualization. Water for personal consumption is clearly a most basic human need, as would be water for subsistence agriculture. Water allocated to export, or cash-crop agriculture, or industry, would probably fall within safety needs – still a fairly fundamental issue. Water is occasionally used as an esteem item, in elaborate fountains or private swimming pools for example, and even for self-actualization, in baptisms and other ritual purification.

Because of the properties inherent to human water needs, competition over water as a scarce resource, when it occurs, can be especially intense:

> At the individual level, the demand for water is highly inelastic, although fairly readily satiable. Personally, we do not need much, but we need that small amount urgently and reliably … The sinister corollary of this, however, is that if such basic needs are not met, they override more sophisticated interests and become absolute and obsessive. (Frey and Naff 1985)

Along with water's particular salience, it has other singular and elusive characteristics that differentiate it as a unique strategic resource. Like timber or agriculture, fresh water is usually treated as a renewable resource. Next year's rains are counted on as inevitable, albeit allowing for some deviation in amount. Much water, however, particularly fossil groundwater, is non-renewable, more like oil or minerals. Unlike most other renewable and non-renewable resources, however, property rights for water, surface or ground, are far from clear.

This is complicated by the fact that water, like air resources, is both pollutable, from point and non-point sources, and mobile, adding another possible point of contention between states. Moreover, water is creatable, or at least purifiable, with the input of enough energy. This adds economic ambiguity to legal ambiguity, by the need to know both from where the water comes and to what use it will be put, before determining efficient allocation.

Water, in short, seems to share only the most contentious characteristics with other resources, particularly in the international setting, making analysis of international water conflicts especially difficult.

Paradigms for analysis of international water conflicts

It is a truism of conflict analysis that there will never be a lack of subjects to study. Conflicts abound, from interpersonal to international,

and approaches to solving them are almost as numerous. As we have seen, water conflicts are particularly difficult to define, evaluate, and resolve.

What follows is a brief description of how various disciplines approach conflict in general, and international water conflict in particular.

Physical sciences and technology

The technical implementers of water policy are the physical scientists, who have traditionally borne the responsibility for making sure that water supply meets demand. These hydrologists, hydrogeologists, engineers, and chemists manage the supply, delivery, storage, and quality of each entity's water to match the needs of each user. On the demand side, agricultural researchers develop new delivery systems, greenhouse technology, and bioengineered crops to lower the need for water on the farm. This section examines the contribution of the physical sciences to alleviation of the water conflict in the Middle East by offering possibilities both to increase supply and to decrease demand.

Increasing supply – New natural sources

No new ''rivers'' will be discovered in the Middle East, but increased catchment of winter flood water anywhere along an existing river system can add just as well to the water budget. This applies to small wadis as well as to large storage projects such as the Maqarin Dam, which alone could contribute a saving of about 330 MCM/yr by storing winter run-off that otherwise is lost to the Dead Sea. When it is possible to store water underground through artificial groundwater recharge, even more water is saved – that not lost to evaporation in a surface reservoir. Less evaporation also means less of a salinity problem in the remaining water. Israel currently stores 200 MCM/yr from its National Water Carrier project by this method (Ambroggi 1977, 25).

Underground is the only place to look for any major new water supplies within the basin. In 1985, Israel confirmed the discovery of a large fossil aquifer in the Nubian sandstone underlying the Sinai and Negev deserts. Israel is already exploiting 25 MCM/yr from this source and is investigating the possibility of pumping 300 MCM/yr in the twenty-first century (Issar 1985, 110). Jordan has also been carrying out a systematic groundwater evaluation project in recent years,

and has begun to tap the fossil Disi aquifer along the Saudi border for 80 MCM/yr (E. Salameh in Garber and Salameh 1992, 114).

Increasing supply – New sources through technology

Projects such as iceberg-towing and cloud-seeding, though appealing to the imagination, do not seem to be a likely emphasis for future technology: the former involves great expense and the latter can be, at best, a small part of a very local solution. Although a representative of Israel's water authority claims that 15 per cent of Israeli annual rainfall is due to their cloud-seeding programme (Siegal 1989), this has been documented only within the northern Galilee catchment and results seem not to have the consistency necessary for reliable planning.

The three most likely technologies to increase water supply for the near future are desalination, waste-water reclamation, and water imports.

DESALINATION. The Middle East has already spent more on desalinating plants than any other part of the world. The region has 35 per cent of the world's plants with 65 per cent of the total desalinating capacity, mostly along the Arabian peninsula (E. Anderson in Starr and Stoll 1988, 4). Israel, too, included plans for both conventional and nuclear desalination plants in its water planning until 1978, when they were abandoned as ''technologically premature and economically unfeasible'' (Galnoor 1978, 352).

It is this problem of cost that makes desalinated water impractical for most applications. Although drinking-water is a completely inelastic good – that is, people will pay almost any price for it – water for agriculture, by far the largest use in the Middle East, has to be cost-effective enough for the agricultural end-product to remain competitive in the market-place. The present costs of about US$0.80–$1.50/m^3 to desalt sea water and about $0.30/$m^3$ for brackish water (L. Awerbuch in Starr and Stoll 1988, 59), do not make this technology an economic water source for most uses. Efforts are being made, however, to lower these costs through multiple use plants (getting desalinated water as a by-product in a plant designed primarily for energy generation), increased energy efficiency in plant design, and by augmenting conventional plant power with solar or other energy sources.

One additional use of salt water is to mix it with fresh water in just the quantity to leave it useful for agricultural or industrial purposes,

effectively adding to the freshwater supply. This method was used in Israel in the 1975/76 season to add 141 MCM/yr to the water budget (Kahhaleh 1981, 40).

WASTE-WATER RECLAMATION. The other promising technology to increase supply is cleaning and reusing waste water. Two plants in Israel at the time of writing treat 110 MCM/yr or 40 per cent of the country's sewage for reuse, and projections call for treating 80 per cent by 1990 (State of Israel 1988, 8). The treated water is currently used to irrigate some 15,000 hectares – mostly cotton (Postel 1989b, 42). It is anticipated that full exploitation of purified waste water will eventually constitute 45 per cent of *domestic* water needs (State of Israel 1988, 147). This type of project could be developed throughout the region (a World Bank loan helped to finance the Israeli project). The obvious limit of this technology is the amount of waste water generated by a population.

INTERBASIN WATER TRANSFERS. Other sources of water could come from neighbouring watersheds that currently have a water surplus. At one time or another, Israel has eyed the Litani and the Nile, Jordan has looked to the Euphrates, and all of the countries in the area have been intrigued by the ''Peace Pipeline'' proposed by Turkey in 1987. The western line of this project would deliver 1,200 MCM/yr from the Seyhan and Ceyhan rivers to Syria, Jordan, and Saudi Arabia (C. Duna in Starr and Stoll 1988, 119). Despite Prime Minister Özal's belief that ''by pooling regional resources, the political tensions in the area can be diffused,'' at a cost of US$20,000 million this project probably will not be diffusing tensions in the near future.

Other recent proposals include bringing Turkish water to Israel in barges (Starr 1991), or towed in plastic ''Medusa bags,'' each with a volume of 1 MCM (Cran 1992). Boaz Wachtel (1992) has devised a branch of the ''mini-peace'' pipeline to come from Turkey, through Syria, to the Golan Heights. This last branch would be in an open canal, doubling as an antitank barricade, then dropping water to both Jordan and Israel for hydropower.

Some proposals have focused on economic incentives as a means of overcoming the political reluctance to transboundary water transfers. Countries upstream to Egypt may have a legal say in any transfer of Nile water, for example. Dinar and Wolf (1992) suggested a technology-for-water exchange between Israel and Egypt, and calculated the economic ''pay-off'' that would be generated to induce such co-

operation. Another cost-cutting option might be to use facilities that are already in place, such as the TAP line, an abandoned oil pipeline that extends from Lebanon to the Persian Gulf.

Once additional water is introduced to the Jordan basin, arrangements can be made for exchanges within the basin from one region to another for the most efficient overall distribution. Nile water, for example, could be brought to Gaza and/or the Israeli Negev Desert for less expense than most alternative sources (Kally 1989; Dinar and Wolf 1991). Increased water from the northern Jordan could then be made available to other parts of Israel, the West Bank, or Jordan. Similar exchanges could be arranged for Litani or Turkish water as well.

Decreasing demand

The guiding principle to decrease demand for any scarce resource should be, ''Can it be used more efficiently?'' This does not always work, however, especially when there is an emotional value associated either with the resource itself or with the proposed solution. Unfortunately, when dealing with water, emotions usually charge both aspects of the issue. For example, one way to cut long-term demand for Middle East water is to limit population growth in the region. However, in an area where each national group and religious and ethnic subgroup seems to be locked in a demographic race for numerical superiority, this is not very likely to occur. Many of the sectors most susceptible to efficient restructuring are also those most laden with emotion.

Some aspects of decreasing agricultural water demand are noncontroversial and have made the region a showcase for arid-agriculture water conservation. Technological advances such as drip-irrigation and micro-sprinklers, which reduce water loss by evaporation, are about 20–50 per cent more efficient than standard sprinklers and very much more so than the open-ditch flood method used in the region for centuries (Hillel 1987). Computerized control systems, working in conjunction with direct soil moisture measurements, can add even more precision to crop irrigation.

Other water savings have come through bioengineered crops that exist on a minimal amount of fresh water, on brackish water, or even on the direct application of salt water (C. Hodges in Starr and Stoll 1988, 109–118).

As a result of using a combination of these conservation methods, Israel's irrigated area has increased from 172 million hectares in 1973

to 220 million hectares in 1988, with total production increasing by 100 per cent, while water consumption for agriculture remained nearly constant (State of Israel 1988, 144). It has been speculated that the irrigated area in the West Bank could, similarly, be doubled without increasing the demand for water (Heller 1983, 130). Meanwhile, these techniques have been spreading throughout the region, and it is reasonable to assume that increased water efficiency will continue to be an important aspect of Middle East agriculture.

Encouraging cooperation in research and development between the countries in the region, possibly in cooperation with other areas facing similar problems, such as the arid south-west United States, can help with this diffusion of technology. Some such programmes exist, but they usually exclude pairing of any two countries with hostile relations, creating a serious technological barrier precisely where the free flow of information and technology is most important. Starr and Stoll (1988) have advocated regional research centres for the Middle East, sponsored by the United States.

Emotional charge enters into the water debate when it is suggested by economists or planners that greater hydrologic efficiency might be gained if less water were used in agriculture in general, as described in the section on economics, below.

Variability in supply and demand

It should be emphasized that an analysis of such a fragile ''hydropolitical'' situation as exists in the Middle East is actually more complicated than so far discussed, because of tremendous variability in the system. Some fluctuation is natural. Even in ''normal'' years, rainfall is extremely variable in both space and time. Almost all of the year's rain falls in the four winter months, and varies from the lush Mount Hermon and Golan Heights, to the desert areas around the Dead Sea. Further, average annual rainfall can vary from year to year by as much as 40 per cent (Stanhill and Rapaport 1988). These fluctuations introduce tremendous challenges to water managers and the water delivery and storage infrastructure on which they rely.

Middle East hydropolitics are made even more difficult to plan for by human-induced variability. Aside from the volatile nature of politics in general, and Middle East politics specifically, two other factors complicate the present precarious situation – one climatic, and one demographic.

CLIMATE. Many climatologists are currently investigating what changes will occur in regional weather patterns, given an anticipated rise in average global temperature (see, for example, Lonergan and Kavanagh 1991). One possible climatic scenario is a northward shift in the distribution of winter rainfall, away from the Jordan Basin. Difficult though they are to predict on a regional scale, the effects of shifting annual precipitation patterns in the Middle East could have profound impacts on the politics of the region, depending on how dramatic the changes are that actually develop. As global, and finally regional, modelling and forecasting improve, this subject will have to be investigated further in order for appropriate planning measures to be taken.

DEMOGRAPHIC CHANGES. A second, more imminent, change is already beginning to occur in the region, which could dramatically affect issues of water distribution and usage. Israel expects at least a million Soviet immigrants in the coming decade, possibly two million (Bank of Israel 1991). Jordan recently absorbed 300,000 Palestinians who left Kuwait in the aftermath of the Gulf War. Furthermore, if political negotiations were to result in an autonomous Palestine on the West Bank, that entity might absorb a percentage of the 2.2 million Palestinians registered worldwide as refugees (Jaffee Center 1989). Heller (1983) has suggested that 600,000 refugees might immigrate to the West Bank under such conditions.

Based on current domestic consumption, Israel would require an additional 94 MCM/yr, or a little over 5 per cent of the current water budget, just to provide for personal use by one million immigrants. Jordan would need 17.5 MCM/yr additional supply for its refugees, and the West Bank would need an additional 15 MCM/yr, or a 14 per cent increase in its water budget, to provide for the personal water needs of 600,000 immigrants.

Admittedly, these numbers represent simple extrapolations based on current water use. However, given not only that hydrologic limits are being reached but also that annual supplies are routinely being surpassed, questions as to the absorptive capacity of the region's water resources for immigrants and refugees should at least be asked.

RELIABILITY OF DATA. Water supply in general, and groundwater availability and flow in particular, are difficult to evaluate. Estimates of rainfall, evaporation, transpiration, run-off, and percolation to the

water-table each can be in error, even by orders of magnitude. Because each measurement adds reliability to available data, the difficulty in measuring and evaluating water resources may add impetus to dialogue within a watershed. Both Kolars (1992) and Starr (1992) have suggested cooperative water data gathering and sharing as an important starting point for regional cooperation.

Law

Authors who have specifically addressed international water law include Caponera (1985), Cano (1982; 1989), and Bilder (1975), while Utton (1982), Hayton (1982), and Hayton and Utton (1989) have focused on the law of international aquifers.

What follows is a brief description of the current state of international water law, the legal ambiguities inherent to Jordan River hydropolitics, and some alternative approaches that others have taken to resolve similar disputes. One procedural note: the critique that follows is of the applicability and enforceability only of the international legal structure – *not* of treaties. It is argued that, while a legal code can offer general guidelines, it is *precisely* a treaty, born out of the process of conflict resolution, that offers an appropriate means for agreement.

International water law

The Charter of the United Nations stipulates that states in dispute have an obligation to ''first of all, seek a solution by negotiation, inquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements, or other peaceful means of their own choice.'' Of the options presented, only ''judicial settlement'' refers specifically to law. According to Alheritière (1985), ''states not uncommonly still prefer to bring their dispute to an ad hoc arbitral forum rather than settling it in well established courts.'' When one examines the painstakingly incremental movement of the international legal structure to grasp and incorporate hydrologic complexities, this lack of legal emphasis in conflict resolution is not surprising.

According to Cano (1989), international water law did not substantially begin to be formulated until after World War I. Before that time, human consumption, industrial waste, and diversion for irrigation, were not deemed major issues. Rivers were used primarily for

navigation and log flotation, both of which were covered for Europe in the Congress of Vienna of 1815.

During this century, organs of international law tried to provide a framework for increasingly intense water use. The concept of a ''drainage basin,'' for example, was accepted by the International Law Association in the Helsinki Rules of 1966, which also provided guidelines for ''reasonable and equitable'' sharing of a common waterway (Caponera 1985). Article IV of the Helsinki Rules describes the overriding principle:

> Each basin State is entitled, within its territory, to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin.

Article V cites all of the factors that must be taken into account for ''reasonable and equitable'' use, including, but not limited to, the following (cited in Caponera 1985, 567; Housen-Couriel 1992, 5): (a) the basin's geography and the extent of the drainage area in the territory of each basin state; (b) the basin's hydrology, including the contribution of water by each basin state; (c) the climate affecting the basin; (d) past and existing utilizations of basin waters; (e) economic and social needs of the basin states; (f) population dependent on the waters of the basin within each basin state; (g) comparative costs of alternative means of satisfying (e); (h) availability of other resources; (i) the avoidance of unnecessary waste in the use of the waters; (j) the practicability of compensation as a means of adjusting conflicts among users; (k) the degree to which a state's needs may be satisfied, without causing substantial injury to a co-basin state. There is no hierarchy to the above components of ''reasonable use''; rather, they are to be considered as a whole. One important shift in legal thinking in the Helsinki Rules is that they address rights to ''beneficial use'' of water, rather than to water *per se* (Housen-Couriel 1992, 5).

The International Law Commission, a body of the United Nations, was directed by the General Assembly in 1970 to study ''Codification of the Law on Water Courses for Purposes other than Navigation'' (Cano 1989). It is testimony to the difficulty of marrying legal and hydrologic intricacies that the Commission, despite an additional international call for codification at the UN Water Conference at Mar de Plata in 1977, has not yet completed its task. After 20 years and nine reports, only a few articles have been provisionally approved.

The final product, which also only establishes general principles for, for example, ''equitable use and apportionment'' and ''prohibition of considerable, substantial, or appreciable harm,'' would not have the force of law until approved by the General Assembly (Falkenmark 1987; Solanes 1987).

The general principles being codified include (after Caponera 1985):

1. Common water resources are to be shared equitably between the states entitled to use them, with related corollaries of
   (a) limited sovereignty,
   (b) duty to cooperate in development, and
   (c) protection of common resources.
2. States are responsible for substantial transboundary injury originating in their respective territories.

The problems arise when attempts are made to apply this reasonable but vague language to specific water conflicts. According to Rogers (1991), there are at least five, often conflicting, doctrines for sharing water in international basins:

1. *Absolute sovereignty*. A state has absolute rights to water flowing through its borders.
2. *Riparian rights*. Any territory along a riverway has rights to a relatively unchanged river.
3. *Prior appropriation*. ''First in time, first in right.''
4. *Optimum development of the river basin*. The basin is considered a single hydrologic unit, and it is incumbent upon states to develop it accordingly.
5. *Reasonable share or equitable use*. Provides rights dependent on some or all of the above criteria, but is difficult to interpret.

More locally to the region in question, both Talmudic and Islamic law each address water rights, the latter in somewhat more detail. Talmudic law mentions only surface water, and that only in the context of irrigation, providing that an upper riparian should have rights to divert for irrigation prior to downstream neighbours. Not surprisingly, given its roots in arid regions and in societies so dependent on wells and oases, the most sophisticated historical treatment of groundwater came out of Islamic law. The Islamic code grants ownership to the person who digs a well, provides a surrounding ''prohibited area'' to prevent drawdown, and obligates the owner to share domestic (although not irrigation) water with others (Hayton 1982). Bedouin code likewise provides for an order for watering at a well, with the largest family having first rights.

It should be noted that one aspect of water law in today's Middle East – the issue of ownership – is somewhat more clear within each nation than it is, for example, in the United States. In all of the countries riparian to the Jordan River, as well as in most of Europe, water within a nation's borders is nationalized. What users gain rights to is the use of water, not ownership of the water itself.

As might be imagined, issues of international groundwater have been especially perplexing. Before the Helsinki guidelines, international agreements referred only to specific wells and ''in no event is there any manifestation that a whole international aquifer was intellectually comprehended, much less embraced by treaty'' (Hayton 1981).

Since the Helsinki Agreement, which mentions ''under-ground water'' in passing, some progress has been made, particularly linking ground and surface water, and allowing for pollution control. Nevertheless, discussion of international groundwater still takes place '' 'on the frontier,' if not in no man's land'' (Hayton 1981). Probably as a consequence, as of 1982, international courts have issued no decisions specifically on the question of groundwater (Utton 1982).

Even given a detailed law code and a more authoritative court, initial negotiations would still be required, or at least somewhat conciliatory relations would be necessary, between the states involved. The International Court of Justice refers to the following guidelines, in order of precedence, for its rulings (Cano 1989):

1. The law of treaties and conventions ratified by governments,
2. Customs,
3. Generally accepted principles,
4. Decision of the judiciary and doctrines of qualified authors.

Moreover, the Court can hear cases only if the parties involved consent.

To summarize, then, general guidelines, although not binding law, are the best that can be expected from the legal structure, for the following reasons (after Caponera [1985] and Cano [1989]):

1. International law is founded on the consent of the nations that participate in the system. A state with pressing national interests can therefore disclaim the court's jurisdiction or findings.
2. There is no superpower or supralegal authority interested in, or capable of, dictating and enforcing international law, except in the most extreme cases.
3. Hydrologic complexities, which are site specific and often poorly understood, preclude the application of sweeping legal generalities.

The legal challenge of Jordan River hydropolitics

SHIFTING RIPARIAN POSITIONS. Given the difficulty of defining the rights of riparians in international law, one can imagine the compounded complications of applying such a code where the riparian positions themselves, and resulting legal claims, continue to shift over time. Lebanon, Syria, and Jordan were all upper riparians between 1948 and 1967, and their corresponding legal claim, therefore, was mostly of ''absolute sovereignty'' of the Jordan River. This conflicted, during the Johnston negotiations (1953–1955), with the United States' desire for ''optimum development,'' and the Israeli claim to its ''riparian rights.'' Because Jordan was somewhat restrained, being also a lower riparian further downstream, a compromise Arab claim was of rights to water allocation proportional to a territory's contribution to its source (Lowi 1985).

From 1964 through 1967, Syria and Lebanon began building a diversion of the Jordan headwaters, again claiming ''absolute sovereignty,'' to thwart a downstream Israeli diversion that threatened Jordanian water supply. The Jordanians challenged the Israeli plan to move water out-of-basin, arguing that it was entitled to the river's ''absolute integrity,'' and that first priority should be given to in-basin uses (Naff and Matson 1984).

After 1967, Israel became the upper, and predominant, riparian and moved towards a claim of ''absolute sovereignty,'' although remaining, for the most part, within the confines of the (unratified) Johnston allocations (Naff and Matson 1984).

Complicating riparian positions even further is the unresolved issue of groundwater. Israel currently receives about 30 per cent of its water budget from aquifers that recharge in the West Bank. Ownership and rights to this water are in conflict, with Israel claiming ''prior appropriation,'' limiting Palestinian groundwater development in the West Bank. Palestinians have objected to this increasing control. As mentioned earlier, legal arguments often refer, at least in part, to the Fourth Geneva Convention's discussion of territories under military occupation (see, for example, Dillman 1989; El-Hindi 1990). In principle, it is argued, the resources of occupied territory cannot be exported to the benefit of the occupying power. Israeli authorities reject these arguments, usually claiming that the Convention is not applicable to the West Bank or Gaza because the powers that these territories were wrested from were not, themselves, legitimate rulers (El-Hindi 1990). Egypt was itself a military occupier of Gaza and only Britain and Pakistan recognized Jordan's annexation of the West

Bank in 1950. Furthermore, it is pointed out that the water that Israel uses is not being exported but, rather, flows naturally seaward and, because Israel has been pumping that water since 1955, it has ''prior appropriation'' rights to the water. Both Israel and Jordan insist that any future allocation to the West Bank must come out of the other's share (Naff and Matson 1984).

RECOGNITION OF STATE SOVEREIGNTY. As mentioned previously, international legal code is applicable only to states that adhere to a court's jurisdiction. This principle runs into two types of problems in the Jordan watershed:

1. *States*. Except for Egypt, no Arab state has recognized Israel's right to exist. One reason given for collapse of the Johnston negotiations was that ratification would have implied recognition of Israel's legitimacy (Wishart 1990). Israel, in turn, does not recognize the national aspiration of Palestinians who, in the absence of sovereign territory, are relegated to observer status in most international forums.
2. *Jurisdiction*. As mentioned above, Palestinians have claimed that much of Israeli action on the West Bank, including control of water resources, violates the Geneva Convention protecting civilians under military occupation (Ataov 1981). Israel rejects the applicability of the Convention to these territories, claiming that, since Jordanian annexation of the West Bank in 1950 was not widely recognized in the international community, Israeli presence is not legally ''occupation.''

As seen, submission of the dispute over the Jordan River to the international legal system would strain the existing state of interpretation and enforcement well past its current limits.

Alternate legal venues: Treaties and river commissions

In contrast to the development and application of a general law code, treaties and river commissions have been established and perpetuated for water systems throughout the world. They were created through direct or indirect agreements, negotiation, or mediation, even between hostile states.

According to Rogers (1991), there are more than 200 river basins shared by two or more countries. This accounts for more than 50 per cent of the land area of the earth, and more than 280 treaties have been negotiated to resolve the inevitable water conflicts. Treaties are brought about either directly between the parties involved (ne-

gotiation) or with the help of a third party (mediation). A treaty, once ratified, has the force of law and is the highest precedent recognized by the International Court of Justice (Cano 1989).

Negotiating a treaty is often the first step in ongoing conflict resolution. One-third of all international agreements contain compulsory dispute settlement clauses (Alheritière 1985). One method of providing a forum to resolve disputes is through the establishment of a river commission. For friendly nations, this process might take place directly, between only the parties involved. A good example is the Rhine River Commission, established in 1831 after a lengthy process dating back to 1785. The Commission, with representatives from six nations, provides consultation and technical assistance, although it can also undertake research and make non-binding recommendations. Commissions exist for the Danube, for US–Canadian joint waters, and for dozens of shared waterways throughout the Americas, Europe, and Africa (Caponera 1985).

If relations are less friendly, commissions can be established through the ''good offices'' and sponsorship of an interested third body. One example is the Indus River Treaty of 1960, which established the Permanent Indus Commission between India and Pakistan with heavy involvement of the World Bank (Caponera 1985). Under the terms of the treaty, the basin was divided and developed, giving each nation exclusive rights to its own tributaries. Any cooperative measure requires unanimity among the Commission members (Saliba 1968). Another example is the Committee for the Lower Mekong River, established in 1957 between Cambodia, Laos, Thailand, and Viet Nam, with close cooperation with the United Nations. Along with hydrologic and management achievements, the Committee deserves special mention for operating uninterruptedly since its inception, despite political differences and occasional armed conflict (Caponera 1985).

Treaties and river commissions have reached a certain level of success, probably because they fill precisely the gaps left in generalized international water law. They address only local conditions and incorporate the vested interests of the specific parties in conflict. In this context, it is not surprising that most law schools in the United States now offer courses in environmental negotiation (Falkenmark 1987). The initial process still requires a certain amount of good will on both sides or, barring that, particularly strong encouragement from a third party. The challenge is to get the parties together initially and, once there, to induce ongoing cooperation. This is a process best

served by ADR strategies, as addressed in the following sections. Nevertheless, as Robert Hayton (1982), a professor of law himself, concludes, ''just as war is too important to be left to the generals, water law is too important to be left to the lawyers.''

Political science

Political theory

Relevance of political science to international water conflict is found in several aspects of the field. The first is the purely theoretical aspect. The Functionalist Theory of International Politics, an alternative to the fairly self-explanatory Power Politics, claims that states will willingly transfer sovereignty over matters of public concern to a common authority (Mitrany 1975, as cited in Lowi 1990). Cooperation over resources, then, may induce cooperation over other, more contentious and emotional, issues. In hydrologic terms, this might be justification for the viability of river commissions and the claim that they are useful even among hostile neighbours. The Realist critics of Functionalism respond that states that are antagonists in the ''high politics'' of war and diplomacy tend not to be able to cooperate in the realm of ''low politics'' of economics and welfare. Lowi (1990) concludes in favour of the Realists on the question of Middle East hydropolitics, suggesting that, until larger issues of recognition and refugees are settled, cooperation on water management would be futile.

The theoretical approach tends to view politics as a passing wave, the forces of which can be analysed and, if one is skilful, perhaps the impacts of which can be predicted. Other approaches tend to take a more deterministic view, as, for example, the branches of institutional and policy analysis, and of international relations. If there is conflict, perhaps either the institutions that make policy or the policy itself may be flawed, and competent analysis will reveal methods for improvement. In the international arena, one should also investigate the likelihood, or even the advisability, of increased cooperation.

Institutional and policy analysis

Several authors approach water conflicts from this angle. Lynne et al. (1990) describe how scarcity can lead to potential conflict between water institutions and the people they serve. Ingram et al. (1984) offer guidelines for effective implementation of water policy.

Among those dealing with Middle East water scarcity, however, the question is occasionally asked ''How does one translate the static and dynamic hydrologic realities of the Middle East into terms that the affected populations can understand?'' The question is a conceptual one, based on the premise that any political process must ultimately be understood by the people affected by it.

In the context of Middle East hydropolitics, it is probably more important to investigate the validity of the premise: that is, for whom it is really important to ''take possession of the issue,'' before tackling the larger issue of how it should be done. This section presents a discussion of the salience of water in general, and an investigation of the interests and power of different populations within each political entity, notably Israel and Jordan, affected by the water conflict. For simplicity these groups are divided into (a) domestic and industrial water users, (b) agricultural users, (c) technical implementers of policy, and (d) policy makers, and interests of each are assumed to be similar on both sides of the Jordan River.

In Naff and Matson (1984), the most thorough examination of regional hydropolitics to date, each actor in the Jordan River conflict – Lebanon, Syria, Jordan, and Israel – is analysed according to its respective ''riparian position,'' ''power,'' and ''interest.'' This approach seems to be based on some derivation of Coplin and O'Leary's (1976) PRINCE method's categories of ''issue position,'' ''power,'' and ''salience'' for political analysis. Whether described as ''interests'' (Naff and Matson 1984), or ''motivations'' (Meltsner 1972), it is clear that the aspects referred to here as ''salience'' – ''the *importance* each political actor attaches to the particular issue'' (Coplin and O'Leary 1976) – and ''power'' – whether legal, political, riparian position, or military – are crucial to political analysis. The ''issue'' is assumed to be, ''where can (or should) water policy emphasis be placed?''

DOMESTIC AND INDUSTRIAL USERS. Every person is a member of this category over and above any other category. Domestic water consumption includes primarily the requirements for each individual's biology, but also other needs around the house, including water for hygiene, cooking, dishwashing, and lawns. The salience of water for domestic consumption depends on the use to which it will be put.

As mentioned earlier, Maslow (1954) categorizes and ranks basic human needs to their level of motivating behaviour. From ''inner'' to ''outer,'' these are physiological needs, safety needs, belongingness and love, esteem, and self-actualization. Water for biological

needs would clearly be a most basic human need, with other domestic uses varying in importance.

One conclusion that might be drawn, then, is that water is (or should be) a highly salient issue for the entire Middle East population. Before jumping to policy conclusions, however, one should recognize not only that water for domestic consumption is a comparatively small portion of the total water budget for each country – from 10 per cent in Jordan to 22 per cent in Israel (Postel 1989b) – but also that the region already has among the lowest per capita consumption rates in any arid area (Falkenmark 1989b).

Moreover, even with a high degree of ''salience,'' domestic consumers cannot significantly affect a country's water budget. This is particularly true, given the price inelasticity of water for personal use. Darr et al. (1976) suggest that, in Israel, consumption is more a function of factors such as geographic location and family size, than it is of price. Policy makers looking to increase political flexibility by decreasing demand would be hard pressed to find meaningful cuts in the domestic sector.

In contrast, industrial users account for a minor portion of each entity's water budget – from close to 0 per cent in the West Bank and Gaza to 5 per cent in Israel and Jordan – but have little influence in water decision-making. In the recent drought, price increases were levied most against the industrial sector, even though several analysts, including those within the Israeli Water Commission, advocated a shift of water resources from agriculture to industry because of the relatively higher contribution to the GNP of the latter per unit of water.

AGRICULTURAL USERS. The vast majority of Middle East water (73 per cent in Israel to 85 per cent in Jordan) is used in the agricultural sector. Water for agriculture for one's own population might be categorized in Maslow's terms (Maslow 1954) as ''physiological needs'' – the most basic type. Even though water for agricultural export may be less crucial to survival, agriculturalists certainly have a vested interest in portraying all agriculture in terms of ''food security.''

The Israeli agricultural sector gains relevance through its ties to settlements and, in turn, to security. Settlements on the Golan Heights, for example, are viewed as more than a source of agricultural production: they are also outposts, the presence of which creates a kind of first line of defence against the Syrians, whom Israelis view as the likely antagonist in a subsequent war.

The high degree of salience of agriculture, the high volume of water in question, and the political power of agriculturalists, probably give the agricultural sector more impact on national water policy than any other. The same national water ethics that give agriculture great economic influence in the region, also give it great political influence. The Water Commission in Israel, the ultimate authority for all water planning and operations in a country where all water is nationalized, is under the authority of the Ministry of Agriculture. In Jordan, the Water Minister is a cabinet-level position, and the primary responsibility of the Jordan Valley Authority is to the farmers in that region. Any cuts to this sector in both Israel and Jordan, even during the 1988–1990 drought, came only after heated political debate.

TECHNICAL IMPLEMENTERS OF POLICY. This group, the technological talent to assess and monitor the resource base, is made up of, in effect, the hydrologic ''keepers of the flame'' of water policy. Policy makers rely on this group of hydrologists, hydrogeologists, engineers, chemists, and economists to implement national policy within the limits imposed by (a) normal seasonal and annual variability, (b) dramatic fluctuations (droughts and floods), (c) groundwater pumping and recharge within ''safe yield,'' (d) delivery system capability, (e) adequate water quality for each use, and (f) economic efficiency. Agriculturalists and domestic users, similarly, count on this group to guarantee that, when a tap is opened, adequate, clean water comes out.

By definition, this group has a high degree of salience and knowledge of water issues but also, interestingly, has been the group most amenable to compromise in the international arena, even without formal power, Scientists on all sides, though constrained by political forces, do have access to each other through scientific journals and international conferences, Possibly as a consequence, along with the tangible nature of water science (as opposed to water politics), technical implementers have found agreement, notably in the 1953–1955 Johnston negotiations over Jordan River allocations, and 1967–1969 planning for nuclear ''agro-industrial complexes.'' Both plans collapsed when the technical committees sent their recommendations to the political level.

This group, however knowledgeable and indispensable, seems often to be taken for granted, particularly by policy makers, for whom water is not adequately emotionally charged to take advantage of politically. The question posed might be restated, then, rather than as, ''How to increase salience of water on the part of the

population?'' as the alternative, and probably more relevant, ''How to increase the salience of technical realities on the part of the policy makers?''

One example of such synergy between the two groups can also be gleaned from the Johnston negotiations, which, in 1953 were deadlocked when, according to Wishart (1990), an engineering study was completed that suggested that larger areas of Jordan could be irrigated with less water than was thought. This allowed the manoeuvrability that led to the negotiations' (limited) success.

POLICY MAKERS. Policy makers receive pressure for policy from the bottom up – that is, from the sectors described above. Domestic users want adequate water ''no matter what,'' and can suggest as much with their votes. It is an interesting contradiction that, salient though water is for survival, it is difficult to picture one actually voting for a ''water platform'' or the ''hydrologic party.'' Perhaps a new term, such as ''unconscious high salience,'' with its seeming contradiction, would be useful.

Agricultural users have greater water needs, and corresponding political influence. Policy makers incorporate these pressures with the advice of technicians to develop national and international policy, the impacts of which are then felt from the top down.

CONCLUSIONS – ''SALIENCE,'' POWER, AND POLICY. Water is more or less salient to all segments of the Middle East population depending, in large part, on whether there is ample supply to accommodate demand. For example, water was a more common subject, from boundary disputes to government information packets, until the 1967 war, when hydrologic allocations shifted with political borders. In recent years, the highest salience has been among agricultural users and technical implementers, although occasional droughts induce awareness on the part of domestic consumers, and policy makers as well.

The interests of each group are summarized as follows:

1. *Domestic and industrial consumers*. Want an adequate, clean water supply as a matter of course. Large population and therefore high power; small percentage of consumption; ''unconscious high salience.''
2. *Agricultural consumers*. Seek constant supply regardless of annual fluctuations. Small population but high power; large consumer; protective of hydrologic status quo. Increasing investment in technology.

3. *Technical implementers of policy*. Responsible for accommodation of needs of domestic and agricultural sectors. Constrained nationally by hydrologic limits and fluctuations, internationally by political considerations. Willing to seek technical solutions. Low power, high salience.
4. *Policy makers*. Responsive to needs of all, but constrained by competing demands. Low salience, except during international crises or years of drought.

These interests suggest the following guidelines for internal policy:

1. It is not crucial that the general public ''take possession'' of the issue of water, except to do what they can to conserve in the home.
2. Agricultural users have more political influence, given their vested interests in a status quo, than may be desirable for effective policy.
3. The single most important link, and therefore the one that should be strengthened, is that between technical implementers and policy makers, for both national and international policy.

The technical steps that might be taken to increase water supply or decrease demand were investigated earlier. The summary above does suggest, however, that in making sure that policy is a reasonable reflection of the hydrologic realities, the most vital step that might be taken in both Israel and Jordan is the removal of responsibility for these policies from its current place in the heart of agricultural and political pressures.

In Israel, for example, this might mean shifting water-policy-making from the Agricultural Ministry to a body less susceptible to constituent interests – perhaps the Ministry of the Environment, as Galnoor (1978) has suggested. An advisory body might then be established, led by technical implementers with input from the other sectors, which could more easily implement the necessary technical and economic policies, within the confines of fluctuating hydrologic limits. A similar framework might work in the institutional hierarchy of Jordanian government.

International relations

Water policy in this region is at present drawn up within the boundaries of a nation, rather than within those of a watershed. Because the flow of water does not respect the political boundaries, it should be clear that regional management, at the watershed level at least, would be a much more efficient approach. In fact, the only point on which the water policy analyses surveyed earlier do agree is on the

need for planned water sharing and joint water development, as Eric Johnston envisioned 35 years ago.

Regional cooperation would open the door to a host of new water distribution alternatives. For example, surface water from the Yarmuk or the upper Jordan could be provided to the West Bank, allowing increased development in that area while alleviating Israeli fears of overpumped Palestinian wells. Alternatively, Israel and Jordan might cooperatively develop both banks of the Jordan, eliminating the current redundant costs of separate delivery systems within each country. In addition, the larger the region cooperating, the more efficient a regional plan can be developed. It is cheaper, for example, to bring water from the Nile to the Negev than it is to pump it from the Sea of Galilee, as is the current practice (Kally 1989, 305).

It has been argued that one need not wait for the cessation of hostilities before developing such water-sharing plans:

> A regional water plan need not await the achievement of peace. To the contrary, its preparation, before a comprehensive peace settlement is attained, could help clarify objectives to be aimed for in achieving peace. (H. Ben-Shahar in Fishelson 1989, 7)

It should be clear that any dreams of regional cooperation in the Middle East run at least the same dangers of confronting issues of deep national emotion as do public policy solutions – probably even more. Listing all the reasons why regional cooperation may not work in the Middle East is certainly well beyond the scope of this work. However, one question is particularly relevant to the proposal of joint water projects, and deserves mention.

Elisha Kally (in Fishelson 1989, 325) contends that "the successful implementation of cooperative projects ... will strengthen and stabilize peace." This concept of inducing increasing integration, even between actors with some hostility, is also a strategy employed in the United States by the US Army Corps of Engineers (interview, Jerry Delli Priscoli, June 1992), and recommended for international settings by their representatives.

As the regional politics increase the political viability of some of these international projects, we might re-examine whether greater interdependence is actually an impetus to greater cooperation or is, in fact, the opposite, leading to greater conflict.

Many of the hostilities that have occurred in the region over water seem to have come about precisely because the water destined for a

downstream user was controlled by an upstream party. Many ''co-operative'' projects might only provide additional opportunity for suspicion and potential for contention. Lowi (1990) suggests that issues of regional water sharing can not be successfully broached in the Jordan basin until the larger political issues of territory and refugees are resolved.

One point where contention seems most likely to develop is over control of a major source of water. Many proposed water transfers, such as the Egyptian offer of Nile water to Israel, have fallen through partly because of concern for whose hand is ''on the tap.'' Tensions were raised immediately before the Gulf War when Turkey closed off the Euphrates River for one month to fill its Ataturk Dam. Some of the greatest resistance to the Johnston proposals was encountered whenever an aspect of the plan called for relinquished control by any of the parties, such as joint storage in the Sea of Galilee or an international Water Master. G. White and co-workers (in Glassner 1983, 491) suggest that, in many group situations, water users prefer private to communal water sources if there is a choice, ''to avoid situations where there is risk of irritating confrontation.''

I recognize the advisability of striving towards ever-increasing integration between political entities. As has been pointed out, ''lasting peace among nations is characterized by a broadly based network of relations'' (H. Ben-Shahar in Fishelson 1989, 1). I suggest, however, that for resource conflicts in general and for water conflicts in particular, an initial condition that should be met is that each entity has adequate control of an equitable portion of its primary source. Past and present grievances need to be addressed before embarking on projects of cooperation or integration. For water projects, this would involve (a) assigning property rights to existing resources, (b) guaranteeing control of a water source adequate to meet future needs, and (c) addressing the issue of equity within the design of any project for cooperative development.

The fact that projects would have to be weighed in terms of the conflict-alleviating tendencies of more efficient water distribution, as opposed to the possible conflict heightening of greater hydrologic interdependence, should not be a reason to abandon the concept. Nor, by any means, should the concept of regional planning be tarnished because of uncertainty about specific projects. Rather, in planning for watershed development and in designing transnational water projects, the ultimate goal might yet be ever-increasing integration. In the initial stages, however, the reluctance by parties to relinquish

control of a resource as vital as water should be addressed and might even be incorporated in the project design. This issue of ''control'' and cooperation-inducing project design is taken up again later in this chapter and in chapter 4.

Economics

Economics, with the individual as a rational maximizer of satisfaction in a world of relative scarcity, offers a useful paradigm for water conflict analysis. When deciding between several possible water development options, for example, the benefit–cost analysis – an economic tool by which all of the future benefits and costs of a project are reduced to a single amount representing the net benefits in current monetary units – can help one to determine which project would be the most beneficial.

Economic theory also provides guidelines for policy options for efficient water distribution. Economic theory argues, for example, that only when the price paid for a commodity is a reasonable reflection of the true cost, can market forces work for efficient distribution of the commodity. In the Middle East, as elsewhere, the cost of water to the user is highly subsidized, especially water earmarked for agriculture. The true cost of water would reflect all of the resource development, pumping, treatment, and delivery costs of that water, most of which are not passed on to the user. In Israel alone, 20 per cent of the country's energy is used solely to move water from one place to another (Naff and Matson 1984, 12).

Subsidized water, it is argued, leads to waste in agricultural practices, to too little incentive for research and development of conservation techniques and practice, and finally, to too much water being allocated to the agricultural sector as opposed to industry. Take away subsidies and allow the price to rise, and market incentives are created for both greater efficiency on the farm and a natural shift of water resources from the agricultural sector to industry, where contribution to gross natural product per unit of water is often much higher. Since, in each of the areas discussed, between 75 and 95 per cent of water use is allocated for agriculture, the savings in water could be substantial (Wishart 1990). Thomas Naff has recommended such a shift of between 35 and 40 per cent of agricultural water in both Israel and Jordan (lecture, University of Wisconsin-Madison, March 1990).

If the price of water reflects the true costs of its development,

and if property rights to water are clear, then a ''water market'' can be established to allow buying and selling, ensuring, through the ''invisible hand'' of the market-place, that each unit of water is being used most efficiently. Water markets, whether national or international, can provide clear incentives for efficient use and guidelines for trades or transfers. Howe and Easter (1971) derived the necessary conditions for economically efficient interbasin water transfers in the United States, and Dinar and Wolf (1992) discussed international water markets using a hypothetical transfer from the Nile to the Jordan basin as a case-study. Zeitouni et al. (1992) discussed trading water rights in an international context and Gonzalez and Rubio (1992) showed that the amount of water to be transferred between basins in a Spanish case could be reduced if economic factors were considered, as opposed to straight extrapolations of need.

Economic analysis may also create a framework for easing regional water tensions. According to Wishart (1990), ''conflicts over water rights are easier to resolve if transaction costs of resolution are lower, and if opportunities exist for improving the efficiency of water use and discovery.'' In other words, if it is cheaper for people to cooperate and save water than it is to fight, they would rather cooperate.

Some other considerations that have been used in the past to enhance the potential for economic cooperation between players include the following:

1. Recognizing that, while water itself is a finite commodity, and therefore conducive only to zero-sum solutions (''distributive'' or ''win–lose,'' in the language of ADR), the benefit, or welfare, derived from water is variable and therefore tradeable for non-zero-sum (''integrative'' or ''win–win'') solutions.
2. Welfare can be measured basin-wide and among all the players participating in cooperation, so that even when one player's individual welfare is not immediately enhanced by the loss of the resource, the resulting pay-offs of trade should result in the region as a whole being better off.
3. Infrastructure considerations can enhance the argument for cooperation, especially when considering the variable aspects inherent to water resources. One or another of the players may have better resources to deal with fluctuating quantity or quality – more storage potential, or better-developed water treatment, for example – which can help encourage an alliance.

There are, however, problems inherent to using economic theory as the tool for water conflict analysis – problems that can lead to weaknesses in the economic solutions prescribed. For one, water is not a pure economic good. Options to the consumer of most goods include migrating to where it is cheaper or abstaining from it altogether if the price is too high. Given small countries with contentious borders, migration to water sources is not a viable alternative, nor, for more obvious biological reasons, is abstaining. Presumably, however, the analysis is restricted to water for agriculture, where there is ample room for reducing demand before running into such limits.

Another problem with economic analysis is more serious because it has to do with a force much more fundamental than economic theory – that is, the emotions of a nation. As mentioned earlier, all of the countries in the area were built from the farm up, and the agriculturalist, whether the *fellah* or the *kibbutznik*, holds a special mystique on both sides of the Jordan. Both Arabic and Hebrew ideologies are rife with slogans of ''making the desert bloom'' and ''nations rooted in their land.'' In this context, water invariably becomes the ''life blood'' of a nation. One result of this has been a certain leeway granted to agriculture in the area, both political, as noted previously, and economic.

One striking example of water ''diseconomy'' is the case of Israeli settlements on the Golan Heights. The 24, mostly agricultural, settlements of the Golan have a population of about 3,500. In 1980, approximately 80 per cent of the 50 MCM/yr used by these settlements was pumped up from Lake Kinneret – a height differential of 600 m (Davis et al. 1980, 27; Inbar and Maos 1984, 22). Each cubic metre of water weighs a metric ton. Were the settlers to include the costs of the energy required to lift that much water that high, their crops could not possibly be competitive in the market-place. But settlements on the Golan Heights are viewed as more than a source of agricultural production: as mentioned earlier, they are also outposts, the presence of which creates a kind of first line of defence against the Syrians, whom many Israelis view as the likely antagonist in an ensuing war.

This perceived connection between settlements and security holds true throughout the country. As Frey and Naff (1985) write,

> Israeli agriculture is not merely an ordinary economic sector. It is linked to the crucial matter of settlements, and settlements are linked to defense and national security.

This, then, is what makes Golan cotton competitive in the eyes of the nation.

Overlooking this fundamental aspect of a ''national water ethic'' of any of the countries involved, can occasionally confound an economist, especially one from outside the region. Cal Burwell, once the Director of Research for the proposed Agro-Industrial Complex, mentioned recently that ''Some of what's valuable to the folks over there just doesn't fit into what our folks would call 'good economics' '' (interview, February 1990).

The economist increasingly recognizes the sometimes overpowering non-economic values that water users occasionally attribute to their water. These might include (from Wolf 1992a):

1. Political attributes of water, e.g. perceived past injustice, national pride;
2. Cooperation *per se* (e.g. the World Bank does not include international cooperation as a benefit in benefit–cost analyses (Olivares 1986);
3. Physical security;
4. Perceptions of beauty in the environment;
5. ''The Land Ethic'' – inherent value of ''non-economic species'';
6. Food or water security – the psychological value of control;
7. Open space.

This last represents a departure from historic economic arguments in the Middle East. In Israel, for example, water has been subsidized for years as a means of promoting population dispersion and food security. These subsidies have dwindled somewhat in recent years, as the Ministry of Agriculture has accepted more of a market approach. Lately, however, as the population soars with natural growth and extensive immigration, the suggestion has been made to increase subsidies once again as a way to keep open space among the extensive developments (interview, Martin Sherman, November 1991).

Additional factors often convolute the possibility for a traditional economic analysis, particularly in an international setting. Some of these possible political and institutional constraints to economic cooperation are as follows:

1. Some level of hostility between the players. Hostility can be between basins (e.g. northern and southern California), between economic sectors (urban versus agricultural users), or, especially, between political entities (e.g. the Turkish Peace Pipeline, Akdogan 1992; Nile water transfer, Dinar and Wolf 1992).
2. Property rights (ownership of water) are often unclear and, occa-

sionally, bitterly contested. Although water is internally nationalized in all of the cases discussed in this work, international ownership is often unspecified.

3. State-subsidized water often makes the economics of any transfer or trade unclear, as described above.
4. National prestige can be tied up in the population's perception of its water resources, decreasing the apparent desirability of cooperation. National pride in ''Israeli oranges,'' or ''Egyptian cotton,'' for example, may preclude a shift to other agriculture or industry, even if the product in question can be imported at less expense from abroad.
5. Usually, when an inter-basin or international exchange is agreed upon, it is for one specific amount to be delivered annually. Because of treaty or infrastructure limitations (such as pumping, storage, or delivery capacity), the ''solution'' is discrete and cannot be arrived at dynamically. This limits the potential for efficient water market transactions, which often rely on variable solutions (e.g. Lekakis and Giannias 1992; Zeitouni et al. 1992).
6. Insulation. Negotiating teams usually include diplomats and engineers. The primary considerations are therefore often of politics and reliable delivery, rather than being influenced by economic efficiency.

Even while recognizing its limits, one can still use economic analysis as a useful tool to provide some guidelines to increase hydrologic efficiency. It has been suggested that following these guidelines can be especially crucial, particularly as water limits begin to be reached:

> Whereas diseconomies dictated by ideology could be tolerated under conditions of conventional water sufficiency, they cannot continue indefinitely, especially with regard to investments under conditions of system's shortage. (Galnoor 1987)

Game theory

Game theory, like economics, assumes enlightened self-interest and ''rational behaviour.'' A quantitative analysis can be performed to show how *n* number of players should react to a competitive setting in order to ''win.'' A rational outcome is defined by an equilibrium point (''pareto-optimality'' to economists), where no player can gain by unilaterally moving away from that point.

Game theory has been applied to a variety of issues as diverse as national security, social justice, and the existence of superior beings,

but it has been applied to international water conflicts only sporadically. Rogers (1969) analyses conflicting interests along the Lower Ganges and suggests strategies for cooperation between India and Pakistan. Dufournaud (1982) applies game theory to both the Columbia and the Lower Mekong to show that ''mutual benefit'' is not always the most efficient criterion to measure cooperative river basins. Dinar and Wolf (1992) use cooperative game theory to explore the economic pay-offs that might be generated in a technology-for-water exchange between Israel and Egypt, and how those pay-offs might be distributed to induce cooperation.

As political science asks, ''Does cooperation beget cooperation?,'' game theory poses, somewhat less didactically, the question ''What is the correlation between cooperation and efficiency?'' In theory, according to R. Axelrod,

> a player who in an opening move acts generously and on a responding move acts cooperatively, never initiating attack, will outscore any other strategy, given time and averaging. (Cited in Painter 1988)

In practice between competing nations, however,

> a strong positive relationship exists between tendencies to initiate and to receive international conflict. The correlation between cooperative initiation and receptive tendencies, however, is much weaker. (Platter and Mayer 1989)

Either game theory has not yet developed to the point where it can adequately model complex international decision-making, or the nations surveyed had neither the time nor the faith in time and averaging to pursue ''efficiency.''

Nevertheless, game theory offers a framework for some level of analysis for water conflict. When the water demand of a population in a water basin begins to approach its supply, for example, the inhabitants have two choices that can be modelled (see Falkenmark [1989a] and LeMarquand [1977] for related work):

1. They can work unilaterally within the basin (or state) to increase supply – through waste-water reclamation, desalination, or increasing catchment or storage – or decrease demand, through conservation or greater efficiency in agricultural practices.
2. They can cooperate with the inhabitants of other basins for a more efficient distribution of water resources. This usually involves a transfer of water from the basin with greater resources.

These options are equally true for the inhabitants of a single basin that includes two or more political entities. A third option exists, of course, and is practised most often in arid countries that are less developed or are racked by military strife: they can make no changes in planning or infrastructure and face each cycle of drought with increasing hardship. Since the most reasonable prescriptions in such a case are usually beyond game theory modelling, this case is not considered further.

For the game theorist, this dichotomy between two parties of whether to work unilaterally (defect) or to cooperate is recognizable as a familiar two-player, two-strategy game (Rogers [1978] discusses game theoretical aspects of water resources). The strategies chosen by each player often depend on the geopolitical relationship between them. For two water basins within the same political entity, with clear water rights and a strong government interest, the game may resemble a ''stag hunt,'' where mutual cooperation is the rational strategy.

Between somewhat hostile players, either within a state but more often internationally, the game becomes a ''prisoner's dilemma,'' where, in the absence of strong incentives to cooperate, each player's individual self-interest suggests defection as the rational approach. In cases of high levels of hostility, a game of ''chicken'' can develop, with each player competing to divert or degrade the greatest amount of water, before the opponent can do the same.

As the amount of water surplus decreases over time, however, the impetus towards conflict or cooperation (pay-offs) might change, depending on such political factors as relative power, level of hostility, legal arrangements, and form and stability of government.

Alternative dispute resolution (ADR)

Of the disciplines surveyed, ADR with its subfield of environmental dispute resolution, uses examples of water disputes quite widely as, for example, in Amy (1987) and Bingham and Orenstein (1991). Although international relations in general are treated extensively in the ADR literature by, for example, Kriesberg (1988), Stein (1988), and Ury (1987), application of ADR techniques to international resource conflicts is rare. Dryzek and Hunter (1987) describe mediation as a mechanism to resolve international environmental problems, and Zartman (1992) discusses the challenges presented in in-

ternational environmental negotiations. An excellent summary of ADR's potential specifically with regard to the problems of international water conflicts can be found in Delli Priscoli (1992).

For an overview of ADR, the works of four sets of authors – Fisher and Ury (1981), Lewicki and Litterer (1985), Susskind and Cruikshank (1987), and Amy (1987) – are compared and contrasted in terms of concepts, methods, and critiques that they offer the field of ADR. The ideas relevant to international water conflict in the Middle East are then culled for inspection.

Four works in ADR – A comparison

Much of ADR literature is divided between works written by mediators or negotiators themselves about their own work, case-studies by outside observers, and a growing body of theoretical work. Of the four works discussed, three – Lewicki and Litterer (1985), Susskind and Cruikshank (1987), and Fisher and Ury (1981) – are each combinations of the three approaches, with the look and feel of ''how-to'' manuals for the successful resolution of conflict. The fourth, Amy (1987), is a critique of the specific field of environmental mediation, and is best considered separately.

Each of the three works that deal generally with the process of ADR makes several important distinctions. The first is between distributive, or zero-sum, bargaining – negotiating over one set amount where one party's gain is the other's loss – and integrative, or ''win–win,'' bargaining, where the solution is to everyone's gain. Lewicki and Litterer (1985) and Susskind and Cruikshank (1987) each have sections on both, while Fisher and Ury (1981) focus on how to avoid the pitfalls of the former in order to reach the latter – ''get to YES.''

Each of the works agrees that the integrative arrangement, being of mutual benefit to the parties in conflict, is a much-desired arrangement, and they vary mostly in the path they advise taking. Susskind and Cruikshank (1987) have a fairly procedural approach, dividing the negotiations into three phases – prenegotiation, negotiation, and implementation – and offering concrete suggestions, such as ''joint fact-finding'' and ''inventing options for mutual gain,'' in order to build consensus in an unassisted process. In assisted negotiations (facilitation, mediation, and arbitration), the authors are more vague, suggesting that whether the outcome is distributive or integrative depends primarily on the personal style of the negotiator. They offer some specific advice, mentioning that a ''team spirit'' may develop in

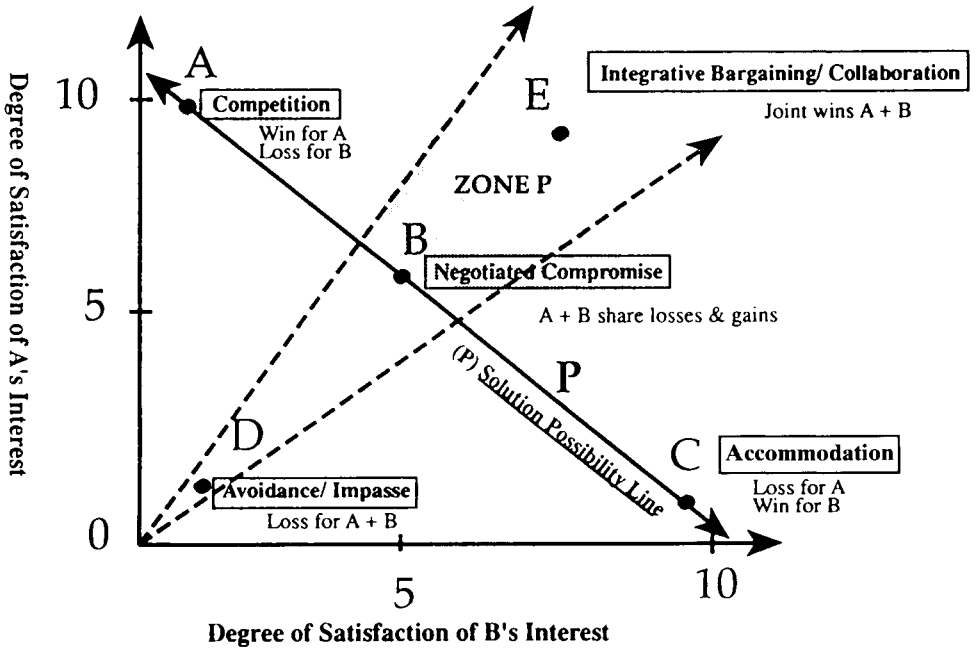


Fig. 3.1 **Styles of conflict management in two-party (A and B) disputes (Source: Delli Priscoli [1992]; derived from concepts presented by Kenneth Thomas [1976] in "Conflict and Conflict Management," in Marvin C. Dunnett, ed., *Handbook of Industrial and Organizational Psychology*, Chicago: Rand-McNally)**

the course of face-to-face negotiations. They do offer the interesting note that "negotiation researchers have established that cooperative negotiators are not necessarily more successful than competitive negotiators in reaching satisfactory agreement."

Lewicki and Litterer (1985) go into a little more detail. They identify five styles of conflict management in a "dual-concern model" along a gradient of the degree of concern for one's own outcome compared with the degree of concern for the other's outcome. The five styles possible, then, are avoidance, compromise, and collaboration (as equal concern for both parties), and competition and accommodation (as completely selfish and selfless, respectively) (see fig. 3.1). The key is to reach a collaborative arrangement. Both the difficulties and the conditions necessary are fairly clearly spelled out, as are guidelines to the process itself. Of special concern are the "factors that make integrative bargaining difficult." These include, primarily, the failure to perceive a situation as having integrative potential, the

history of the relationships between the parties, and ''black–white'' thinking. Ury (1991) offers specific advice to getting past historically difficult and value-based conflicts – ''getting past NO.''

Given these common pitfalls, it should be mentioned that Lewicki and Litterer (1985) also provide the most detailed description of distributive bargaining of the three works considered. Recognizing that, often, a conflict situation involves fixed resources for which both sides compete, the authors provide useful concepts and strategies to ''maximize'' one's share of the outcome. In win–lose bargaining, each side comes to the table with a ''bargaining mix'' including their starting, target, and resistance points. Strategies offered range from the comprehensive – influencing the other's resistance point – to the mundane – scheduling negotiations for when the opponent has jet lag.

One element mentioned in both Fisher and Ury (1981) and in Susskind and Cruikshank (1987) should be introduced at this point – the concept of a BATNA, the best alternative to a negotiated agreement. The latter authors point out that no one should be at a bargaining table to begin with if their BATNA away from the table is likely to be higher than can be gained through negotiations. A clear understanding of one's own BATNA and, if possible, of the opponent's, gives a fairly clear idea of what the bargaining range is likely to be.

Lewicki and Litterer (1985) conclude their discussion with ''strategies of integrative bargaining,'' useful concepts that are common in one form or another to much of ADR literature (including Fisher and Ury, whose terminology for similar concepts is presented in parentheses):

1. Identify the problem. (Separate the people from the problem.)
2. Generate alternative solutions. (Focus on interests, not positions.)
3. Generate viable solutions. (Invent options for mutual gain.)
4. Evaluate and select alternatives. (Insist on objective criteria.)

The difference in tone between Lewicki and Litterer (1985) and Fisher and Ury (1981) suggests a subtle but distinct difference in outlook throughout the works and, consequently, a probable reason for the success of the latter work. Fisher and Ury (1981) are indefatigably optimistic. They do not offer much detail for successful distributive bargaining (what they call ''positioning bargaining''), only suggestions to ''change the game'' to ''principled negotiation.'' Their examples of success (and where mistakes were made) are from everyday life and show how conflict at every level can be resolved amic-

ably. The language throughout is simple, upbeat, and, one can see, appealing: one would prefer to ''invent'' or ''focus'' rather than the clinical ''generate.'' One's conflicts are resolved by ''controlling'' rather than by passively ''evaluating.'' In short, Fisher and Ury (1981), though covering much the same material as in other ADR literature, are accessible.

Amy (1987) provides an altogether different approach to ADR, one of harsh criticism. The author suggests that, since most studies of mediation are carried out by mediators, there is relatively little criticism of the fundamental claims made by the field. Roughly the first half of the work is an examination of the claims made by ADR proponents. He begins by reviewing the advantages claimed by mediation over legislature, bureaucracy, and the courts to resolve environmental conflicts and concludes that mediation tends to be justified only when (a) there is a relative balance of power between the disputants and (b) an impasse has been reached in the conflict; that is, neither side can move unilaterally in what they perceive as their best interest. He also contests the common assertions that environmental mediation is cheaper, faster, and more satisfying than other approaches, especially litigation.

Amy approaches his critique from the perspective of political science, and his most important observations are of power distributions throughout the process of mediation and of some resulting drawbacks. The main thrust of his argument is that the same power relationships that exist in the real world are brought into the negotiating process. In the classic environmental dispute of developer versus conservationist, the former will usually have the power advantage. As such, the developer will enter into negotiations only if he or she somehow has that power blocked through, say, a restraining order. The mediator, then, usually approaches a conflict looking for a compromise, which will be found between the two initial positions. The problem may be rooted in fundamental differences in values or principles, however, for example as to whether development should even take place – representing an alternative ''not on the table.''

Further, if one party believes strongly one way or the other, any compromise is capitulation. In other words, positions or interests can be compromised but not principles. A mediator is usually not entrusted with finding the ''right'' solution, only the best compromise, and a mediator who becomes an advocate, either against disproportionate power or in favour of any specific world view, will not be likely to find ready employment. Amy (1987) therefore recommends

that, for disputes of basic principles, the best venues for resolution are still the traditional ones of court, bureaucracy, or legislature.

ADR and the Jordan River watershed

The works presented offer guidelines for how one might approach the facilitation of dispute resolution between the parties involved in conflict over the Jordan River basin. What follows are some specific guidelines and cautions for a presumed facilitator involved in assisted negotiations. The ideal goal, as suggested by the four works cited, is an integrative solution but, given the length and depth of the conflict on this and other issues, a reasonable distributive solution might be more than acceptable to the parties involved. Much of the terminology is from the three ''checklist'' works. Although it is used interchangeably, the emphasis is from Fisher and Ury (1981).

IDENTIFY THE ACTORS, INTERESTS (SALIENCE), AND POWER. Borrowed from the conflict-analysis literature (e.g. Coplin and O'Leary 1976), this is perhaps the most difficult and most important step in conflict resolution, particularly given the intense hostility between the parties involved. This point, therefore, receives special attention.

The primary assumption of the works examined above and, in fact, of most ADR literature is that the parties at conflict not only wish to hold negotiations but are already at the bargaining table. The parties in question here, however, not only have never negotiated officially but either do not recognize other parties' right to existence or do not acknowledge other parties' national aspirations. A crucial task, along with identifying the actors themselves, is to induce, entice, or coerce mutual acceptance not only of legitimacy but also of the desire to negotiate. This process would presumably be under the auspices of an interested (and, it is to be hoped, powerful) third party, and would take place in conjunction with comprehensive issues other than solely the water conflict. It is assumed for this analysis that the various other issues would take place simultaneously but separately.

One other issue that should be resolved early is, ''What kind of conflict is it?'' Delli Priscoli (1992) suggests that five different kinds of conflict – data, interest, structural, relationship, and value conflicts – each have different components, each of which informs different strategies to conflict resolution. Water conflicts have aspects of each of the five conflict types listed, not only complicating the negotiations but also offering the potential for ''spillover effects'' of any breakthroughs into other realms.

Once the actors have been brought to the table, some of Amy's conclusions (Amy 1987) become relevant to the facilitator, particularly those relating to power inequity. As noted by Susskind and Cruikshank (1987), each party will negotiate only as long as its interests can be served best at the negotiating table. Further, Amy (1987) warns that ''only when politics of power are exhausted can politics of cooperation become a viable possibility.'' It should be remembered that, in contrast to the examples of national environmental disputes that Amy (1987) presents, international courts are not necessarily a more egalitarian option than negotiation (see the description of international water law above), nor are the UN forces or economic sanctions, the international equivalents of law enforcement, liable to be mobilized if negotiations fail. Nevertheless, a third party, such as the US State Department or the World Bank, can hold out economic incentives as either a ''carrot,'' by offering aid on a cooperative project, for example, or as a ''stick,'' threatening to withhold aid if cooperative steps are not taken. Both have been used successfully in the Middle East in the past. Here it will be up to the facilitator, and the body he or she represents, to act as advocate not just for compromise but for fairness.

One important point to consider as the facilitator evaluates the ''bargaining range'' is that, in international relations, armed conflict is sometimes chosen by a state as the BATNA. Predictors, as determined by relative positions and power, of when water conflict may help lead to warfare, are suggested by Naff and Matson (1984), Lowi (1900), and Frey (1992).

As the negotiating process is initiated, it will be crucial to ''separate the people from the problem.'' In our context, the problem is too little water for too many people, *not* Palestinian national aspirations versus Israeli security. Nevertheless, the issues of water, security, and nationalism are so intertwined that ignoring the ties between them can condemn potential cooperation to failure. This pattern has been seen repeatedly in past attempts at cooperation in the Middle East, such as the Johnston negotiations and the ''water-for-peace'' process. Ury (1991) and others recognize that ''satisfying unmet interests'' is a crucial step in ''getting past NO.''

Furthermore, each state's interests are informed by sectoral conflict – agricultural needs compared with those of industry or domestic consumption – and even intersectoral pressures: which crop gets the most return per unit of water, for example. The work of Frey and Naff (1985) in developing ''cognitive maps'' of national views of

water would be useful in identifying from where the pressures on an entity's position are likely to come.

INSIST ON COMMON CRITERIA FOR ANALYSIS. Getting the parties to focus only on people and water will be only half of the hydrologic battle. Determining the technical and policy alternatives that can help to alleviate the water crisis will depend, first, on establishing a common base of information for the physical hydrography of the region. This crucial step is not always straightforward, as data are presented and contested. Kolars (1992) and Starr (1992) offer suggestions for a regional centre for water data gathering and exchange, as a first step in regional cooperation.

Even once the physical parameters are agreed, finding a mutual definition of such concepts as ''ownership'' and ''value'' can be equally difficult. Fisher and Ury's suggestion of using fair and mutually agreed standards for criteria for measurements as a step in ''focusing on interests, not positions'' (Fisher and Ury 1981) is well taken (although one might question their belief in ''objective'' criteria). Some of the possible paradigms for evaluating the rights to, and value of, water, including legal and economic guidelines, are explored above.

One additional useful tool for evaluating efficient distribution is the concept of ''per capita availability'' (PCA) of a nation. Falkenmark (1987; 1989a) describes the technical options that are useful, and the common political pressures that are likely, given a state's PCA (the total amount of water available per person). This is especially helpful, both in determining a likely target for the water from diversion or desalination projects and because PCAs can be projected into the future, adding a dynamic element to the search for solutions.

INVENT OPTIONS FOR MUTUAL GAIN. As mentioned, a mutual distributive solution to the problem of Middle East water allocation would be a great step forward for the parties in question, but even an agreed distribution scheme for existing resources will not solve the regional shortage. Without cooperation, each entity's quest for more water supply or less demand will take place unilaterally, with the probability of duplicate efforts and foregone opportunities. It might be shown, however, that cooperative efforts both are more efficient and allow for greater options. Access to independent and creative expertise necessary for generating ''elegant solutions'' would be crucial to the facilitator to be able to prompt the bargaining from distributive to integrative.

DETERMINE A FEEDBACK MECHANISM FOR PERPETUATING AGREEMENT. A viable agreement must incorporate mechanisms for any future misunderstandings to be resolved. This is a final, but crucial, step that has to be taken for a negotiated arrangement to last beyond the signing ceremony. The circumstances that brought about a conflict to begin with are seldom static, nor are the conditions of agreement. This is particularly true for hydrologic conflicts, where supply, demand, and understanding of existing conditions all change from season to season, from year to year. Crisis management for droughts, floods, and technical (e.g. dam or sewage facility) failures, must also be addressed.

The section above on law examines the kinds of multinational bodies of joint research, development, and management that might be established for the Jordan River watershed and that would help guarantee the perpetuation of a negotiated arrangement.

A comparatively recent subfield in ADR, ''dispute systems design,'' is a process of integrating the potential for ADR in public institutions and other organizations that deal with conflict. Described by Ury et al. (1988a), ''dispute systems design'' may offer lessons in cooperation enhancement in water systems as well. Although most of the work in this field describes incorporating cooperation-inducement within organizations, some of the same lessons for ''enhancing cooperation capacity'' (Kolb and Silbey 1990), or ''design considerations'' (O'Connor 1992) and ''guidelines'' (McKinney 1992), might be applicable to technical or policy systems as well. A water-sharing agreement, or even a regional water-development project, for example, might be designed specifically to induce cooperation in ever-increasing integration from the beginning. This possibility is explored in more detail in chapter 4.

The conflict over the Jordan watershed provides a particular challenge for the application of ADR guidelines offered by the works of four groups of authors. One can imagine Lewicki and Litterer developing a new category for the basin, called ''Factors that make integrative bargaining difficult – with a vengeance'': the actors do not recognize each other's legitimacy; the enmities between them are deep and ancient; the hydrology is intricate, poorly understood, and seems arranged almost to spite the contentious political boundaries; and everyone is running out of water.

On the other hand, once a strategy for resolving international water conflicts is developed for the Jordan basin, other applications of ADR probably could not get much more complicated.

An interdisciplinary approach to water basin analysis and conflict resolution

In the survey of disciplines relevant to the analysis of water basins and water conflicts, I examined the applicability of several paradigms to water issues in general, and to the conflict over the waters of the Jordan River watershed in particular. I showed, in the process, that each discipline offers several useful tools and guidelines for water basin analysis, but that no single discipline can provide all the answers necessary for a thorough study. In this section, I select useful tools from each discipline and compile them in a single interdisciplinary analytical framework that might be applicable to any international watershed.

Summary of disciplinary survey

Each of the disciplines surveyed offers useful tools and guidelines for water basin analysis. The physical sciences offer several practical options, both for increasing water supply through such measures as desalination and waste-water reclamation, and for decreasing demand, through more efficient agricultural practices. Other technical options offered included other political entities – through shared information and technology – and other water basins, through water transfers.

A discussion of law has revealed that, although assignment of water rights is requisite both for addressing past and present grievances, and for the establishment of water markets, the current state of international water law is not sufficiently developed to handle the task. Treaties, which can be negotiated using the principles of ADR and incorporating the guidelines of ''dispute systems design'' to encourage ongoing conflict resolution, are both site and conflict specific. Emphasis, therefore, might be placed on water-sharing and basin-development treaties, incorporating the contentious issues raised historically of ''equity'' (''Who gets how much?'') and ''control'' (''From where, and whose hand is on the tap?'').

Political science suggests strategies for reducing water use within each country, informed by the relative salience and power of each of the groups of water users. A discussion of international relations has suggested some ambiguity over whether increased international integration of water planning and projects leads to increased stabilization or the opposite, to increased points for contention. This discussion, combined with the lessons offered in the section on history and in

the field of dispute systems design, may reinforce the contention that both joint planning and joint water projects may be designed in a progression of cooperation toward the goal of ever-increasing integration, but starting with ''small and doable'' projects safeguarding the need for each political entity to have direct control over its own primary water source.

Economics offers the useful tools of the benefit–cost analysis, to help provide a method of comparative measurement of water projects, and the water market, which could help to increase efficiency both within each entity and internationally. Prerequisites for the latter include allowing the price of water to reflect its true costs and the clear assignment of water rights, both of which, we found, present difficulties under the current conditions. Some policy guidelines were offered as well, including allowing the price of water to reflect the costs associated with its development, treatment, storage, and delivery, as mentioned above, which might lead to greater efficiency of water use and greater incentive both for water-saving research and even for international cooperation.

A brief discussion of game theory has suggested that the field offers options both in terms of predicting the strategies that might be chosen by entities in competition over water, and for analysing the distribution of pay-offs for potential cooperative projects, for a variety of possible coalitions.

Finally, ADR offers guidelines for the process of resolving conflicts, from prenegotiation, to the process itself, to guidelines for implementation. Suggestions have been made for when a party should, or should not, be at the negotiating table to begin with, and what can be expected, given each party's ''bargaining mix.'' The recent subfield of ADR, ''dispute systems design,'' offers methods to incorporate the dynamics of conflict resolution into the institutions that deal with conflicts. Some of these methods may be applicable to physical systems of cooperation as well.

Towards an interdisciplinary approach

The discussions of history and physical science have conveyed a sense of water basin planning as an ongoing dynamic process, as water quantity, quality, and demand factors all fluctuate over space and time. Political science also shows the equally fluctuating political pressures that act on water policy markers, both within each political entity and internationally. From ADR, we have found that successful

conflict resolution should be equally dynamic, with constant feedback and iteration incorporated within the process to match the variability of both the physical and the political systems.

Even while recognizing the fluctuations inherent to water basin analysis, we can also recognize the need to examine each option available and its viability at a certain point in time. To bring options and evaluations together, I begin by listing each of the technical options presented in the section on physical science, and adding the policy options recommended by economics. Each option can then be evaluated for its viability, as recommended in three sections – physical sciences, economics, and political science.

I offer three phases to the process of water conflict analysis, parallel to ADR's prenegotiation, negotiation, and implementation (Susskind and Cruikshank 1987). Within each phase, I offer guidelines as suggested by the previous disciplinary discussions. The justification for each phase from ADR is included in parentheses, as are the disciplines that inform each of the guidelines.

1. Preliminary watershed analysis.
   (Identify Actors' Initial Hydropolitical Position)
   – Survey positions, salience, power (political science, ADR)
   (Insist on Common Criteria for Analysis)
   – Establish overall goals
   – Choose an appropriate planning horizon
   – Determine future water supply and demand.
2. A framework for evaluation: options and viability.
   (Invent Options for Mutual Gain)
   – Determine technical and policy options
   (physical science, economics, political science)
   – Measure technical, economic, political viability
   (physical science, economics, political science).
3. Implementation.
   (Determine Feedback Mechanism for Perpetuating Agreement)
   – ''Dis-integrate'' resource control to address past and present grievances (history, law, political science)
   – Examine details of initial positions for options to induce cooperation (ADR)
   – Design plan or project, starting with small-scale implicit cooperation, and building towards ever-increasing integration, always ''leading'' political relations (political science, ADR – dispute systems design).

To match the technical, economic, and political dynamics of the

system, I suggest that the process of analysis be both interactive and iterative, as described below.

Preliminary watershed analysis

To develop a suitable strategy for a water basin under conflict, one must determine what technical and policy tools are most appropriate, given the specific physical and political parameters.

The first stage of a preliminary watershed analysis ought to include a brief survey of the current hydropolitical position of each of the actors. Attitudes and power relationships might be examined, which, in addition to future water needs, might suggest what bargaining mix each player will bring to the table. Power, in hydropolitical terms, may include riparian position and legal water rights, in addition to the more traditional forms of political and military power.

Both defined overall goals and a reasonable planning horizon should then be determined. For an overall goal, I suggest ''providing for future water needs while alleviating water-related political pressures.'' I have chosen a 30-year planning horizon, which both allows observation of long-term effects of short-term policy decisions and provides time for larger technical projects to be implemented and their effects studied.

The next step is to project adequately the water needs for each entity over the planning horizon. For this purpose, a ''water stress index,'' as developed by Falkenmark (1989a), is used that relies on an index of per capita water availability (PCA). Falkenmark (1989a; 1989b) and Falkenmark et al. (1989) describe the combined PCA for a population in a semi-arid region as follows:

- Above 10,000 m^3 per person: limited management problems;
- 10,000–1,600 m^3 per person: general management problems;
- 1,600–1,000 m^3 per person: water stress;
- 1,000–500 m^3 per person: chronic scarcity;
- Less than 500 m^3 per person: beyond the ''water barrier'' of manageable capability.

Falkenmark combines all uses – domestic, agricultural, and industrial – in her calculations, and includes only natural sources – no additions for reclaimed water or desalination, for example. In actuality, industrialized countries willing to invest heavily in water technology and management might not be under the same ''stress'' as another country with the same PCA. Nevertheless, from the categories presented, it is clear that policy options are different for countries in different categories. The concept of ''drought,'' for example, might

mean a lack of water for survival in Ethiopia, a lack of water for agriculture in Jordan, or a lack of delivery infrastructure in Spain. As described in the next chapter, each of the riparians to the Jordan watershed falls well below the "water barrier."

The next step is to calculate water supply and demand dynamically over the planning horizon. There are dangers associated with any extrapolations over time, which increase, the further into the future a model projects. Patten (1976) and Bossel (1986) discuss ecosystem modelling and the hazards of extrapolation. It is recommended, by these authors and others, that any predictive model should incorporate any of a variety of possible scenarios and that a range of results should be presented. In a model of water supply and demand, these scenarios might include population variations, based on changing birth or death rates or on immigration or emigration. Supply fluctuations from the natural system might be included, as might gains from technical advances or increased cooperation, or losses from global warming or the demands of a higher standard of living. The uncertainties of resource estimates, such as aquifer yield and surface water supplies, should also be included.

A framework for evaluation: Options and viability

TECHNICAL AND POLICY OPTIONS. Once one knows the planning horizon and goals of a watershed plan, and has calculated what the future water needs are likely to be, one can look to the technical and policy options described in previous sections to determine the most useful strategy over time. These options for overcoming shortages in a watershed, taken from the physical sciences and from economics, are as follows:

Unilateral Options

DEMAND

1. Population control.
2. Public awareness.
3. Allow price to reflect true costs (including national water markets).
4. Efficient agriculture, including:
   – drip-irrigation;
   – greenhouse technology;
   – genetic engineering for drought and salinity resistance.

SUPPLY

1. Waste-water reclamation.

2. Increase catchment and storage (including artificial groundwater recharge).
3. Cloud seeding.
4. Desalination.
5. Fossil aquifer development.

Cooperative Options

1. Shared information and technology.
2. International water markets.
3. Interbasin water transfers.
4. Joint regional planning.

MEASURES OF VIABILITY. Once the technical and policy options are known, the next, and probably the most crucial, step is to develop a method for evaluating the options against each other; that is, to create a hierarchy of viability. As explored in previous sections, many disciplines provide their own version of viability. Where an engineer might ask, ''Can it be done?'', an economist might add, ''At what cost?'', a political analyst could suggest, ''Is it politically feasible?'', and anyone environmentally aware might counter, ''Should it be done at all?''

One problem with these varied standards of viability is that they often measure at cross purposes, arriving at differing or even contradictory conclusions. Dinar and Wolf (1991), for example, evaluate a potential transfer of water from the Nile to the Jordan basin, in terms of both economic and political viability. Their findings using each standard are in diametric opposition to each other: whereas an economic analysis suggests greater pay-offs for larger coalitions of cooperating states, a political investigation shows that the likelihood of such coalitions actually forming decreases as the size of the coalition increases, and that the most likely action is no cooperation whatsoever.

What I propose here is a unified approach to overall viability that incorporates established measures for technical (including environmental), economic, and political viability. Technical viability measures the physical parameters of a system or proposal: how much water might be produced; what is the quality; how reliable is the source, and what are the likely environmental impacts? Economic viability has one primary standard – efficiency. For relative water projects, one might use the results of a benefit–cost analysis and use the resulting net present value of benefits as a measure or, more directly, the cost per unit water that would result from each project. An im-

portant economic point is that costs are not fixed over time. A ''resource depletion curve'' for any project would show at what rate the utility, or value, of a unit of water would begin to drop and, consequently, what the most efficient rate of development would be.

The most tenuous measure is political viability. To incorporate this important parameter in an integrated model, one must use a relative scale for a value that is difficult to quantify. While I recognize the general lack of enthusiasm for quantitative political analysis for its necessarily subjective nature (see Ascher 1989, for a good critique), I recommend the inclusion of results of a process such as the PRINCE Political Accounting System. Coplin and O'Leary (1976) describe the method of incorporating each player's ''position,'' ''power,'' and ''salience,'' for any of a number of policy options, to arrive at a relative ranking of political viability. In Coplin and O'Leary (1983) they extend the process to provide an absolute measure of the likelihood of a policy action taking place. Appendix IV shows how the PRINCE Political Accounting System might be applied to derive a measure for political viability, in this case for a number of possible coalitions for a transfer of water from the Nile to the Jordan basin (Dinar and Wolf 1992).

Two other qualitative measures might be used for political viability. For projects within a country, how well a proposal ''fits'' with national goals might be evaluated. Population control, for example, which might be successful in western Europe or the United States, runs counter to both Israeli and Palestinian interests in numerical superiority. International projects might be determined in terms of relative measures for ''equity'' of project costs and water distribution, and ''control'' by each political entity of its own major water sources.

The above measures of viability can be described in qualitative terms (+, 0, −, for example, representing good, neutral, or poor) adequate for a preliminary analysis. If the resources are available to perform a detailed feasibility study, the results can be described quantitatively as well. Listed below are the proposed measures of viability, followed by the possible quantitative standards that might be used:

1. Engineering
   - quantity (e.g. MCM/yr);
   - quality (e.g. ppm salinity or pollutants);
   - reliability of source (e.g. standard deviation of flux);
   - environmental impact (e.g. detail of potential damage).

2. Economic
   – efficiency (net present value of benefits, or cost per unit of water).
3. Political
   – as political probability from PRINCE model, or equity of project cost and water distribution, and control of source by each entity.

RESULTS, ITERATION, AND INTERACTION. Table 3.1 shows the technical and policy options listed lengthwise, and the possible measures of viability along the top, so that any possible option can then be evaluated with each measure of viability. By examining the results, it should be possible to sense which options are more viable than others, and why. It should be remembered that these results are for a particular geographic location, and for a single point in time.

Although a column is provided for a measure of ''overall viability,'' it is recommended that, if this column is used at all, it be used with great caution. First, each measure does not necessarily have equal weight, and each was arrived at with both some subjectivity and some uncertainty. Adding or multiplying across would therefore only compound and accumulate error. Instead, by leaving the measures separate, one acquires a greater sense of why options are viable and where emphasis can be placed for the future in order to help boost viability. Public awareness, for example, has been shown to be a very cost-effective method of saving water, but the total amount that can be saved is rather small in comparison to the total water budget. In contrast, unlimited water can be made available through desalination, but at a relatively higher cost. The latter might change with technological breakthroughs, but the former is likely to remain fairly constant over time.

As mentioned above, each measure can be evaluated in qualitative terms, such as $+$, 0, $-$, to represent good, neutral, or poor, or quantitatively, using the values described above. Chapter 4 includes a discussion of the options available to the Jordan River watershed using qualitative values, and several examples of quantitative evaluation are also presented.

It should be emphasized that this evaluation process should be iterative – repeated often to allow for the constant changes of so many of the parameters over space and time. Changes that can affect viability include the following:

Table 3.1 **Evaluation table for tools to decrease demand or increase supply of water**

	Viability measure			
Method	Technical[a]	Economic[b]	Political[c]	Overall viability
Unilateral				
DEMAND				
Population control	/ / /			=
Public awareness	/ / /			=
Allow price to reflect true costs (incl. national water markets)	/ / /			=
Efficient agriculture:				
Drip-irrigation	/ / /			=
Greenhouse technology	/ / /			=
Genetic engineering for drought and salinity resistance	/ / /			=
SUPPLY				
Waste-water reclamation	/ / /			=
Increase catchment and storage	/ / /			=
Cloud-seeding	/ / /			=
Desalination	/ / /			=
Fossil aquifer development	/ / /			=
Cooperative				
Shared information and technology	/ / /		/	=
International water markets	/ / /		/	=
Interbasin transfers	/ / /		/	=
Regional planning	/ / /		/	=

a. Quantity/quality/reliability/environmental impact.
b. Efficiency.
c. National goals (or international: equity/control).

1. Technical:
   - Fluctuations in seasonal and annual water supply, as well as long-term changes due to global warming
   - Changes in water quality
   - Technical breakthroughs

- Relative infrastructure for each party in:
  (a) research and development
  (b) storage and delivery
- Changes in understanding of physical system.

2. Economic:
   - Movement along the resource depletion curve
   - Expense for water resources development
   - Changes in efficiency of water use.
3. Political:
   - Power relationships
     (a) riparian position
     (b) military
     (c) legal (e.g. clarity of water rights)
     (d) form and stability of government
   - Level of hostility.

The evaluation process should also allow for interaction, with ongoing feedback between the disciplines, to reflect real-world influences. For example, a project with extremely positive economic results might help overcome political reluctance to enter into cooperation. Likewise, political constraints can effectively cause a project, which has been judged worthwhile in terms of its technical and economic value, to be vetoed.

Implementation

Based both on the information of the preliminary watershed investigation and on the ranking of technical and policy options from the evaluation framework described above, a plan can be developed for the watershed in question, both to overcome projected deficits in the water budget and, in the process, to help alleviate water-related political pressures. Lessons from political science in general, and from the region's history of hydropolitics specifically, can be combined to develop a plan for increasing cooperation and integration as political relations develop. The process techniques from ADR can help to guide the actors through the negotiation process and allow feedback for ongoing conflict resolution in the future.

The general steps that might be followed include the following.

"Dis-integrating" the control of water resources to address past and present grievances. The previous discussion of history, law, and political science suggests that, because much water conflict has been over ambiguities over water rights, any attempt at cooperative

projects preceding the clarification of these rights would be building on years of accumulated ill will. It was also mentioned, in the section on economics, that the clear establishment of property rights is a prerequisite for any market solution. As also discussed previously, the political viability of international planning or projects depends on each entity agreeing on the equity of the project (who gets how much), and on control of the resource (from where, and who controls it). The necessary steps include (a) negotiating property rights to existing resources, (b) guaranteeing control of a water source adequate to meet future needs, and (c) addressing the issue of equity within the design of any cooperative project. As these steps involve a separation of control as a precondition to ''integration,'' we might refer to the process as ''disintegration.''

EXAMINING THE DETAILS OF INITIAL POSITIONS FOR OPTIONS TO INDUCE COOPERATION. Each party to negotiations usually has its own interests uppermost in mind. The initial claims, or ''starting points'' in the language of ADR, often seek to maximize those interests. By closely examining the assumptions and beliefs behind the starting points, one might be able to glean clues for inducing some movement within the ''bargaining mix'' of each party. These underlying assumptions and beliefs may also provide indications for the creative solutions necessary to move from distributive bargaining (''win–lose'') over the amount of water each entity should receive, to integrative bargaining (''win–win'') – inventing options for mutual gain.

DESIGNING A PLAN OR PROJECT, STARTING WITH SMALL-SCALE IMPLICIT COOPERATION, AND BUILDING TOWARDS EVER-INCREASING INTEGRATION, ALWAYS ''LEADING'' POLITICAL RELATIONS. Building on the first two steps, the riparians of a watershed, who have clear water rights and control of enough water for their immediate needs, might begin to work slowly towards increasing cooperation on projects or planning. Even hostile riparians, it has been shown, can cooperate if the scale is small and the cooperation is secret. Building on that small-scale cooperation, and keeping the concerns of equity and control firmly in mind, projects might be developed to increase integration within the watershed, or even between watersheds over time.

The design of a plan or project can incorporate a feedback loop to allow for greater cooperation as political relations develop, encouraging the project always to remain on the cutting edge of political relations. A process for ongoing conflict resolution would also help to

relieve tensions that might arise owing to fluctuations in the natural system.

The ''cooperation-inducing design'' process described in this section can be applied to water rights negotiations, to watershed planning, or to cooperative projects for watershed development, as described in chapter 4.

Water and its evaluation

Because of water's particular ''salience'' and its singular characteristics as a resource, it is not surprising that water poses a particular challenge for the disciplines that attempt to analyse conflict. Delli Priscoli (1992) lists five kinds of conflicts: value, interest, structural, data, and relationship conflicts. Water has been, and will no doubt continue to be, the source of many conflicts of all five types.

As is seen in this chapter, the disciplines through which we seek to evaluate conflicts have parallel roles, sometimes complementary, sometimes contradictory, in the long-term assessment of water basin development. One important point that should be mentioned is that none of the paradigms are autonomous. Just as political considerations can effectively block a project with an otherwise favourable economic evaluation, a project that can be shown to bring greater economic welfare to a region might influence the political decision-making process to allow the necessary cooperation.

Because these disciplines become so intertwined in issues raised by international water scarcity, the proponents of each approach increasingly have to become not only aware, but thoroughly knowledgeable, of the criteria and concerns of the other.

As the interdisciplinary needs of water resources planning draw the worlds of the physical scientist, the economist, and the political analyst increasingly closer, each will have to learn at least a little about the other. Hydrologic variations in water supply and demand, political considerations of equity, control, and ideology, and economic measures of marginal utility and relative advantage, all interact to determine overall viability of solutions to interbasin water issues. But new opportunities to influence, rather than strictly to analyse, the needs and opportunities of a water basin can ensue from a united language, resulting in increased options for the ever-desperate inhabitants of water basins. The results, finally, should be well worth the effort.

One such interdisciplinary framework for water conflict analysis,

presented in this chapter, might be applied to any number of the more than 200 international water basins. The results of such an analysis are extremely site specific, however, depending on the unique combination of hydrology and politics of each basin. In chapter 4 this interdisciplinary framework is applied to the Jordan River watershed, to explore options for watershed development and cooperation-inducing project design.

4

Interdisciplinary analysis and the Jordan River watershed

> Legend has it that the headwaters of the Jordan River were originally three separate streams flowing in various directions, and quarrelling constantly over which was the largest and most important. Finally, the streams invited the Lord of the Universe to judge between them. The Lord descended and seated Himself on a small hill between them that, until today, is known as Tel Dan or Tel el-Kadi, Hill of the Judge in both Hebrew and Arabic. ''Rivers! Ye are dear to Me, all three. Hearken to My counsel: unite together and ye will indeed be the most important.'' And so the Jordan was formed.

Introduction

In chapter 2, I described the long and contentious hydropolitical history of the Jordan River watershed. I concluded with several policy recommendations informed by the lessons of history. In chapter 3, I suggested an interdisciplinary analytical framework for water conflict analysis, using precepts from the physical sciences, law, political science, economics, game theory, and alternative dispute resolution. In this chapter, I bring the site-specific lessons from history together with the general guidelines from the analytical framework, in an attempt to address the problems of the Jordan River watershed.

There are actually two distinct problems in the Jordan River watershed. The first is a ''water crisis'' – too little water supply for too much demand – similar to that in many water basins throughout the region and the world. The second problem is the ''water conflict'' – the political tensions brought about by a water crisis in this particular international water basin, which is shared by riparians who have deep and long-standing enmity towards each other.

My approach in this chapter is to address the water crisis by formulating a water development plan for the Jordan basin, using the general guidelines of my analytical framework. In the process, by keeping in mind the lessons of the history of this particular watershed, I

may be able to offer suggestions for alleviating some aspects of the water conflict as well.

The general process is as outlined in chapter 3:

1. Preliminary watershed analysis.
   - Survey of hydropolitical positions.
   - Goal statement and planning horizon.
   - Future water supply and demand, water stress.
2. Evaluation framework.
   - Options and viability.
   - Recommendations.
3. Implementation – three examples of cooperation-inducing project design.
   - An agreement for water sharing.
   - The mountain aquifer.
   - A Med–Dead or Red–Dead Canal.

Preliminary watershed analysis

Survey of hydropolitical positions

Before examining possible solutions to the water crisis, it is important to explore the possible opening position of each of the actors in negotiations. The brief, and highly generalized, positions that are listed below are taken from the section on history, as well as from interviews with the water advisers to each of the delegations.

Jordan: The Jordanians might put much of their emphasis on the allocations achieved during the Johnston negotiations. Although they would probably allow for some revisions in Israel's favour, they point out that they are currently being deprived of Yarmuk water from both downstream and up. Israel takes advantage of Jordan's lack of storage capacity to increase its annual intake from the Yarmuk (currently about 90 MCM/yr, versus 25 MCM/yr originally allocated). Meanwhile, Syria has launched a drive to impound Yarmuk headwaters upstream to Jordan, partly with the presumed justification of depriving Israel of this water. Currently 250 MCM/yr is impounded by Syria, with plans for an additional 50 MCM/yr. Jordan hopes that, by reaching agreement with Israel, similar accord will follow with Syria, clearing the way both for allocations closer to those of the Johnston negotiations (originally 377 MCM/yr), and for building a long-planned storage facility at Maqarin. Jordan is also hopeful of

reaching an accord with Saudi Arabia on a programme for joint exploitation of a large fossil aquifer underlying their shared border.

West Bank and Gaza Palestinians: The Palestinians, not separately represented during the Johnston negotiations, might base their claims on a combination of past promises and heretofore unacknowledged groundwater rights. Had the water diversions included in the Johnston negotiations been developed, water from two sources would have been delivered to the West Bank. The West Ghor Canal would have brought 70–150 MCM/yr to a narrow agricultural strip parallel to the Jordan River, in addition to up to 300 MCM/yr designated for the Jordan Valley from the Yarmuk and the Jordan rivers. Palestinians also claim first rights to all of the groundwater that originates in the West Bank and Gaza – about 615 MCM/yr and 60 MCM/yr, respectively (see, for example, Zarour and Isaac 1992). Since 1967, Palestinians have objected to Israeli measures to control development of West Bank water resources, including nationalizing and integrating West Bank water with the Israeli grid and limiting agricultural allocations to 1967 levels.

Israel: Israeli claims combine political modifications due from the Johnston negotiations with the concept of ''water security.'' Israel accepts the principles of the Johnston allocations but insists that modifications, reflecting changing geopolitics, be incorporated. For example, Israel claims a greater share of Yarmuk water than was originally allocated on the basis of its obligations to the West Bank since 1967, as well as by rights acquired through its historic use of what it considers to be surplus flow unexploited by the Jordanians. By the same token, Israel considers its historic rights to the mountain aquifer, which originates on the West Bank but which has been tapped by Israel from its side of the Green Line since the 1950s, to be irrevocable and tied to greater issues of security. Measures taken to restrict pumping on the West Bank have been described by Israelis as defensive, necessary to protect their wells and the integrity of the water system as a whole. Unchecked Palestinian water development or pollution in the Judaean hills west of the watershed line, it is argued, could endanger both the quantity and quality of water sources on which the heavily populated coastal plain of Israel relies. Israel's focus for the future might be to try to retain as many of its current sources as possible, and to introduce large-scale desalination projects into the region with international backing.

The specific issues of the water conflict that have to be addressed in the context of solutions to the water crisis include the following:

1. An ongoing dispute between Israel, Jordan, and Syria regarding the proposed Unity Dam on the Yarmuk River. Israel and Jordan must reach agreement on the former's share of the Yarmuk waters before funding from the World Bank, which insists all riparian states agree to a water project, can be allocated. Jordan is also concerned with Syria's impoundment and diversion of an increasing amount of the Yarmuk headwaters.
2. Final determination of who will provide the West Bank with its legitimate allocations of surface water from the Johnston negotiations, and from where.
3. Israeli concerns about upgradient Palestinian groundwater development versus Palestinian assertion of the legal right both to more of the water of the shared mountain aquifer than they currently receive, and to greater control of the aquifer's development. Other, lesser, groundwater disputes (and opportunities for cooperation) exist between Israel and Gaza, Israel and Jordan, Jordan and Saudi Arabia, and Israel and Egypt.

Goal statement and planning horizon

As suggested in chapter 3, the goal statement remains: "To provide for future water needs for the riparians of the Jordan River watershed while alleviating water-related political pressures." I use a 30-year planning horizon to allow the results of both short-term and longer-term technical and policy options to manifest themselves.

Future water supply and demand, "water stress" index

In order to estimate the water needs over the 30-year time horizon for each entity dependent on the watershed – Israel, Jordan, the West Bank, and Gaza – I have developed a computer program that will determine future water supply and demand per capita for any number of possible scenarios. Initial conditions, population growth rates, climatic conditions, and technical developments can all be varied to simulate different technical and policy options. All of the screens for the model are collected in appendix V, with initial conditions and explicit and implicit assumptions listed.

The results of several runs, representing different immigration scenarios, are listed in table 4.1. As can be seen, each of the entities is

Table 4.1 **Projected population and water demand, for different immigration scenarios, of entities dependent on the Jordan River watershed**

Entity	Scenario[a]	Year	Population (millions)	Water needs (MCM/yr)[b]		Low/high water deficit (MCM/yr)[c]
				Low demand	High demand	
Israel	1 million immigrants	1991	4.80	1,800	1,800	200/200
		2000	6.44	2,000	2,000	400/400
		2020	8.85	2,200	2,200	600/600
	2 million immigrants	1991	4.80	1,800	1,800	200/200
		2000	7.46	2,100	2,100	500/500
		2020	10.01	2,400	2,400	800/800
Jordan	300,000 refugees:	1991	3.60	870	980	0/110
		2000	4.91	960	1,100	90/230
		2020	9.76	1,300	1,600	430/730
West Bank	No immigration:	1991	0.90	115	180	0/65
		2000	1.21	120	210	5/95
		2020	2.37	140	330	25/215
	600,000 immigrants	1991	0.90	115	180	0/65
		2000	1.61	125	250	10/135
		2020	3.67	170	460	55/345
Gaza		1991	0.60	95	140	35/80
		2000	0.81	100	160	40/100
		2020	1.58	120	240	60/180

a. Assumes 1 million immigrants to Israel by 1993, 2 million by 2000; Palestinian immigration is (as infact, was the case) assumed to be between 1995 and 2005, all to the West Bank.

b. Projections assume constant demand for agriculture, growth to come through technology; low demand assumes urban use grows at current per capita usage; high demand allows 100 m^3 per capita for urban use.

c. Projected deficit equals current annual natural potential minus projected demand.

already well past the ''water barrier'' of manageable capability, defined by Falkenmark (1989a) as 500 m^3 per person. If no changes are made, the annual per capita availability will drop in 30 years from 391 to 247 m^3 per person in Israel; from 242 to 89 m^3 per person in Jordan; from 122 to 46 m^3 per person in the West Bank; and from 100 to 38 m^3 per person in Gaza – even without any immigration.

Evaluation framework

Options and viability

Table 4.2 shows the evaluation framework filled out, qualitatively, for the Jordan River watershed. Relative values are derived from the survey in chapter 3 but are, nevertheless, somewhat subjective. The column labelled ''overall viability'' has a relative ranking for each option and, in parentheses, the measure that makes an option either particularly positive or negative. As mentioned in chapter 3, this process should be iterative to allow for changes in the system and interaction between the disciplines. Particular attention in future analyses might be paid to the measures that are highlighted.

In general, the relatively higher ranking of unilateral options but the small amounts that result suggest that there is still some hydrologic room to manoeuvre within each political entity, but not much. The relatively large quantities that could be made available if cooperative measures were politically viable suggest a hypothetical amount of water that could be offered at the negotiating table as incentive to cooperate.

Recommendations

The overall rankings of the evaluation framework, as they currently stand, indicate a general four-stage process for water basin development. The initial emphasis would be on unilateral projects, with increasing cooperation and integration as political developments allow. Allowing for some overlap, the four stages of water basin development recommended are:

1. Negotiate an equitable division of existing resources;
2. Emphasize greater efficiency for water supply and demand;
3. Alleviate short-term needs through interbasin water transfers, if available and politically viable;

Table 4.2 **Evaluation table for Jordan riparians for tools to decrease demand or increase supply of water**

	Viability measure				
Method	Technical[a]	Economic[b]	Political[c]		Overall viability[d]
Unilateral					
DEMAND					
Population control	+/+/+/+	+	−	=	− (pol)
Public awareness	−/+/+/+	+	+	=	+ (econ)
Allow price to reflect true costs (incl. national water markets)	+/+/+/+	+	+	=	+ (gen)
Efficient agriculture:					
Drip-irrigation	+/+/+/+	+	+	=	+ (gen)
Greenhouse technology	+/+/+/+	0	+	=	+ (gen)
Genetic engineering for drought and salinity resistance	+/+/+/−	−	+	=	0 (econ)
SUPPLY					
Waste-water reclamation	+/−/+/−	0	+	=	0 (env)
Increase catchment and storage	+/+/−/−	0	+	=	0 (env)
Cloud-seeding	−/+/−/−	0	+	=	− (tech)
Desalination	0/+/+/−	−	+	=	0 (econ)
Fossil aquifer development	+/−/−/−	0	+	=	0 (tech)
Cooperative					
Share information and technology	+/+/−/+	+	−/−	=	− (pol)
International water markets	+/+/−/−	0	+/−	=	0 (pol)
Interbasin transfers	+/−/−/−	0	−/−	=	0 (pol)
Regional planning	+/+/−/+	+	−/−	=	0 (pol)

a. Quantity/quality/reliability/environmental impact.
b. Efficiency.
c. National goals (or international: equity/control).
d. pol, political; econ, economic; gen, general; env, environmental; tech, technical.

4. Develop a regional desalination project in cooperation-inducing stages.

Negotiate an equitable division of existing resources

Each of the riparians of the Jordan already has water development

high on its list of priorities. The history of this basin shows, however, years of accumulated ill will over the division of existing resources. Because the water shortage is basin wide, this option would address each entity's perceptions of the water conflict more than it would add to the regional water budget. However, each party's perceptions of the water conflict are crucial to determining the direction of future development, and the overall issue of control of one's resources can take on the importance of control of one's national destiny. Palestinians and Jordanians should not have cause to feel that Israeli lawns or swimming pools come at the expense of their own agriculture, nor should Israelis have cause to watch Palestinian or Jordanian upstream development projects with trepidation. After 70 years of contested water rights, it would seem that this issue would have to be resolved before any of these hostile parties could be induced to cooperate on regional projects.

In addition to addressing past and present grievances, legal allocations will define the property rights of water resources. This is an important prerequisite to using the market-place to help increase efficiency in supply and demand. Water markets cannot take place, either nationally or internationally, until clear water rights have been established.

Recommendations for how an agreement for water sharing might be reached are offered in the section on implementation, later in this chapter.

Emphasize greater efficiency for water supply and demand

After it is clear who has rights to what water, but before developing intricate and expensive projects for new water supplies, a great return can be achieved simply by investing in the existing system of water supply and demand. Options for increasing efficiency can be attempted either unilaterally, by each country and territory involved, or regionally, with cooperation between the entities in the area. In fact, the scarcity of a resource as critical to economic and physical survival as water may provide inducement to cooperation over other regional issues in the context of peace negotiations. Many of the options that follow are described in more detail in the section on ''Physical sciences and technology'' in chapter 3.

UNILATERAL EFFORTS. Israel already encourages efficient agricultural water practices such as drip- and computerized irrigation, and both

Israel and Jordan are pursuing policies for waste-water reclamation. More drastic steps, such as moving water away from agriculture and into the industrial sector, are also possible, but clash with national ideologies and entrenched water institutions of nations built around the mystique of the *fellah* or the *kibbutznik*. A recent Israeli State Comptroller's report (State of Israel 1990) blamed an annual over-pumping of water resources partially on the historically close relations between the agricultural sector and the Water Commissioner, who is responsible for allocating the nation's water. Water scarcity is not likely to change immigration policies, for similar reasons of ideology. In any event, unilateral measures cannot add more than incrementally to alleviation of the problem for any of the entities involved.

The inextricable link between water and politics suggests several options for easing regional water tensions, as follows.

Efficiency of water use could be enhanced as much as is politically, economically, and technologically possible. Increased efficiency could be obtained, first, by increased economic efficiency through a shift of water use from agricultural to industrial sectors. Although some recommend a shift of as much as 35–40 per cent, it should be remembered that the states involved have security concerns that may preclude their becoming major food importers, even if it is more economical to do so. These concerns should be weighed when determining how much of a shift is warranted.

The second goal could be increased support for research and development of water-saving technology. This could include small-scale applications, such as low-flow shower nozzles and toilets, and larger-scale projects, such as sequential reuse and waste-water treatment, for the agricultural and industrial sectors. The Maqarin Dam might finally be built, if political relations allow. Special emphasis might be placed on desalination technology, again both small and large scale. A regional desalination project, based on the goals of the Agro-Industrial Complex but using a combination of solar power, natural gas, and hydropower rather than nuclear power, might be implemented with many of the regional benefits foreseen in the original plan, as is explored later.

Recommendations for immediate emphasis include the following:

1. Waste-water reclamation at all the urban centres would allow greater allocations to agriculture and provide, by exchange, better-quality drinking-water for personal use.
2. Investment in water-efficient agriculture, including drip-irrigation

and the necessary pressurized delivery system, greenhouse technology, and genetic engineering for drought- and salinity-resistant crops.
3. Overhaul of the current delivery systems to prevent leakage and excessive evaporation. Saline springs, which currently are diverted away from the Sea of Galilee and into the lower Jordan, might be piped to the Dead Sea, sweetening the lower stretches of the river.
4. The price of water could be allowed to rise to reflect the actual cost of delivery and treatment. This step, already planned for most of the region, would help to reduce demand where use is inefficient and also would make alternative supply sources more attractive economically.

SHARED INFORMATION AND RESEARCH. The most workable opportunity for cooperation over water is for the entities on both sides of the Jordan River to share what information they have and to develop joint research strategies for the future. Regional water resource planning on, at a minimum, the watershed scale, can be encouraged. In the case of the Jordan River, representatives from Lebanon, Syria, Jordan, Israel, and the West Bank could work together on watershed management planning. For greater efficiency, the geographic scale of planning could be increased. Planning options multiply as the scale considered and the sources of water resources increase. Allowances should be made for changes in climate and demographics, as well as for increasing understanding of the physical system.

In May 1967, even as tensions were leading to the following week's outbreak of the Six-Day War, the US Departments of Interior and State convened an ''International Conference on Water for Peace'' in Washington, D.C. Today, as national water demand approaches supplies throughout the Middle East and, in fact, the world, similar forums for dialogue ought to be emphasized. Israeli and Arab expertise in water-saving agricultural practices, waste-water reclamation, and desalination technology should be exchanged and developed together. A 1987 study sponsored by the Center for Strategic and International Studies called for a US-sponsored project for joint information and technology (Starr and Stoll 1987). Clearly, arid areas of the United States would also benefit from such a project. Both Starr (1992) and Kolars (1992) suggest centres for water data sharing and gathering as a means of promoting cooperation. In spring of 1992, a conference on Middle East regional water issues was finally undertaken as part of the regional peace process begun in Madrid. Crea-

tive third-party assistance and influence will be necessary to help the ongoing negotiation process to overcome the obstacles to cooperation that will undoubtedly be encountered.

Alleviation of short-term needs through interbasin water transfers

Along with information and technology, water itself might be moved across borders for mutual benefit. Water transfers to the region have been considered at least since the turn of the century and are enjoying renewed interest. Immediate surpluses could be exploited as a stopgap measure while more elaborate projects are being planned and constructed. Short-term surpluses are currently available in the Litani and Nile systems and, further afield, from Turkey (see appendix I, map 31).

Elisha Kally of Tel Aviv University has dedicated much of his career to developing plans for such cooperative water projects (Kally 1989). One example is the possibility of storing Yarmuk winter run-off in the Sea of Galilee for use in Jordan, and possibly the West Bank, during the summer. This would save Jordan and Syria the expense of a proposed dam on the Yarmuk River, and at the same time help sweeten the somewhat saline Galilee water for Israeli use. Other possibilities suggested by Kally include transfers of excess surface water from the Nile to Gaza and from the Litani to the West Bank, alleviating desperate shortages without endangering groundwater supplies in the region. Another option, on a slightly larger scale, is the proposed Turkish ''Peace Pipeline,'' a US$20,000 million project to bring fresh water to parched states as far south as the Arabian Peninsula (Starr and Stoll 1988).

One arrangement was developed by Jordan after the extensive Johnston negotiations (1953–1955). In the context of its own national water diversions along the East Ghor, 70–150 MCM/yr was allocated to the West Bank, which at the time was an integral part of Jordan. A siphon was planned to move water from the East Ghor Canal for this purpose, but was never built. Although modern Jordan has its own water problems, it still ''owes'' this water to the West Bank. This surface water would increase the West Bank water budget by more than 60 per cent and lessen the dangers to Israel of unchecked groundwater development. Jordan more recently has made preliminary investigations into the possibility of importing Euphrates water from Iraq.

The most viable options for the near future include, first, diverting the Litani into the Sea of Galilee, from where it could go to Israel,

the West Bank, and/or Jordan. A pipeline along the coast might bring water from the mouth of the Litani as far as Gaza. Integrating Litani water with the Jordan watershed has the added advantage of increased hydropower development – the Jordan terminates 400 m below sea level. If a conventional energy plant were built in Lebanon in the context of regional development, that country might be persuaded to allow greater Litani water through the Qir'awn Dam, where most of the Litani is currently diverted to the Awali watershed for hydropower generation. Costs might be reduced by using existing infrastructure. The TAP line, an abandoned oil pipeline, runs from the Litani, up over the Golan Heights (where a section is currently being used for water delivery), as far as the Persian Gulf. As yet, Lebanon's position has been that the rights to Lebanese water should be retained for Lebanese use. If that were to change, the Litani is poised to be beneficial to any number of regions.

Second, extending the El-Arish pipeline from the Nile to Gaza or to the Negev Desert would allow the same exchanges throughout the region as the addition of Litani water. Increased water in southern Israel, for example, would free water from the northern Jordan to be delivered to Jordan or the West Bank. Although Sudan and Ethiopia may have legal rights to a say in any out-of-basin transfer, an exchange of water-saving technology for water between Israel and Egypt may reduce those claims and allow the water export to proceed for longer into the future (Dinar and Wolf 1992).

Third, Turkey, as the only country in the region with a substantial water surplus, is invariably named as a possible source of water imports. Along with the ''Peace Pipeline,'' several smaller projects have been advanced to bring Turkish water to any of a number of states in the area by pipeline, by barge, or in ''Medusa bags'' each holding 1 MCM. Another proposal, forwarded by Boaz Wachtel, is to pipe 1,100 MCM/yr from the Ataturk Baraji Lake from the Turkish GAP project to the Golan Heights, where an open channel would provide new freshwater supplies and hydropower for Israel, Syria, the West Bank, and Jordan, as well as acting as an antitank barricade on the border between Israel and Syria. Wachtel (1992) estimates the cost of such a project at US$5,000–$7,000 million.

Again, once additional water becomes available, the appropriate exchanges could be made from sources to users, so that the most efficient regional distribution is achieved. However, because these surpluses are extremely tenuous, in terms of both engineering and polit-

Table 4.3 **Viability of interbasin water transfers**

Method of water transfer	Viability measure		
	Technical[a]	Economic[b]	Political[c]
Status quo[d]	0/0/na[e]/0	0.00	1.00
Litani to Israel	100/good/fair/na	0.14	0.10
Nile to Jordan watershed			
Partial coalition			
Nile to Gaza	500/fair/good/na	0.20	0.89
Nile to Israel	500/fair/good/na	0.20	0.23
Grand coalition	500/fair/good/na	0.20	0.73
Turkey to Jordan watershed			
Wachtel Plan	1,100/fair/good/na	na	0.05
Medusa bags	500/fair/poor/na	0.21	0.90

Sources: Litani to Israel transfer, Kally (1989); Nile to Jordan basin, Dinar and Wolf (1992); Wachtel Plan, Wachtel (1992); Medusa bags, Cran (1992).

a. Quantity (MCM/yr)/quality (ppm salinity or pollutants)/reliability (flux)/environmental impact (relative, or cost).

b. Efficiency (price [US$]/$m^3$).

c. Results of the PRINCE Political Accounting System (see appendix IV).

d. No cooperation.

e. na, not assessed.

ical viability, it is recommended that these new sources be considered short-term measures only.

To explore the most viable options for interbasin water transfers, as well as to provide an example of how the evaluation framework might be approached quantitatively, an assessment of the above projects is provided in table 4.3. Values for a Litani to Israel transfer are taken from Kally (1989). The Nile to Jordan basin water transfer has three options – partial coalitions, with (a) Nile water to Gaza, or (b) Nile water to Israel; and (c) a Grand Coalition, with the cooperation of Egypt, Gaza, Israel, and the West Bank. The values are taken from Dinar and Wolf (1992). Two Turkey to Jordan basin options are offered – the ''Wachtel Plan,'' with a canal/antitank barrier, and transporting water by barge, in ''Medusa bags.'' Values for the two options are from Wachtel (1992), and Cran (1992), respectively. The option of ''status quo'' (no cooperation) is included for comparison.

As described in the previous chapter, quantity is measured in MCM/yr, quality in ppm salinity or pollutants, reliability is the flux in the system, and environmental impact can be measured relatively or in dollar amounts. Efficiency is calculated as price per cubic metre,

and political viability is taken as the results of the PRINCE Political Accounting System, as described in appendix IV. Some qualitative terms are used for values that are not available.

The above evaluation suggests that in terms of technical and economic assessments, all the proposals are fairly similar. Although the Litani to Israel transfer provides less quantity than the others, and then only to Israel, it does so at less expense. The other exception is the Wachtel Plan. Although it offers twice as much water to the region as any of the others, and five times as much as a Litani to Israel transfer, the Wachtel Plan is both technically and politically the most complex. Also, though no cost per cubic metre is available, at US$5,000–$7,000 million in construction costs, the Wachtel Plan is probably the most expensive proposal as well.

The PRINCE Political Accounting System reflects the political differences for each of the options. As we can see, the more political entities involved, the lower the likelihood of success. The countries involved in possible cooperation also make a difference. It is suggested that bilateral cooperation between Turkey and Israel, who enjoy warm diplomatic relations, is more likely than cooperation between Israel and Egypt, which is restrained by legal agreements with Sudan. This option in turn is more likely than any arrangement between Israel and Lebanon, which is politically influenced by Syria. Any arrangement involving Syria and Israel together is considered highly unlikely at this point.

On the basis of this preliminary evaluation, which is based on extremely tenuous information, we might prioritize the options as follows:

1. Turkey to Israel, Medusa bags;
2. Nile to Gaza;
3. Nile to Gaza, Israel, and, by exchange, to the West Bank;
4. Nile to Israel;
5. Litani to Israel;
6. Turkey to Israel, Syria, Jordan, and the West Bank, Wachtel Plan.

Again, it should be stressed that this evaluation process should be iterative. A change in any of the parameters evaluated would change the ranking of priorities.

Large-scale regional desalination projects

Large-scale desalination projects have often been looked to for a ''quick fix'' of regional water scarcity in the Middle East. Any large-scale desalination projects will have to pass the difficult triple test of technical (including environmental), economic, and political viabi-

lity. Past attempts at large-scale water projects, both unilateral and cooperative, may provide useful clues to guide successful implementation in the future. Two such projects, the Agro-Industrial Complex, a US-supported cooperative project for the Middle East studied in the 1960s, and the Med–Dead Sea Hydroelectric Canal, which the Israelis studied in the 1980s, may provide useful models. The best aspects of the two types of projects, neither of which were built, might be combined and expanded for a new hybrid project for water and power for the 1990s, if technical and political developments allow. These aspects would include the regional approach and emphasis on international cooperation of the Agro-Industrial Complex and the comparatively safe energy applications of the Med–Dead Canal. The project, in turn, could be incorporated in a badly needed regional water development plan for the Middle East. Such a project is offered as an example of cooperation-inducing design, in the next section.

Cooperation-inducing implementation: Three examples

Given the vital need for a regional water development plan that would incorporate the political realities of the region, as well as the limitations imposed by economics and hydrology, possible steps that might be taken have been described in the above four-stage process for regional water development. Even if the riparians of the Jordan River watershed were to agree to the above process, only the regional water crisis – that is the lack of water in basin for anticipated needs – would be addressed; the water conflict – the political tensions attendant on the lack of water – would remain.

The foregoing survey of history, as well as the lessons provided in the sections on political science and ADR, suggest that cooperation-inducing strategies might be incorporated in the process of implementation as well. This section offers three examples of cooperation-inducing implementation. General guidelines, as formulated in chapter 3, include the following:

1. Control of one's major water sources is of primary concern to each of the riparian entities, and is necessary both to address past and present grievances, and as a prerequisite for market-driven solutions. As such, an initial ''dis-integration'' of the basin is recommended.
2. Opportunities for cooperation may be hidden in the details of each entity's bargaining mix.

3. Water basin development can then proceed from ''small and doable'' projects to ever-increasing cooperation and integration, remaining always on the cutting edge of political relations.

The three examples of cooperation-inducing implementation are taken from throughout the four stages of basin development described above: (1) towards an agreement for sharing existing resources; (2) cooperation over the mountain aquifer, and (3) a cooperation-inducing regional desalination plan.

Towards an agreement for sharing existing resources

The first stage of the four-stage process for water basin development is the need for an agreement on allocation of the existing resources. This was described as necessary both to address past and present grievances, and as a prerequisite to market-oriented solutions to water use efficiency. Although special envoy Eric Johnston negotiated such an agreement between Israel, Lebanon, Syria, and Jordan in an extensive process from 1953 to 1955, the agreement was never ratified. Forty years later, the agreement is somewhat outdated. The Palestinians were not considered a separate entity at the time and, consequently, they received no explicit allocation. Furthermore, the issue of groundwater, which has since become a point of contention, was not considered. In this section, I consider updated guidelines for allocation of the water of the Jordan River watershed. Emphasis is on Jordan, Israel, and the Palestinians of the West Bank and Gaza.

One issue at the heart of the negotiating process for allocations will be each party's definition of ''equity,'' as perceived by the attending parties. As ''equity'' is a vague and relative term in any event, its criteria are particularly difficult to determine in water conflicts, where international legal guidelines are poorly developed. Some of the criteria by which water conflicts have been assessed by legal authorities and in past negotiations include the following (taken from Bilder [1975], Cano [1989], Caponera [1985], Rogers [1991], and the Israel/Palestine Center for Research and Information [IPCRI] [1990–1991]).

1. Legal
   - Absolute sovereignty. A state has absolute rights to water flowing through its borders.
   - Riparian rights. Any territory along a riverway has rights to a relatively unchanged river.
   - Prior appropriation. ''First in time, first in right.''

- Optimum development of the river basin. The basin is considered a single hydrologic unit, and it is incumbent upon states to develop it accordingly.
- Reasonable share, equitable use, or relative sovereignty. Provides rights dependent on some or all of the above criteria, but is difficult to interpret.

2. Other measures
   - Economic efficiency. The ability to achieve the most return per unit water achieves ''rights'' through the invisible hand of the free market.
   - Rights proportional to the amount of water source within a nation's territory.
   - Equal per capita allocation to each of the riparian states.
   - In absence of any agreement on the above, force is sometimes used to achieve ''equity,'' at least as perceived by the party with the greater power.

The issue is further convoluted by the question of whether or not areas within a riparian state but outside the watershed boundary should be included for consideration.

Another important issue to be taken into account for successful negotiations is the matter of ''control.'' Water for personal needs and subsistence agriculture is clearly a most fundamental human need. In addition, much of a nation's economy can depend on a reliable source of water for export agriculture and industry. Consequently, the need for control of a stable source of water in an environment of hostile co-riparians can be urgent and absolute in relevant foreign policy decisions, and many of the obstacles to past water negotiations have been over this issue. During the Johnston negotiations, the Unified Arab position strenuously resisted any storage of the Yarmuk (which rises in Syria and Jordan) in the Sea of Galilee (lying wholly in Israel), although it was shown to be less expensive than building a new storage facility. Israel, in turn, objected to international control of annual allocations as an ''infringement of sovereignty.'' In more recent years, Israel has resisted proposals of water imports from such sources as Egypt and Turkey. Reacting to President Anwar Sadat's offer in 1979 to bring Nile water to the Negev Desert, the then Israeli Minister of Agriculture, Ariel Sharon, expressed a common aversion to the lack of control, as mentioned earlier: ''I would hate to be in a situation,'' he is quoted as saying, ''in which the Egyptians could close our taps whenever they wished'' (cited in Spector and Gruen 1980).

In short, between the two formidable issues of equity and control, negotiations would be contentious with conflicting claims and criteria for evaluation. The approach, outlined below, that Eric Johnston took to these two issues might offer lessons to current negotiations.

EQUITY. Johnston measured equity by what each state could reasonably use in the future on its irrigable land within the watershed line. This gave a concrete measurement by which his proposed allocations were achieved. Once the allocations were reached, each state could do what it wished with the water, including transferring it out of basin. This was not only an acceptable formula to the parties at the time but it allowed for a breakthrough in negotiations when a land survey of Jordan concluded that its future water needs were lower than previously thought. Agricultural water needs would no longer be as relevant a measure, with current emphasis on meeting future personal consumption and industrial requirements, but the concept of developing an objective measure for future demand is still applicable.

The ultimate measure of water demand is that for personal consumption, and populations are beginning to approach the point where *all* of the annual renewable supplies of a watershed will be allocated first to that need (Shuval 1991; interview, Meier Ben-Meier, December 1991). Figure 4.1 shows schematically the attendant conceptual shift in water management from the traditional model, where water from the primary source is used once and then lost, to an intensive management model, where water is used sequentially for several needs and managed constantly for the most appropriate use for its quality.

Natural annual water availability in those entities dependent on the Jordan River watershed – Israel, Jordan, the West Bank, and Gaza – is approximately 2,500 MCM/yr. This amount reflects the natural supply of renewable fresh water (what might be called the primary water source). It includes usable rainfall, melted snow, and the renewable recharge to shared aquifers, and excludes secondary sources such as reclaimed waste water, desalination, fossil or saline groundwater, and freshwater aquifers lying wholly within any state. At an annual allocation of 100 m^3 per capita, all of this amount would be used first for personal consumption when the combined Israeli/Jordanian/Palestinian population reaches 25 million, as is expected by the first half of the twenty-first century. Water for agriculture and industry then will

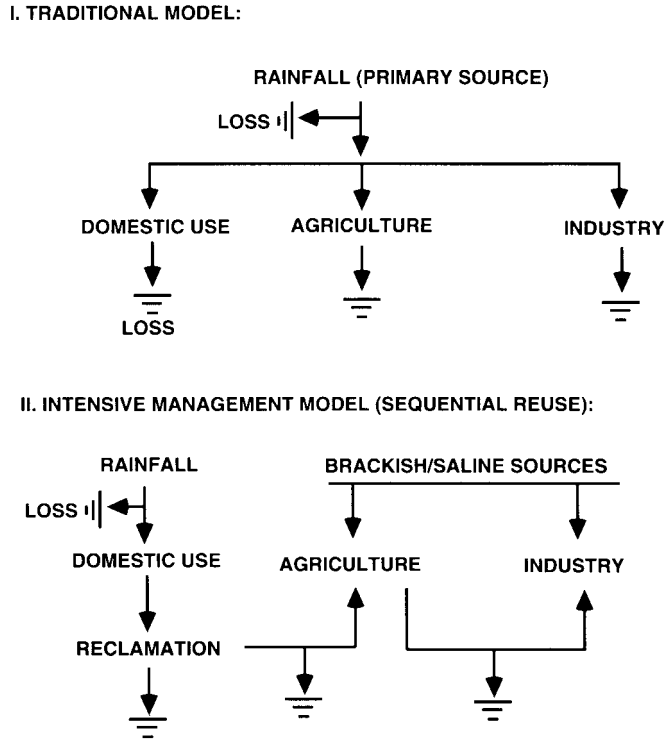


Fig. 4.1 **Traditional and intensive water management**

have to come entirely from waste-water reuse, desalination, or water transfers.

It is not difficult to calculate population projections that will provide percentages for each entity of the total population, and then to apply those proportions to the primary water source. In the above example, when the combined population reaches 25 million, the population by entity will be about 10 million each in Israel and Jordan, 3 million in the West Bank, and 2 million in Gaza. Applying these proportions to the water supply, 1,000 MCM/yr would be allocated to each of Israel and Jordan, 300 MCM/yr to the West Bank, and 200 MCM/yr to Gaza. The comparison between current and proposed allocations is shown in table 4.4. It should be stressed that these values are estimates for illustration only. The actual allocations would have to be negotiated between the parties involved. In addition, the allocations are based on average amounts, and do not consider variability in water quality and development costs for each source, nor do they

Table 4.4 **Estimated allocations of primary source of water supply on the basis of population projections**

	Allocation (MCM/yr)	
Entity	Current	Proposed
Israel	1,500	1,000
Jordan	800	1,000
West Bank	110	300
Gaza	60	200

address the issue of storage. These aspects, too, would have to be negotiated between the parties.

These allocations could be reached gradually, allowing each entity both time and incentive to develop the most productive combination of reuse and new sources to provide for agricultural and industrial needs. Furthermore, once these allocations are established as property rights, international water markets or technology-for-water transfers can be established to allow market forces to help determine the most efficient water distributions and applications. As mentioned earlier, water *per se* is a zero-sum commodity, while the benefits that water can provide are variable, and therefore tradeable for integrative (''win–win'') solutions. As an example, the stated allocations would increase Palestinian water supplies and decrease those to Israel. Since Palestinians currently use significantly less water per capita than Israelis, they could sell surplus supplies to Israel or exchange them for water-saving technology, arrangements that would encourage efficiency on both sides. Water negotiations would be combined with issues of immigration and population growth, which will have to be dealt with in any event in the course of regional peace talks.

CONTROL. Johnston also addressed the issue of control, eventually allowing for as much of a state's water allocation as possible to originate within its borders. For example, Israel's allocation came mostly from the Jordan River headwaters, while Jordan's share was to come from the Yarmuk. He also addressed the related issue of variability in annual water supply by determining which of the participants' water source was defined as ''residue,'' that is, to be allocated after the other states had received their share.

Although these allocations will have to be newly negotiated, the principles of the original negotiations could be retained. For exam-

Table 4.5 **Safe yield and current use of components of the mountain aquifer**

		Consumption (MCM/yr)	
Aquifer	Yield (MCM/yr)	Israelis	Palestinians
Western	320	300	20
Eastern	125	25	50
North-east	140	120	20

ple, the bulk of the water allocated to Israel and Jordan could still originate from the Jordan and Yarmuk, respectively, and the majority of Palestinian sources would come from the groundwater that their territories overlie.

Negotiations over the mountain aquifer

As outlined in the description of each party's initial position at the beginning of this chapter, as well as in chapter 2, one of the most contentious issues between Israelis and Palestinians is the status of the mountain aquifer. By closely examining the claims of both Israel and West Bank Palestinians to this groundwater, insight might be gained on how to resolve this aspect of the water conflict.

As noted earlier, the mountain aquifer is actually three hydrogeologic units, all three of which recharge in the Judaean Hills on the West Bank – the western aquifer, which flows west to Israel and the Mediterranean; the eastern aquifer, which flows towards the Jordan River; and the north-east aquifer, which flows towards the Jezreel Valley. Their annual ''safe yield'' and current use is as shown in table 4.5. Total consumption within the west Bank is 35 MCM/yr, mostly from wells, for Israeli settlements, and 115 MCM/yr, from wells and cisterns, for Palestinians.

The initial claims by each party for these aquifers, including legal ambiguities, are detailed in chapter 2, as is a note of warning on the concept of ''safe yield'' (see chap. 2, footnote 1). In general, the positions can be summarized as follows.

Israel considers its historic rights to the water it currently uses to be irrevocable. Israel has been pumping the western aquifer from its side of the Green Line since 1955, and views with trepidation the loss of upgradient control of this aquifer. Measures taken to restrict Palestinian pumping on the West Bank are viewed as defensive, necessary to

protect the quantity and quality of Israeli wells. The Ministry of Agriculture has claimed that control of the water resources on the entire West Bank is necessary to protect Israeli water. The total amount claimed is 445 MCM/yr, together with control of water resources development over the entire West Bank.

Palestinians have claimed first right to all of the water that originates on the West Bank (see, for example, Zarour and Isaac 1992) and have objected to Israeli controls. Palestinians were also to receive 70–150 MCM/yr from the Jordanian share of the Johnston negotiations. The total amount claimed is 655–735 MCM/yr, together with control over water resources development over all of the West Bank.

The issue of water quantity was dealt with in the previous section. It would be difficult to accept either the Palestinian claim to all of the water originating on the West Bank, or the Israeli claim to 75 per cent of it. I suggest again future per capita needs as a basis for both claims. By this token, West Bank Palestinians would gain rights to a total of 300 MCM/yr, compared with the current use of 115 MCM/yr. Israel would go from a total current allocation from all sources of 1,500 MCM/yr to 1,000 MCM/yr, the loss to be made up through desalination, waste-water reclamation, interbasin transfers, or water purchases. Cuts would be made from a variety of sources, as described below.

The remaining issue is control. In chapter 2, I examined the Israeli claim that control over all of the West Bank is necessary for its ''water security'' and found the claim hydrologically lacking. Because of the flow of groundwater, and the depth to the water-table at the water divide, it would be difficult for Palestinians to impact Israeli wells in the western aquifer if they acquired control to the eastern aquifer. Further, because of the great depth of the water-table in the Judaean Hills, Israeli water managers have suggested that control might be relinquished to as much as two-thirds of the area overlying the western aquifer, with their water supply still guaranteed.

In turn, the Palestinian claim to control of the water resources of the entire West Bank is also difficult to accept. Just as Israelis must come to accept the Palestinian need for control, Palestinians must recognize Israeli concerns for water security. If the above water allocations are accepted, at least 400 MCM/yr of Israeli water would still originate on the West Bank, and Israel would be remiss in not guaranteeing its future supply before relinquishing control.

Several steps might address the twin concerns of Palestinian control and Israeli water security. The first might be to emphasize surface water development on the West Bank. As mentioned, Jordan still ''owes'' the West Bank 70–150 MCM/yr from the Johnston accords. Although Jordan has its own water deficit, this water might be acquired through a series of water exchanges, as described below.

Another step might be to take advantage of topography to give mutual guarantees of Palestinian and Israeli supplies. As mentioned earlier, because of the disparate depths to the water-table near the Mediterranean coast and in the Judaean Hills, and the difference in efficiency between wells and surface-delivery systems, it is cheaper to pump water from the mountain aquifer at the Israeli wells and then pipe it to the hills of the West Bank, than it is to pump directly in the hills. This suggests a mutually dependent system of water delivery, where Palestinian water is pumped at Israeli wells, then piped to Palestinian users. Since the Palestinians are upgradient and can threaten Israeli supplies, both parties would have a ''hand on the tap,'' and therefore each would have an incentive to cooperate.

The final step to address the issue of control would focus on the problem of water quality and the threat to its degradation. Israeli concerns over upgradient Palestinian control extend beyond threats to water quantity and include dangers to water quality. Palestinian industrial development could threaten the quality of water in Israeli wells, even unintentionally; however, as for water quantity, some sites on the West Bank are more susceptible to groundwater contamination than others. A joint Israeli–Palestinian committee to establish zones of groundwater susceptibility, investigating soil type, rock formation, and groundwater flow movement, might allow Israel more confidence to release control. In turn, it might provide Palestinians with a useful basis for a plan for development on the West Bank, which would help protect their own water supplies.

Any combination of the above steps for addressing both Palestinian concerns for control and Israeli needs for security could help break a difficult impasse. Each approach might also have repercussions on other water conflicts. Some possible combinations are outlined below.

The first possibility is that Israel gives up claim to the eastern side of the mountain aquifer in favour of Palestinian control. In exchange, Jordan accedes to some Israeli claims on the Yarmuk (which can then be supplied by gravity to Israeli settlements in the Jordan valley), and Syria agrees to allow more Yarmuk water to flow to Jordan and Is-

rael. Turkey might increase Euphrates flow to Syria by the relatively small amount that would be foregone.

Alternatively, Israel waives its claim to the Yarmuk in exchange for Jordan retaking responsibility to supply the West Bank with ample surface water for its development needs, which in turn alleviates Israeli concerns over Palestinian groundwater exploitation.

Either of the above agreements would allow the Unity Dam to proceed. During construction, Israel allows Jordan to store Yarmuk winter run-off in the Sea of Galilee, thereby not only allowing a stable Jordanian water supply during the dry summer months but also reducing the salinity levels in Israel's main reservoir.

Negotiations would then focus on the western mountain aquifer, and on methods of joint inspection and planning between Israelis and Palestinians, as described earlier.

A Med–Dead or Red–Dead Canal as a cooperation-inducing desalination project

A final example of cooperation-inducing design involves plans for a large-scale regional desalination project. In guidelines from history we noted that ''the more complex a project is technically, the more complex it is politically.'' Although at first pass the project that follows is fairly complex, it will be argued that, if attention is paid to detail, it can be designed as a series of smaller projects, each with the potential to be developed more fully and with increasing cooperation as technical and political developments occur.

What follows is a conceptual proposal for a regional desalination complex, including sections on (1) background (the Agro-Industrial Complex [1960s] and the Med–Dead Canal [1980s]), (2) project description, (3) economic considerations, (4) environmental impacts, and (5) implementation in the framework of a regional water development plan.

Historical background: The Agro-Industrial Complex and the Med–Dead Canal

Immediately after the Six-Day War of 1967, Dwight D. Eisenhower (by then a private citizen), Lewis Strauss of the Atomic Energy Commission, and Alvin Weinberg, Director of the Oak Ridge National Laboratories, developed a ''water for peace'' proposal on a massive scale, including a series of nuclear desalination plants in the Middle East that would provide power and water for immense agro-indus-

trial complexes, to ease the political tensions caused by refugees and water scarcity (Oak Ridge National Laboratories, Summary Report 1971; Strauss 1967).

The plan was given a boost by Senate Resolution 155, sponsored by Senator Howard Baker, which supported development at three likely sites in Egypt, Israel, and Jordan. Recently declassified reports show that a fourth site, at Gaza, was also planned in conjunction with a project for refugee resettlement (Oak Ridge National Laboratories, Gaza Area 1970) (see appendix I, map 26.) As described earlier, the plan faltered on political and economic grounds, along with the dangers of introducing nuclear technology to the region. Nevertheless, two years of cooperative research between Americans, Arabs, and Israelis, showed that, on the technical level at least, cooperation over regional water resources and planning was possible.

Fifteen years later, in the early 1980s, the Israelis began planning a canal designed primarily for hydropower by bringing Mediterranean sea water across the Negev Desert and under the Judaean Hills to drop it 400 m to the Dead Sea, the lowest point on the earth. The 800 MW of electricity that would have been made available by this Med–Dead Canal would, by itself, just have been worth the cost of the project, estimated at US$1,500–$5,000 million, but the benefits of several ancillary projects, made possible by the salt water for cooling or artificial lakes, added viability to the scheme (Mediterranean–Dead Sea Company Ltd 1983). That project was finally shelved, mostly on the question of the final cost. Although it was an exciting project, the Med–Dead Canal focused on power generation, rather than water, and was politically unilateral, bringing benefits only to Israel (see appendix I, map 32). In fact, Palestinians objected to the intake, proposed for Qatif, because of a belief that it would further integrate Gaza with Israel. Jordan protested about the anticipated rise in the level of the shared Dead Sea, and three separate resolutions condemning the proposal were brought before the UN General Assembly. Jordan took the opportunity, however, to investigate the possibility of a similar (and even more short-lived) proposal of its own – the ''Red–Dead'' Canal.

Project description

The best aspects of the two types of projects – the regional approach and emphasis on international cooperation of the Agro-Industrial Complex and the comparatively safe energy applications of the Med–Dead Canal – might be combined and expanded for a new hybrid pro-

ject for water and power for the 1990s. The project, in turn, could be incorporated in a badly needed regional water development plan for the Middle East.

The core of the complex would be either a Med–Dead or a Red–Dead Canal, with a new emphasis on desalination fuelled by hydropower and augmented with solar and conventional energy generation. Whereas the original plans were focused on power generation and unilateral development, a new approach would make available power and water, both fresh and salt, for agriculture, fish and algae ponds, industry, and even recreation on artificial lakes, in sparsely populated areas, to the benefit of populations from Egypt, Israel, Jordan, Gaza, and the West Bank. The scope of the project could be expanded, depending on cost, financing, and on which of the countries and territories of the region would become involved, with greater benefits accruing with larger scale. Although more groundwork has been done on the Med–Dead route, most of the components of the project are feasible with either location, should the Red–Dead route become more technically or politically attractive. Either way, the focus on water, rather than on power, and an emphasis on cooperative regional development over unilateral benefits, may add both economic and political viability to the original evaluations.

The Med–Dead salt-water canal would have been located in a particularly opportune position to foster regional cooperation (see appendix I, maps 4 and 32). The intake would have been located in or near the Gaza Strip – the site both of some of the most squalid and densely populated refugee camps in the world, and of severe groundwater overpumping. The canal would have run parallel to the Egyptian–Israeli border. Were these two countries to set aside some of this sparsely populated land, power and water from the project could be routed to a trinational (Egyptian/Israeli/Palestinian) agro-industrial site in the Negev–Sinai deserts. A Red–Dead route would likewise provide the opportunity for a Jordanian/Israeli/Palestinian complex. Ample agricultural land exists along both routes, limited currently by the lack of a freshwater supply. A large plain south and east of Gaza and El-Arish, the Plain of Pelusium, was one site suggested for an agro-industrial complex (and, in 1902, as the possible site of a Jewish State) because of its suitability for a wide variety of agriculture. Similar tracts exist further inland in both the Sinai and Negev deserts if the intake were placed at Qatif, as planned for the Med–Dead Canal.

For a Red–Dead route, agriculture and industry could be developed in the Arava Valley on both sides of the Israel–Jordan border. The minimal development in this region has been limited only by a steady supply of fresh water. Both Israel and Jordan are currently attempting to overcome the natural limits through water transfers: both foresee this area as the eventual terminus of their respective national water carriers. Joint development and a local water supply could eliminate the need for redundant planning and piping.

Either project, as originally envisioned, would be ideally suited for clean power generation. Not only could clean hydropower be generated at the Dead Sea, but this could be augmented by high-temperature solar generation of electricity. The region has 300 cloudless days a year.

The crucial contribution of the project, however, would be water – with power being a useful by-product. Current research into the concept of solar ponds suggests that water of two distinct salinities will trap heat in the lower, denser layer. The heat differential can be exploited to power turbines, or to fuel distillation desalination. The relatively less-saline water of the Mediterranean or Red Sea would provide the cover to a lower, more saline level of Dead Sea water. A 5 MW demonstration plant recently went on line at the Dead Sea. One estimate is that the Dead Sea itself could support a 450 km^2 solar lake, operating a 2,500 MW power plant, if the less-saline water were made available. If a dual-purpose plant for power generation and distillation desalination were to be built at the intake (as proposed along the Israeli coast or at Aqaba in any event), the resulting brine from the desalination process could be used for smaller self-perpetuating solar pond/desalination plants all along the way to the Dead Sea. The project could thereby grow as power or water demand increased. The brine, which is a by-product of any desalination process, would find use in the potash and salt works of both Israel and Jordan, already active at the Dead Sea.

The 400 m drop at the Dead Sea could be used not only for hydropower generation, but, in conjunction, could also be exploited for reverse-osmosis desalination – a pressure-dependent method using selective membranes – adding even more fresh water as output. The cost of desalinated water would be sharply reduced if brackish water were used instead of sea water. As it happens, brackish fossil aquifers have recently been discovered in this area, in and below the Nubean sandstone formation underlying the Negev–Sinai deserts, which could be tapped for at least 300 MCM/yr into the twenty-first century. Re-

cent research at the Ben-Gurion University of the Negev suggests that even more brackish-to-saline groundwater may be available in these aquifers than previously thought.

If enough fresh water became available, it could be exported to other areas of chronic shortage such as the West Bank or Jordanian cities. The water itself need not be piped to these regions; rather, water provided at Gaza or in the Negev would allow for a water reallocation from the northern sources of the Jordan River, abundant but currently fully exploited, to be substituted. Additional Yarmuk water could go to Amman, for example, or more of the storage in the Sea of Galilee could be allocated to Haifa or Ramallah. Cooperative planning would allow for greater alternatives for such reallocations and enable the most efficient and economical approach to be developed.

Such a Med–Dead, or Red–Dead, agro-industrial project would take advantage of sparsely populated lands for agricultural and industrial production utilizing two ports (Gaza and/or Eilat/Aqaba), add impetus to regional cooperation and refugee resettlement, and help to alleviate the area's water shortage.

Because of the currently relatively high cost of water produced through desalination, the complex might become a showcase for the cutting edge of desalination techniques and efficient water use. If these techniques were investigated jointly between researchers from the region and abroad, the results could have application in arid regions around the world. Employment at all levels would also be provided for dangerously underemployed populations, such as Palestinians from Gaza and the West Bank and immigrant Israelis from Ethiopia and the Soviet Union. New sources of water and power would provide opportunities for a range of ancillary projects, from inland power plants to artificial lake resorts to salt-water aquaculture. These projects could induce population inward away from the crowded coast and might eventually support entire towns.

Either route would face clear obstacles in terms of political viability. One optimistic note, however, is that proponents of both the Med–Dead and the Red–Dead Canal include prominent nationalists on both sides of the Jordan River. The former Israeli Minister of Science and Technology, Yuval Ne'eman of the right-wing Tehiya party, has been actively supporting the Med–Dead Canal since its inception, while Jordanian Crown Prince Hassan has been a principal advocate of the Red–Dead Canal.

Economic considerations

The project, as described, would not be cheap. The original agro-industrial complex was estimated at about US$1,000 million (1967), and this was before nuclear plant decommissioning costs were included in the analyses. The Med–Dead Canal costs were estimated as from US$1,500 to US$5,000 million (1982), even without the ancillary projects. Nevertheless, both original projects were calculated to break even at least, in benefit–cost analyses. It is assumed that a co-operative project, presented in the context of a Middle East working towards peace, would provide for several factors, outlined below, to help tilt the balance in the project's favour.

First, such a project would undoubtedly spark the interest, and induce the financing, of agencies and individuals interested in fostering Middle East cooperation. US, European, or World Bank grants or soft loans would add economic viability to the project. Adding ''induced cooperation'' as a benefit to water project evaluations (as yet unrecognized, at least by the World Bank) would help even further. The joint research and development components for desalination technology and efficient water use would qualify the project for the Middle East Regional Cooperation (MERC) Program of USAID.

Second, even without an anticipated Marshall Plan for a Middle East at peace, one might assume a certain ''peace dividend'' from countries no longer locked in a regional arms race, which might be reallocated to peaceful development. Water resource development is high on the list of priorities for all parties in the region, particularly in the light of both imminent and ongoing influxes of immigrants and refugees. Pooled investment resources and planning would allow for greater flexibility in design and, consequently, for greater economic efficiency in development.

Third, if Saudi Arabia or other Gulf states backed the scheme, their support might come in the form of inexpensive oil or natural gas for conventional power generation, with co-generation of desalination capability. This could substantially reduce the cost of these components of the project.

Fourth, although a 30-year project life was assumed in the calculations for the original Med–Dead Canal, there is no reason that this has to be the case. The flow rate of the canal will have to be cut back after a 20-year ''filling period'' when the Dead Sea reaches its historic level, but even then, a flow of 1,250 MCM/yr, which will just match evaporation rates, will not require too sharp a drop in power

generation. Unlike a nuclear power plant, or even a dam, a Med–Dead or Red–Dead Canal, with the proper maintenance, could function indefinitely. Once the project has been amortized, power and water generation would become extraordinarily inexpensive (after Weinberg 1985).

Environmental impact

As with all grand schemes, the environmental assessments would need to be honest and rigorous. Many such projects have passed muster with benefit–cost analyses conceived by the proponents, which deliberately or inadvertently ignored environmental costs. It is heartening that those who performed the environmental impact statement for the original Med–Dead Canal seem to have had their hearts in their work. ''With the onset of fall,'' they wrote of the Jordan Valley plants, ''the leaves turn yellow and colour the river landscape. The Jordan tamarisk is evergreen and colours the landscape with its pinkish-white blooms in the spring and summer . . .''

But the risks will come not just directly, from the movement of salt water through fragile desert ecosystems, but also indirectly, from inland population movement or from the necessary infrastructure, for example. Other risks include the unknown consequences of mixing water from two chemically distinct bodies – one researcher suggests that the result may be floating clumps of plaster of Paris in the Dead Sea. These risks will have to be accounted for throughout the project's implementation. A key element would be to include costs of environmental externalities from the beginning.

One clear environmental benefit of the project would be the restoration of the Dead Sea to its historic level. Before the national water projects of Israel and Jordan began diverting fresh water upstream in the 1960s, the inflow to the Dead Sea of fresh water just matched the rate of evaporation, and the lake level remained fairly constant. Since that time, the level has dropped 10 m, with an accompanying reduction in surface area. Early diversion schemes, from the turn of the century onward (Theodore Hertzl described a Med–Dead Canal in *Altneuland*), each included an attendant project to ameliorate the effects of the loss of inflow to the terminal lake. Without such a project, the Dead Sea will continue both to drop and to shrink. Although not much wildlife is being affected in the Sea – except for bacteria, the Dead Sea is appropriately named – potash works and health resorts on both shores have had to contend with the costs of an

increasingly distant shoreline. The lake would be restored after about 20 years, after which the amount of Mediterranean inflow would be pared back to equal the natural evaporation rate.

A dispersion of populations away from the congested and increasingly polluted population centres may also reduce health risks, especially from air pollution. Furthermore, the canal would allow an emphasis on solar desalination techniques, which are significantly less polluting than the planned alternative of coal-fired dual-purpose plants.

Environmental issues may help to determine the most desirable route for the project. It should be noted, for example, that the Med–Dead route would take a salt-water tunnel directly through the heart of the mountain aquifer of the Judaean Hills, on which the entire West Bank population is dependent and Israel relies for 40 per cent of its water supply. The possibility of potential environmental degradation effectively blocked an earlier proposal for a canal project through the Jezreel and Jordan valleys.

Cooperation-inducing stages of implementation in the framework of a regional water development plan

Once the legal and economic foundations have been laid for ownership and distribution of current sources, and the existing water supply and demand system is functioning at its most efficient (as described above), a project of the scope of a Med–Dead or Red–Dead Canal can begin to be implemented. At this point, too, it will be important to approach the project in stages, checking constantly for economic and engineering (including environmental) viability, and using each step to induce cooperation towards completion of the whole (see appendix VI).

The first phase can begin immediately, even as peace negotiations are in progress. A traditional (coal-fired) dual-purpose energy/desalination plant could be built in Gaza, the most parched of the areas under discussion. (The plant would be at Aqaba for a Red–Dead route.) Either way it would be designed both to be expandable, as need grows, and to serve later as the intake site for the Canal. Meanwhile, a pumped-storage facility would be built at the Dead Sea for Israeli or joint Israeli–Jordanian use. Such a facility pumps water up to a higher level of storage during off-peak hours, then generates hydropower electricity when demand is at its peak. This facility, too, can be designed to be incorporated in a Canal project, for hydro-

power generation with Mediterranean or Red Sea water. Both of these projects have already been in the planning stages for some time but coordination would be important to be able to proceed to the next phase.

Once the intake and the power generation facility are in place, even under different sovereignties, the incentive to connect the two and, later, to develop the consequent ancillary projects, would, one hopes, be powerful enough to help induce ever-increasing cooperation. Only when the two are linked would solar-pond desalination, (both at the Dead Sea and along the way), reverse-osmosis desalination, aquaculture, and inland industry, be feasible.

The Canal project could not only be ideally suitable for development in such a stepwise fashion, dependent on increasing confidence-building incentives, but it could also be expandable, designed to incorporate additional components as power and water needs grow in the future.

Conclusions: Water basin analysis and the Jordan River watershed

In this chapter, I have brought together the general approach to water conflict analysis, as developed in chapter 3, and the site-specific lessons learned from the history of the Jordan River watershed to try to gain insight into how both the water crisis – the shortage of water within the basin – and the water conflict – the political tensions attendant on the lack of water – might be resolved.

In the first section of the chapter, I looked at the initial conditions of the watershed – that is, who are the actors, and what are their political concerns and future water needs. I then applied the framework for water basin evaluation that was developed in chapter 3, to the Jordan River watershed. The evaluation suggested a four-stage process for water basin development.

The final section offered three examples of cooperation-inducing design. The first two dealt with proposed water allocations, one between all of the riparians dependent on the Jordan, and the second focusing on Israeli and Palestinian concerns regarding the mountain aquifer on the West Bank. The final example was a project for regional desalination that might be designed specifically to induce cooperation.

As mentioned in chapter 3, by combining lessons from a variety of

disciplines, new options for conflict resolution can become apparent. This chapter showed, through concrete examples of the planning and project opportunities suggested for a watershed enmeshed in deep and intractable conflict, how this may be so. Had I looked at the options for water transfers, for example, solely on the basis of the technical or economic merits, they would have looked fairly similar to each other. By including political viability, however, I was able to determine, at least tentatively, which plan suggested greater viability at this point in time. By including the guidelines from the history of the basin with lessons taught by ADR and political science, I was able to offer new approaches to resolve the fairly intractable positions on water conflicts that have lasted for decades.

Each of the disciplines that provides a measure for the analysis of water conflict offers an important component of an integrated evaluation of the options open to the riparians of a watershed under conflict. Working in concert, however, they offer new ways around entrenched impasses and may help to provide a path for ancient enmities finally to be laid aside.

5

Summary and conclusions

Water is an eloquent advocate for reason.
—Admiral Lewis Strauss

Where history has conspired to bring together two peoples sworn to seemingly perpetual hatred, nature has deprived the inhabitants of the most vital of all resources – water.

Nations have further conspired to make difficult the achievement of any cooperative solutions to the water shortage. But populations and economies in the region are growing to the point that people can no longer afford the proclivities toward conflict. Ironically, water may just be crucial enough an issue to force ancient enmities aside.

The Jordan River watershed, with all its competing national and economic pressures, provides a clear example of the strategic importance of water as a scarce resource. In this study, I have examined the relationship between the hydrology of a contentious international watershed and the people who are dependent on it, not just for their livelihoods but for their lives.

My goal was twofold: to contribute to the field of water resources management by developing an interdisciplinary framework for water conflict analysis and, by applying such a framework to a worst-case scenario of hydropolitical relations, to help offer solutions to the water conflict of the Jordan River watershed. My approach took a rather circuitous route, each step building on the other. In chapter 2, following the belief that good planning for the future is founded on a thorough understanding of the past, I examined the historic relation-

ship between the riparians of the Jordan River watershed. My findings were summarized as follows:

1915–1926. As the Ottoman Empire crumbled, the location of water resources, particularly the headwaters of the Jordan River, helped influence the boundaries of the French and British Mandates, later the borders between Israel, Lebanon, Syria, and Jordan (see appendix I, map 2).

1930s and 1940s. As populations and economies grew against hydrologic limits, so, too, grew the dangers of conflict over water. In the 1930s and 1940s, water was a focus of several reports that tried to determine the economic absorptive capacity of the land. These reports influenced British, Arab, and Jewish attitudes and policies towards immigration and land settlement.

1948–1953. Unilateral development, occasionally infringing on demilitarized zones, led to brief armed conflict between Syrians and Israelis.

1953–1955. Johnston negotiations. Eric Johnston, special envoy to US President Eisenhower, worked for two years to hammer out a water-sharing agreement between the riparians of the Jordan River. Although unratified for political reasons, the allocations agreed to by Arab and Israeli technical committees have generally held, with recognized modifications. Moreover, both Israel and Jordan agreed to send technical representatives to regular ''Picnic Table talks'' to determine day-to-day hydrologic operations. These talks, named for the site at the confluence of the Yarmuk and Jordan rivers where the meetings reportedly take place, have proved fruitful over the years in reducing minor tensions.

1964–1967. ''Water Wars.'' Beginning with the Arab decision to build an All-Arab diversion of the Jordan headwaters to preclude the Israeli National Water Carrier, and ending three years later when Israeli tank and air strikes halted construction on the diversion, this was a period of the most direct water-related conflict.

May 1967. Even as tensions were leading to the following week's outbreak of the Six-Day War, the US Departments of Interior and State convened an ''International Conference on Water for Peace'' in Washington, D.C., which attracted 6,400 participants from 94 countries, including Israel, Egypt (then the UAR), Jordan, Yemen, and Saudi Arabia.

June 1967. The Six-Day War changed regional riparian positioning. Israel acquired two of the three Jordan River headwaters, riparian

access to the entire river, and the recharge zone for mountain aquifers that currently supplies about 40 per cent of Israel's freshwater supply. Israel also destroyed the ''All-Arab'' diversion scheme of the Jordan headwaters, which would have reduced Israeli water by 35 per cent.

6 May 1977. Only ministerial-level meeting between Jordanians and Israelis to discuss joint watershed planning.

June 1982. The Israeli war in Lebanon reportedly had a minor hydrologic component.

1980s. Philip Habib helped to renegotiate Johnston allocations based on political and demographic changes, and tried to reach arrangement over ''Unity Dam.''

1967–Present. Ownership and management conflicts between Israel/West Bank, Israel/Gaza, Israel/Jordan, and Jordan/Syria.

1989–1990. Richard Armitage led US State Department indirect mediations to reach arrangement over ''Unity Dam.''

1991–Present. Impetus towards cooperation grows as regional peace talks develop.

I emphasized that none of the events described above happened in a political vacuum; that I had pulled only those events relating water resources to strategic decision-making out of the geopolitical maelstrom that makes up history. In a section on ''hydroconspiracy'' theories, I examined two theories, the ''hydraulic imperative'' and ''hydronationalism,'' which overemphasize water as a political force, and I found both lacking in hydrologic, and therefore in political, legitimacy.

The contention that I made regarding history was only as follows: (a) that water, as a strategic resource, has played a larger role in regional conflict than is generally known; (b) that water issues have precipitated some conflict and added to existing tensions in the region; and (c) that, occasionally, water issues have led to dialogue and attempts at cooperation.

Before proceeding to examine possible solutions to the Middle East water conflict, I offered some lessons that are informed by the history of the region and that could be useful in helping to formulate options for solutions to water-induced tensions, as follows:

1. *Observation*: The link between water resources and political alternatives is inextricable, with water scarcity leading directly both to heightened political tensions and to opportunities for cooperation.

Implication: For negotiations for a political settlement to be successful, they will also have to address solutions to the water conflict. Similarly, workable solutions to the problems of regional water shortage should also address the constraints posed by regional politics.

2. *Observation*: Water has historically been a factor in Middle East population distribution, including some border considerations.
   Implication: Successful negotiations over Jewish immigration or Palestinian ''right of return'' will have to incorporate the hydrologic limitations of the region.
3. *Observation*: No dispute between Arabs and Israelis, on water or on any other issue, has ever been resolved without third-party (usually United States) sponsorship and active participation.

and

4. *Observation*: The better a state's ''hydrostrategic'' position, the less interest it has in reaching a water-sharing agreement.
   Implication: Strong third-party involvement will be necessary for successful negotiations. The United States, or other sponsor of negotiations, should be prepared with a comprehensive strategy to induce cooperation, with particular emphasis on the upstream riparians.
5. *Observation*: Projects of limited and implicit cooperation have been successful even in advance of political solutions between the parties involved (e.g. Picnic Table talks, water-for-peace process). Nevertheless, explicit cooperation (e.g. Maqarin Dam), has not preceded political relations.

and

6. *Observation*: The more complex a proposal is technically, the more complex it is politically.
   Implication: In the context of regional talks, progress in negotiations over water resources may encourage dialogue on other, more contentious, issues. While water continues to ''lead'' the peace talks, projects to induce cooperation can be designed in a stepwise fashion beginning with ''small and doable,'' and leading to ever-increasing integration, always remaining on the cutting edge of political relations.
7. *Observation*: The two conditions at the core of political viability of water-sharing are *equity* of the agreement or project (that is, how much each participant gets), and *control* by each party of its own primary water sources (or, where it comes from, and whose hand is on the tap).

Implication: These two contentious issues will have to be addressed fairly early in negotiations. Unless a water-sharing agreement is worked out, with each party having its historic as well as future needs addressed, any negotiations over intricate cooperative projects will be building on accumulated ill will.

If one accepts that conflict can come about in part because of scarce water resources, and understands that as populations and economies continue to grow against hydrologic limits, so do the dangers, the logical question is, ''What is to be done?'' In chapter 3, I surveyed the literature of several disciplines to develop an interdisciplinary model for evaluating water-basin development and international water conflicts. I examined the disciplines of physical sciences, law, political science, economics, game theory, and alternative dispute resolution (ADR). I demonstrated, in the process, that each paradigm offers several useful tools and guidelines for water basin analysis, as outlined below, but that no single paradigm can provide all the answers necessary for a thorough study.

The physical sciences and technology offer several practical options, both for increasing water supply through such measures as desalination and waste-water reclamation, and for decreasing demand, through more efficient agricultural practices. Other technical options offered included other political entities (through shared information and technology) and other water basins (through water transfers).

A discussion of law revealed that, although assignment of water rights is requisite both for addressing past and present grievances, and for the establishment of water markets, the current state of international water law is not sufficiently developed to handle the task. Treaties, which can be negotiated using the principles of ADR and incorporating the guidelines of ''dispute systems design'' to encourage ongoing conflict resolution, are both site and conflict specific. Emphasis, therefore, might be placed on water-sharing and basin-development treaties, incorporating the contentious issues raised historically of ''equity'' (who gets how much) and ''control'' (from where, and whose hand is on the tap).

Political science suggests strategies for reducing water use within each country, informed by the relative salience and power of each of the groups of water users. A discussion of international relations suggested that there was some ambiguity over whether increased international integration of water planning and projects leads to increased stabilization, or, conversely, to increased points of contention. This discussion, combined with the lessons offered in the section

on history and in the field of dispute systems design, may reinforce the contention that both joint planning and joint water projects may be designed in a progression of cooperation toward the goal of ever-increasing integration, but starting with ''small and doable'' projects safeguarding the need for each political entity to have direct control over its own primary water source.

Economics offers the useful tools of the benefit–cost analysis, to help provide a method of comparative measurement of water projects, and the water market, which could help increase efficiency both within each entity and internationally. Prerequisites for the latter include allowing the price of water to reflect its true costs, and the clear assignment of water rights, both of which present difficulties under the current conditions. I have offered some policy guidelines as well, including that of allowing the price of water to reflect the costs associated with its development, treatment, storage, and delivery, as mentioned above, which might lead to greater efficiency of water use and greater incentive for water-saving research and even for international cooperation.

A brief discussion of game theory suggested that the field offers options both in terms of predicting the strategies that might be chosen by entities in competition over water, and for analysing the distribution of pay-offs for potential cooperative projects, for a variety of possible coalitions.

Finally, alternative dispute resolution offers guidelines for the process of resolving conflicts, from prenegotiation, to the process itself, to guidelines for implementation. Suggestions were made for when a party should, or should not, be at the negotiating table to begin with, and what can be expected, given each party's ''bargaining mix.'' The recently developed subfield of ADR, ''dispute systems design,'' offers methods to incorporate the dynamics of conflict resolution into the institutions that deal with conflicts. Some of these methods might be applicable to physical systems of cooperation as well.

Once I had surveyed the literature of each discipline, I formulated an interdisciplinary evaluation framework, listing the technical and policy options available to a watershed to increase supply or to decrease demand. Each option is evaluated for its technical, economic, and political viability, to allow a hierarchy of relative viability to be formulated. Such a framework, I argued, can be incorporated into the guidelines for an integrated process for water conflict analysis, which, I suggested, might proceed as follows (with rationale from ADR in parentheses):

1. Preliminary watershed analysis.
   (Identify Actors' Initial Hydropolitical Position)
   – Survey positions, salience, power (political science, ADR)
   (Insist on Common Criteria for Analysis)
   – Establish overall goals
   – Choose an appropriate planning horizon
   – Determine future water supply and demand
2. A framework for evaluation: options and viability.
   (Invent Options for Mutual Gain)
   – Determine technical and policy options
   (physical science, economics, political science)
   – Measure technical, economic, political viability
   (physical science, economics, political science)
3. Implementation.
   (Determine Feedback Mechanism for Perpetuating Agreement)
   – ''Dis-integrate'' resource control to address past and present grievances (history, law, political science)
   – Examine details of initial positions for options to induce co-operation (ADR)
   – Design plan or project, starting with small-scale implicit co-operation, and building towards ever-increasing integration, always ''leading'' political relations (political science, ADR – dispute systems design).

To match the technical, economic, and political dynamics of the system, I suggested that the process of analysis be both interactive and iterative.

In chapter 4, I used the model developed in chapter 3, and incorporated the guidelines from history outlined above, to suggest a process of ever-increasing cooperation for development of the Jordan River watershed. The preliminary watershed analysis calculated water supply and demand for a 30-year planning horizion. The framework for option evaluation suggested a four-stage process for regional development:

1. Negotiate an equitable division of existing resources.
2. Emphasize greater efficiency for water supply and demand.
3. Alleviate short-term needs through interbasin water transfers, if available and politically viable.
4. Develop a regional desalination project in cooperation-inducing stages.

The final section on implementation offered three approaches to cooperation-inducing project design for the basin. The first suggested methods for establishing both equity and control in a division of water rights to the major riparians of the basin – Israel, Jordan, the West Bank, and Gaza. The second focused on the difficult issue of the mountain aquifer on the West Bank, and ways that its quantity and quality could be utilized jointly by Israel and West Bank Palestinians. The last example offered cooperation-inducing design in a physical project for regional desalination.

This study has emphasized the importance of an interdisciplinary approach to water conflict analysis. In examining the conflict in the Jordan River watershed, any one discipline alone could miss opportunities to evaluate the options or to provide the necessary guidelines to reduce conflict. By interacting in an integrated framework, however, the disciplines build on each other to provide new opportunities to circumvent entrenched positions, and to allow options to induce cooperation.

By broadening the tools available to the water resources manager, this approach has also broadened the applications of some of the individual disciplines available to the resource manager. ''Dispute systems design,'' for example, which previously has been applied only to institutions and organizations, has been expanded to what I term ''cooperation-inducing design,'' a process to incorporate the lessons of ADR into physical systems of development plans or projects. The examples used involved water resources development projects, but the principles of ''dis-integrating'' control, examining the bargaining mix for clues to system design, and designing for ever-increasing cooperation and integration, might be applicable to any number of resource conflicts as well.

Finally, the issues are not of disciplines and theory, but of people and water. I have shown that, just as nations have shaped the flow of water, so, too, did water shape the face of history. As Middle East peace negotiations attempt to lift the riparians of the Jordan River watershed incrementally out of a perpetual cycle of violence, water can continue to ''lead'' the process towards ever-increasing cooperation.

The present hydropolitical situation in the Middle East is one of intricate problems and delicate solutions. The distribution of scarce water

resources in the Jordan River watershed is particularly precarious. The dangers of conflict and the opportunities for cooperation are both growing as annual supplies are currently being reached and surpassed. As Gideon Fishelson (1989) of the Armand Hammer Fund for Economic Cooperation in the Middle East writes:

> The danger of war over water hangs over the heads of the Middle East countries, yet there is also the possibility of cooperation and harnessing new technologies and capital that would prevent such wars. Solving the water issue is one of the essential prerequisites to achieving a meaningful and lasting peace in the Middle East.

Afterword: Parting the waters

> . . . but let justice roll down as waters, and righteousness as a mighty stream.
> Amos 5:24

There is a certain risk involved in attempting an analysis of contemporary issues – recent history seems to be developing a perplexing habit of outpacing publishing schedules. This work is certainly a case in point.

When I began looking at the relationship between water and politics in the Middle East more than seven years ago, I was fairly comfortable that I would be working in a static environment. Modern political conflict between Arabs and Jews in the region had gone back at least a century, after all, and ancient enmities between the two peoples dated back millennia. Certainly the world's intractable conflicts were increasingly finding hidden tractability – nuclear weapons were being destroyed in the crumbling Soviet empire, Blacks were gaining suffrage in South Africa, and pieces from the Berlin Wall were being sold as paperweights in finer boutiques. But the Arab–Israeli conflict felt different; almost divinely intractable.

It wasn't. What I first asked as a hypothetical academic question back in 1988, ''What if there were a peace process – what would the water issues be and how might they be resolved?'' has been superseded by a blur of stunning images. Yitzhak Rabin and Yassir Arafat shaking hands on the White House lawn. King Hussein at the controls of a Royal Jordanian jet circling Jerusalem, being wished Godspeed by Shimon Peres from below. Barbed wire and mine fields being cleared from the banks of the Jordan River to allow the people of the region to cross more freely.

The question I posed is no longer hypothetical. There *is* a peace process that, to date, has produced a declaration of principles allowing Israelis and Palestinians to recognize one another as legitimate political entities, and a peace treaty between Israel and Jordan, formally ending a 46-year state of war between these uneasy neighbours. And water *has* been a vital, sometimes overriding factor in these agreements. The creation of a Palestinian Water Authority was an important aspect of the Declaration of Principles, and its announcement and acceptance led to a particularly

productive round of multilateral negotiations in Oman in April 1994. Conversely, the issue of water rights was identified as the final issue requiring resolution before the peace treaty between Israel and Jordan was able to be signed.

Some updating of chapter 2 is necessary: The Declaration of Principles signed between Israel and the Palestine Liberation Organization on 13 September 1993 came about as a result of intense secret talks now known as the Oslo negotiations (exploratory contacts for which were reportedly made, incidentally, at the 1992 Israeli–Palestinian conference on water in Zurich). Although the declaration was generally seen as a positive development by most parties, some minor consternation was expressed by the Jordanians about the Israeli–Palestinian agreement to investigate a possible Med–Dead Canal. In the multilateral working group on regional economic development, the Italians had pledged $2.5 million towards a study of a Red–Dead Canal as a joint Israeli–Jordanian project; building both would be unfeasible. The Israelis pointed out in private conversations with the Jordanians that *all* possible projects should be investigated, and only then could rational decisions on implementation be made.

Although a bilateral agreement, the Declaration of Principles helped streamline a logistically awkward aspect of the ongoing multilateral negotiations, as the PLO became openly responsible for representing the Palestinians – previously the Palestinian delegation had been affiliated with the Jordanian delegation. By the fifth round of water talks in Beijing in October 1993, somewhat of a routine seemed to be setting in at the multilateral negotiations, whereby reports were presented on each of the four topics agreed to at the second meeting in Vienna – enhancement of data availability; enhancing water supply; water management and conservation; and concepts of regional cooperation and management.[1]

The sixth and most recent round of talks was held in Muscat, Oman, in April 1994, the first of the water talks to be held in an Arab country and the first of any working group to be held in the Gulf. Tensions mounted immediately before the talks as it became clear that the Palestinians would use the occasion as a platform to announce the appointment of a Palestinian National Water Authority. While such an authority was called for in the Declaration of Principles, possible responses to both the unilateral nature and to the appropriateness of the working group as the proper vehicle for the announcement were unclear. Only a flurry of activity prior to the talks guaranteed that the announcement would be welcomed by all parties. This agreement set the stage for a particularly productive meeting. In two days, the working group endorsed:

- an Omani proposal to establish a desalination research and technology centre in Muscat, which would support regional cooperation in desalination research among all interested parties. This marked the first Arab proposal to find consensus in the working group;
- an Israeli proposal to rehabilitate and make more efficient water systems in small-sized communities in the region. This was the first Israeli proposal to be accepted by *any* working group;
- a German proposal to study the water supply and demand development among interested core parties in the region;
- a US proposal to develop waste-water treatment and reuse facilities for small com-

1. For more information on the most recent negotiations, see A. Wolf, ''International Water Dispute Resolution. The Middle East Multilateral Working Group on Water Resources,'' *Water International*, Summer 1995 (Forthcoming).

munities at several sites in the region. The proposal was jointly sponsored by the water and environmental working groups;
- implementation of a US/EU regional training programme.

Recent progress made in bilateral negotiations between Jordan and Israel has outpaced the multilateral negotiations. On 7 June 1994, the two states announced that they had reached an agreement on a sub-agenda for cooperation, building on an agenda for peace talks that had been agreed to 14 September 1993, which would lead eventually to a peace treaty. This sub-agenda included several water-related items, notably in the first heading listed (in advance of security issues, and border and territorial matters), Group A – Water, Energy, and the Environment:

I. Surface water basins.
   A. Negotiation of mutual recognition of the rightful water allocations of the two sides in Jordan River and Yarmuk River waters with mutually acceptable quality.
   B. Restoration of water quality in the Jordan River below Lake Tiberias to reasonably usable standards.
   C. Protection of water quality.

II. Shared groundwater aquifers.
   A. Renewable fresh water aquifers – southern area between the Dead Sea and the Red Sea.
   B. Fossil aquifers – area between the Dead Sea and the Red Sea.
   C. Protection of the water quality of both.

III. Alleviation of water shortage.
   A. Development of water resources.
   B. Municipal water shortages.
   C. Irrigation water shortages.

IV. Potentials of future bilateral cooperation, within a regional context where appropriate.
   [Includes Red Sea–Dead Sea Canal; management of water basins; and interdisciplinary activities in water, environment, and energy.]

On 26 October 1994, Israel and Jordan formalized a peace treaty after resolving the last and most contentious issue – shared water resources. According to Annex II of the accord:
- Israel will yield 40 MCM/yr. from the Yarmuk plus 10 MCM/yr. desalinated brackish spring water;
- An additional 50 MCM/yr. will be developed through joint projects, to be determined by a Joint Water Committee;
- Jordan will store 20 MCM/yr. of winter flood water in the Sea of Galilee, to be returned during summer months – flood water in addition to current uses will be split between the two countries;
- Two dams will be constructed – one each on the Yarmuk and the Jordan (Israel can use up to 3 MCM/yr. of increased storage capacity).

The pace of conflict resolution in the region puts the predictive aspects of this work in an interesting (if occasionally unsettling) position – many of my conclusions can actually be tested against the real world. Many of the recommendations and confidence-building measures of chapter 4 are, in fact, being implemented, in roughly the order suggested. (With one conspicuous exception – discussions of water rights

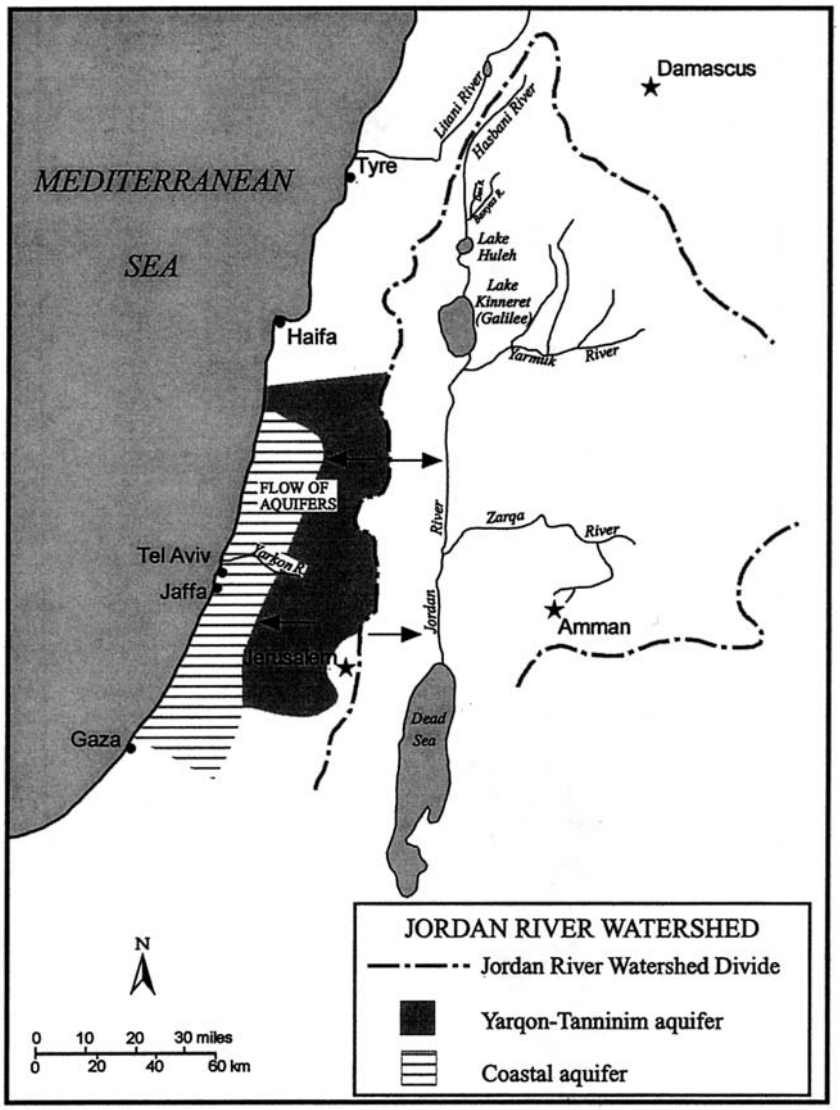
have routinely been postponed as too intricate to deal with early. It *is* being recognized, though, that a final arrangement over water resources in the region is not possible without addressing this vital aspect.) While I leave it for future study to determine precisely how close these predictive aspects came to reality, these preliminary results seem to reinforce the methodology described here as a useful tool for integrated water management in other basins with conflicting political interests.

Regardless, the changes in the region are overpowering. The Palestinian flag flies freely over official buildings of the Palestinian Authority. Israelis visit the Nabatean city of Petra, carved into the rose-red sandstone of Wadi Musa. Jordanians swim in the Sea of Galilee. Despite the horrendous efforts of extremists of all sides, the region seems to be moving inexorably towards peace, towards a time when one can take a train from Cairo to Damascus, when military bands practise and perform together, when the boundaries on maps used for water resources planning in the Jordan basin are only those of the watershed itself.

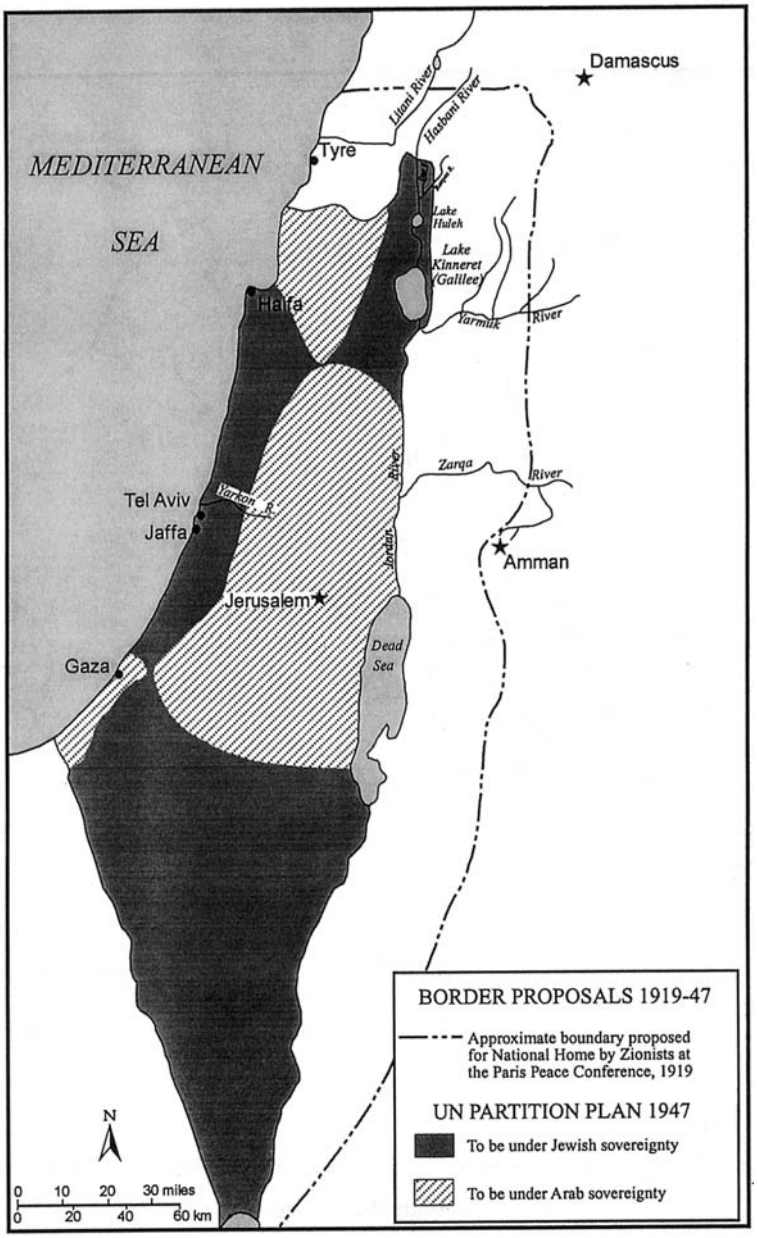
Aaron T. Wolf
November 1994

Appendices

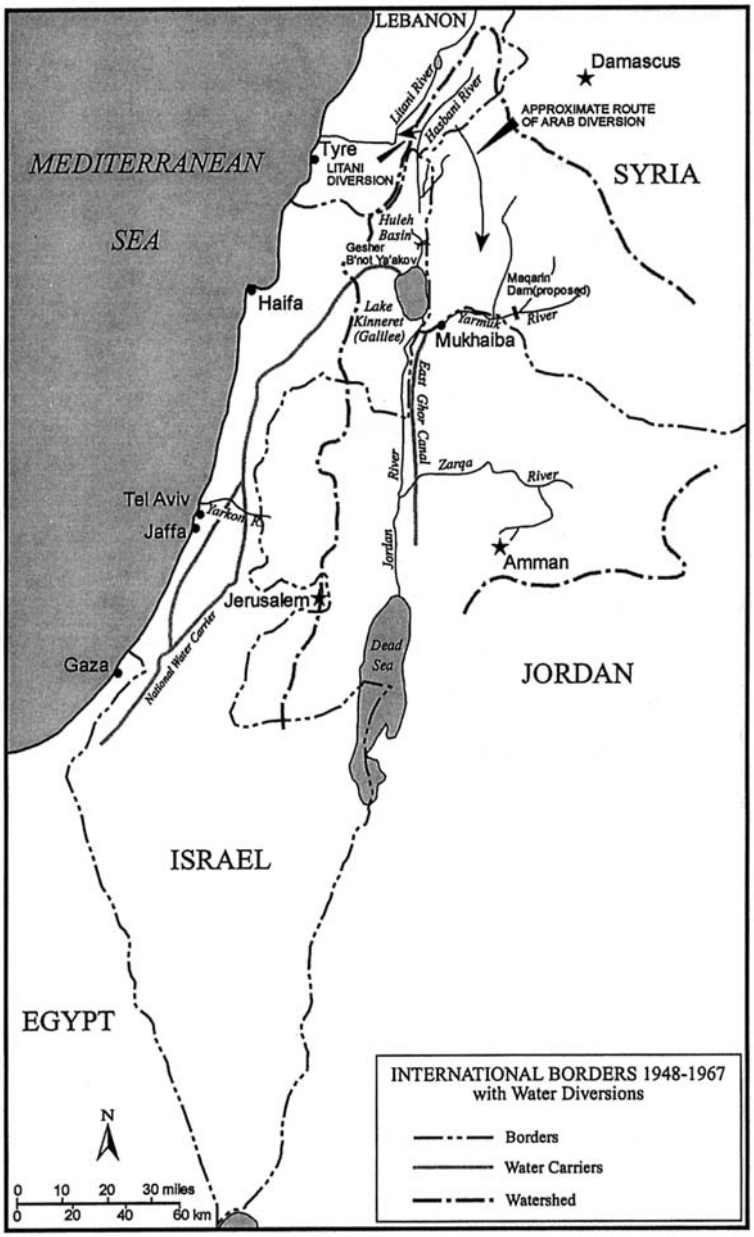
Appendix I: Maps



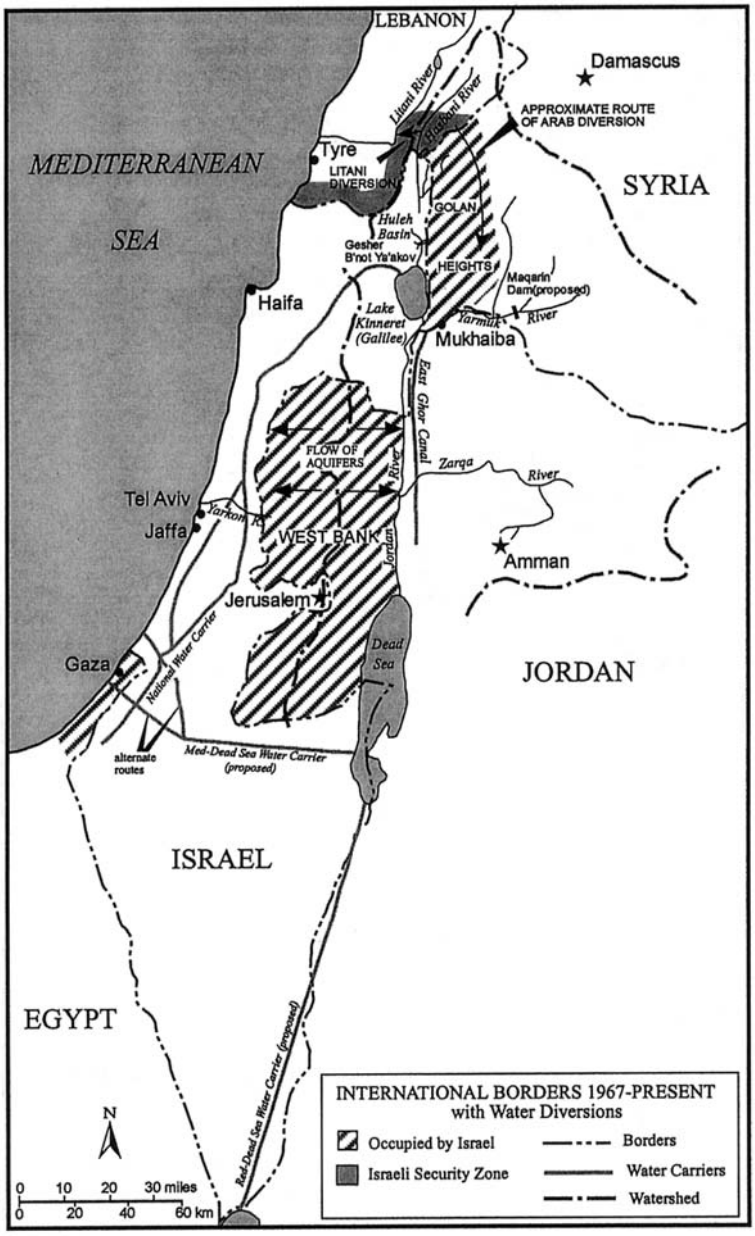
Map 1 **Jordan River watershed**



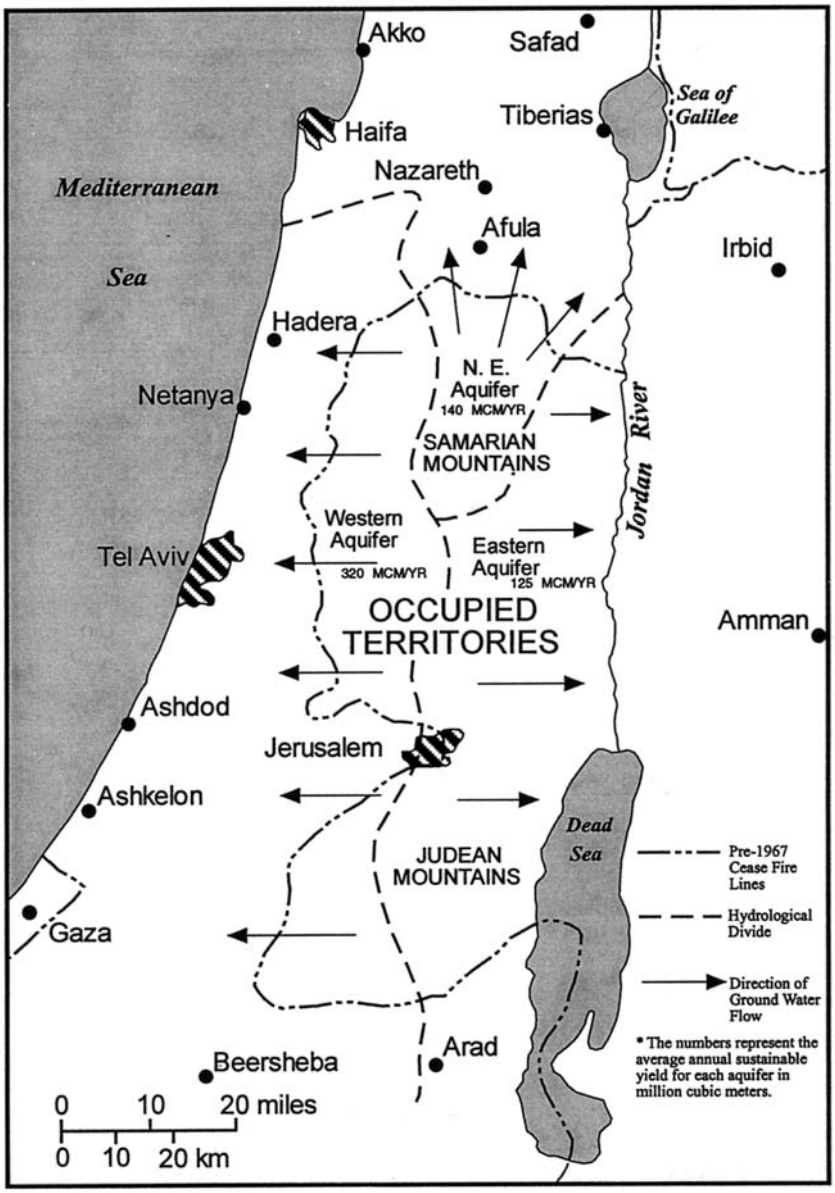
Map 2 **Border proposals 1919–1947**



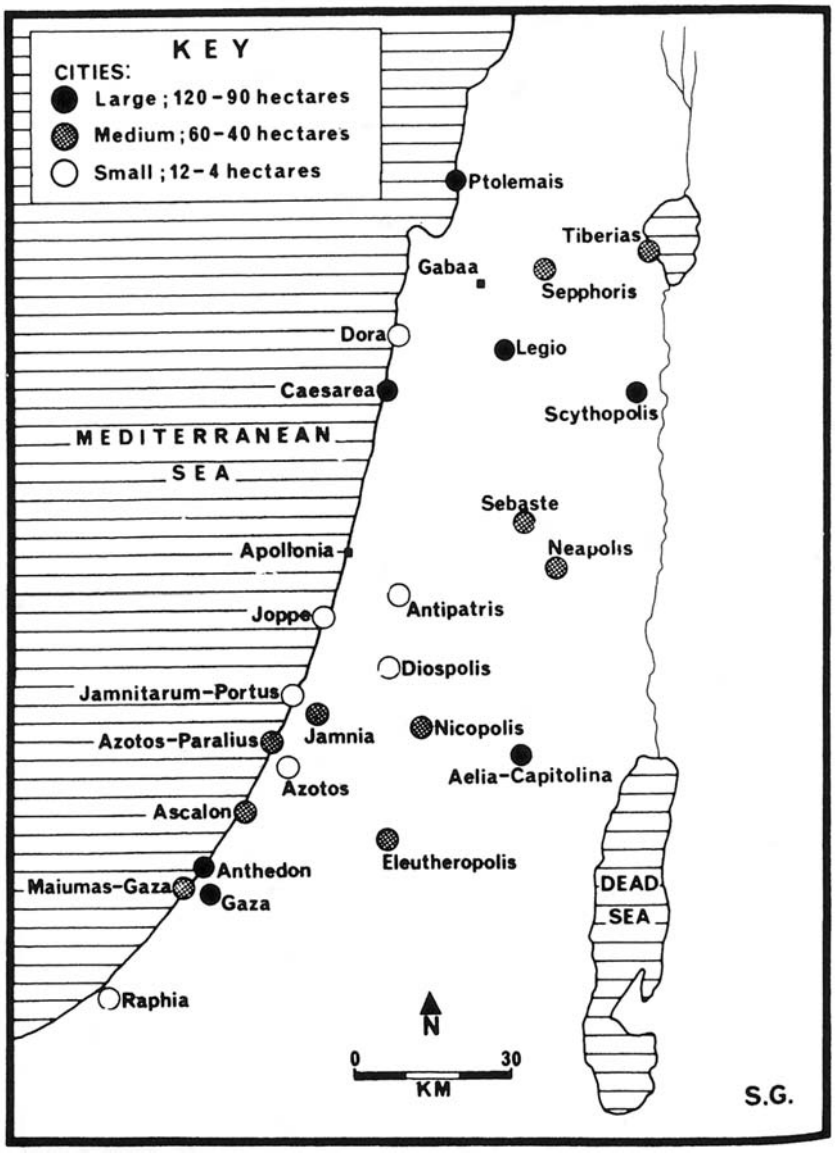
Map 3 **International borders, 1948–1967, with water diversions**



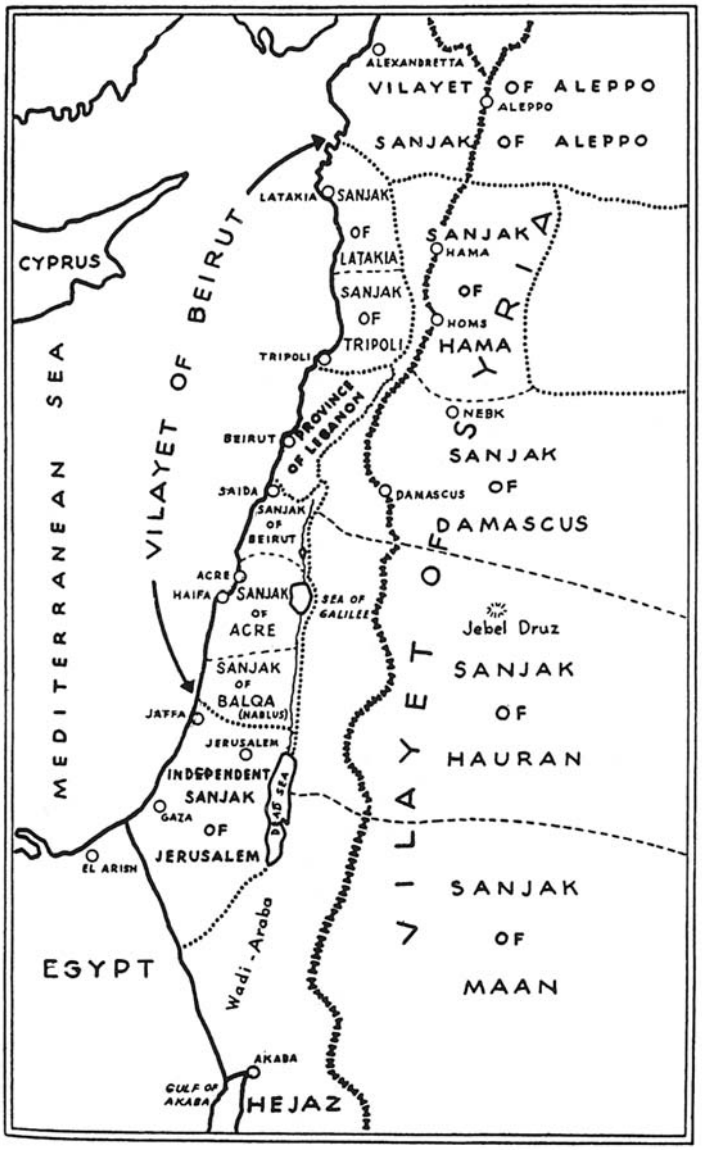
Map 4 **International borders, 1967–Present, with water diversions**



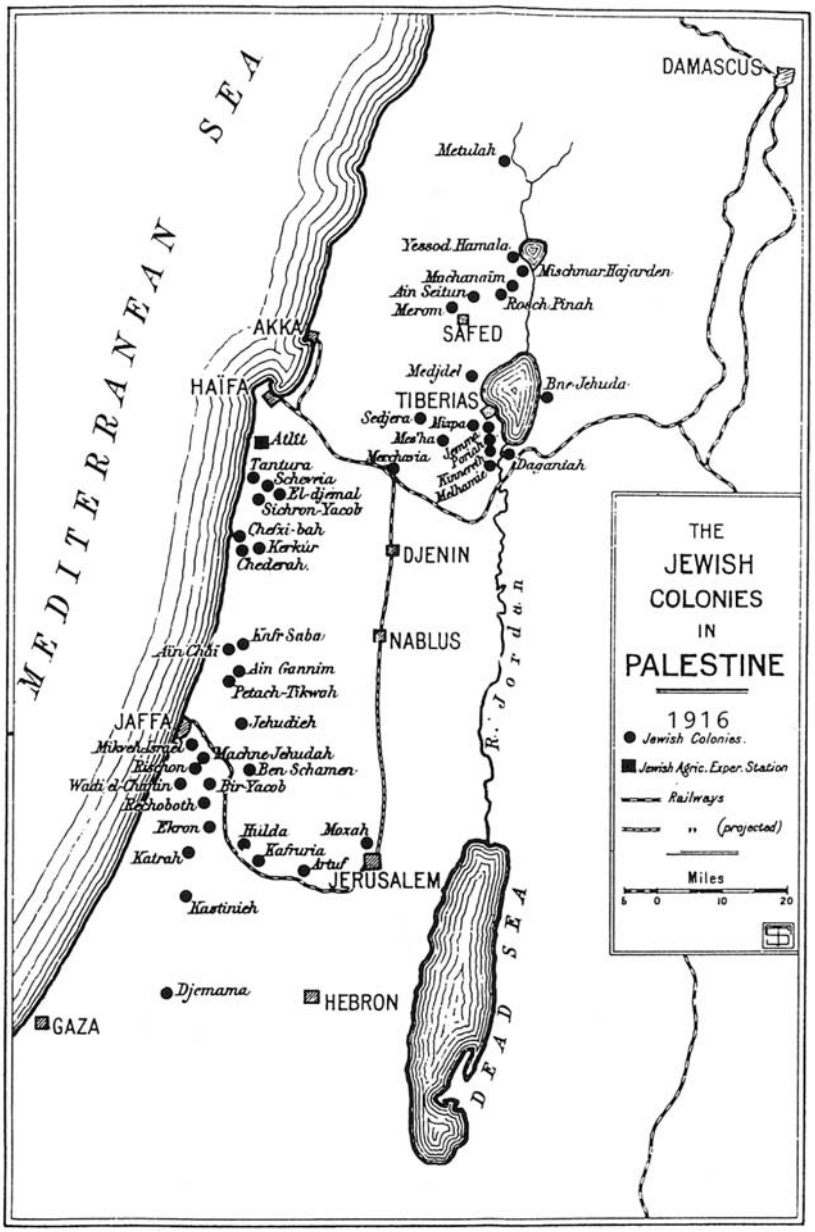
Map 5 **Diagrammatic representation of groundwater (mountain aquifer). Source: Shuval (1992)**



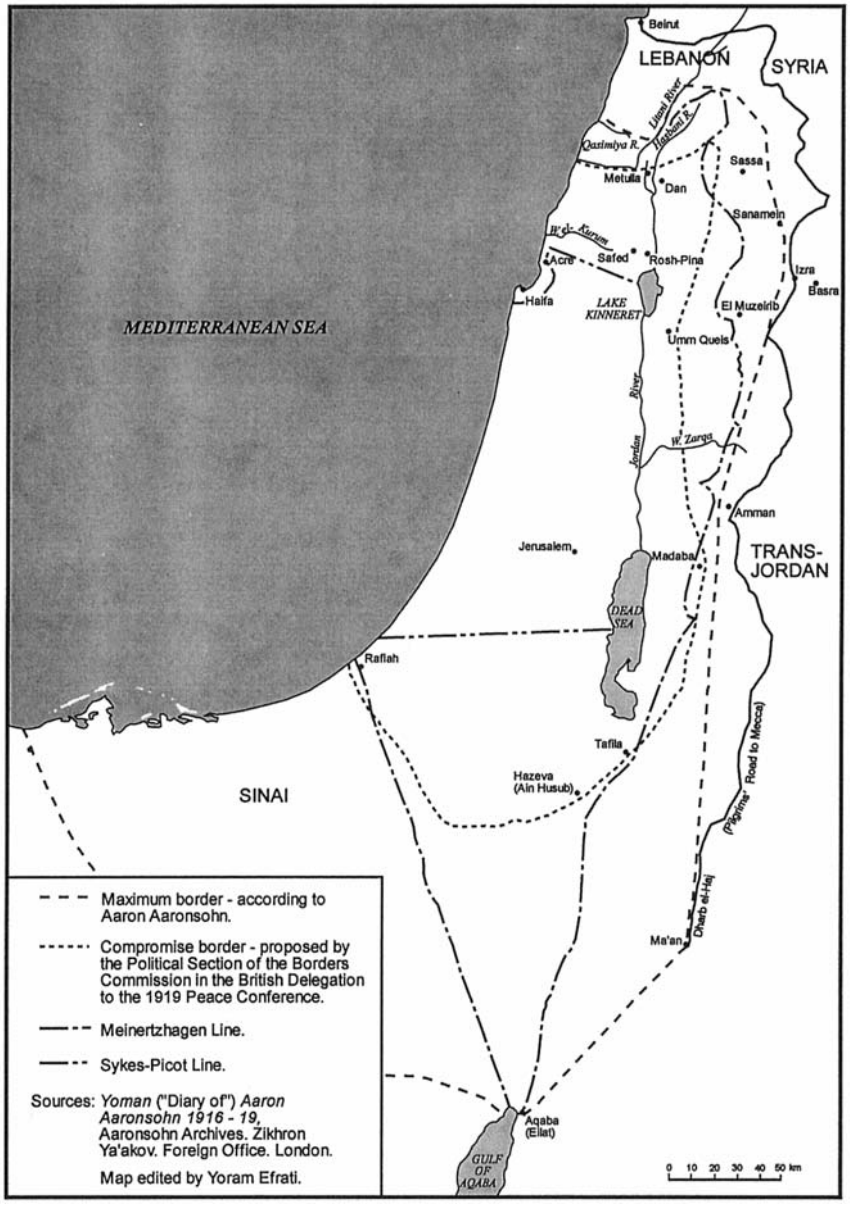
Map 6 **Settlements in antiquity. Source: Broshi (1979)**



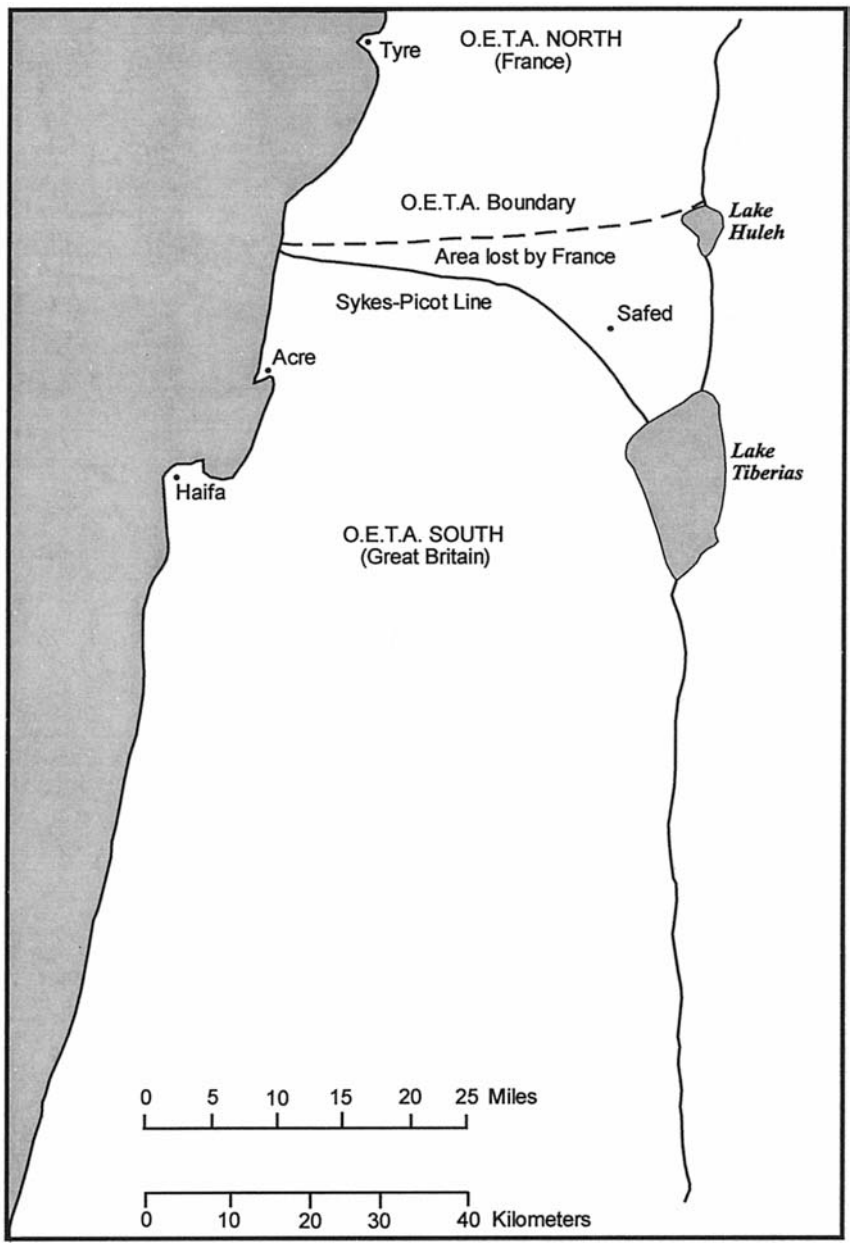
Map 7 **Palestine and Syria in 1915. Source: Esco Foundation (1947)**



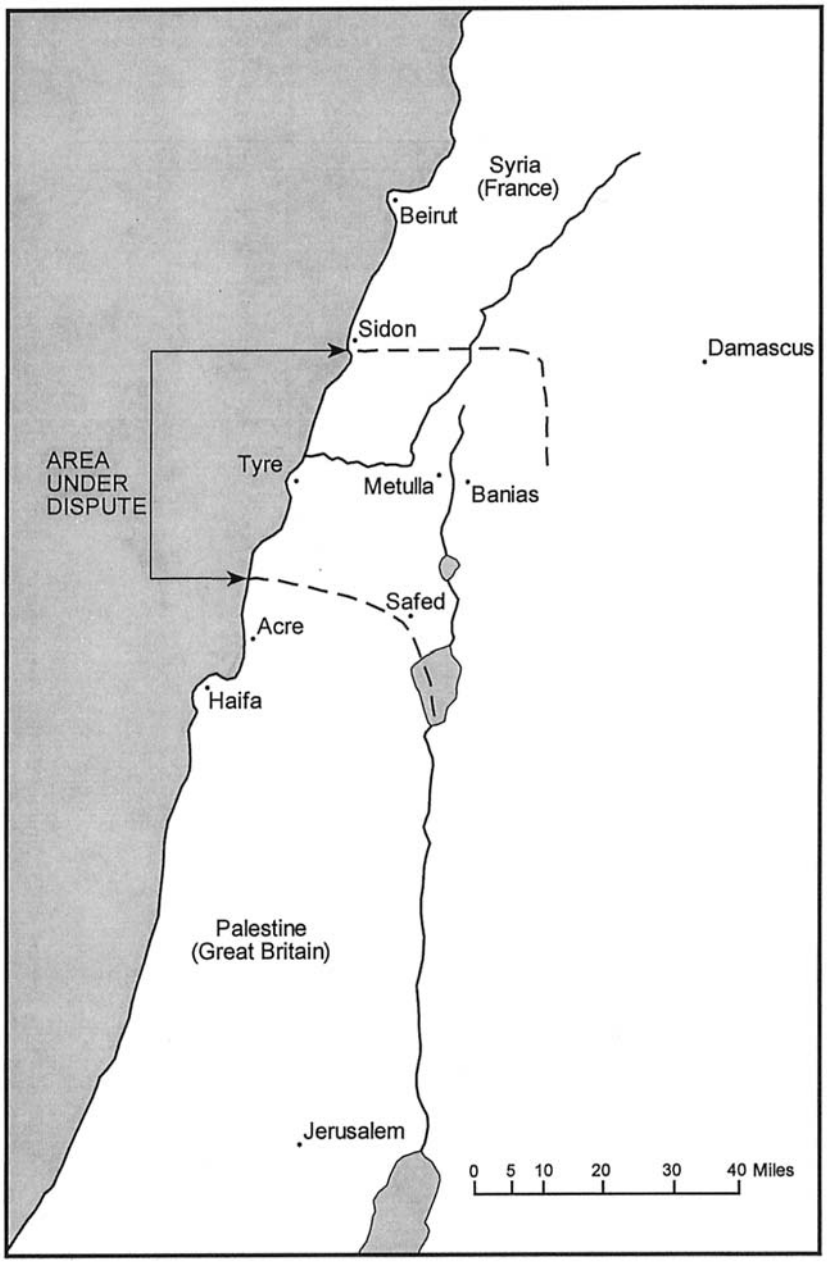
Map 8 **Jewish colonies in Palestine, 1916. Source: Sacher (1916)**



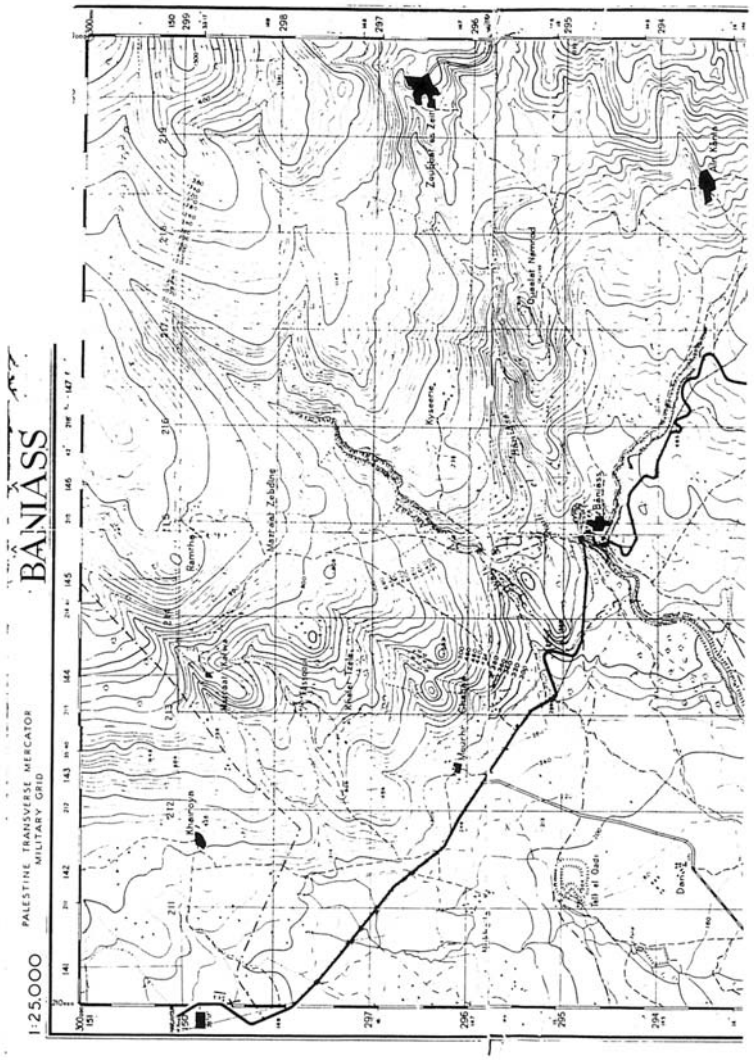
Map 9 **Borders proposed for Palestine, 1916–1919. Source: Weizmann Letters (1968); original source: *Yoman Aaron Aaronsohn 1916–1919*, Aaronsohn Archives. London: Foreign Office.**



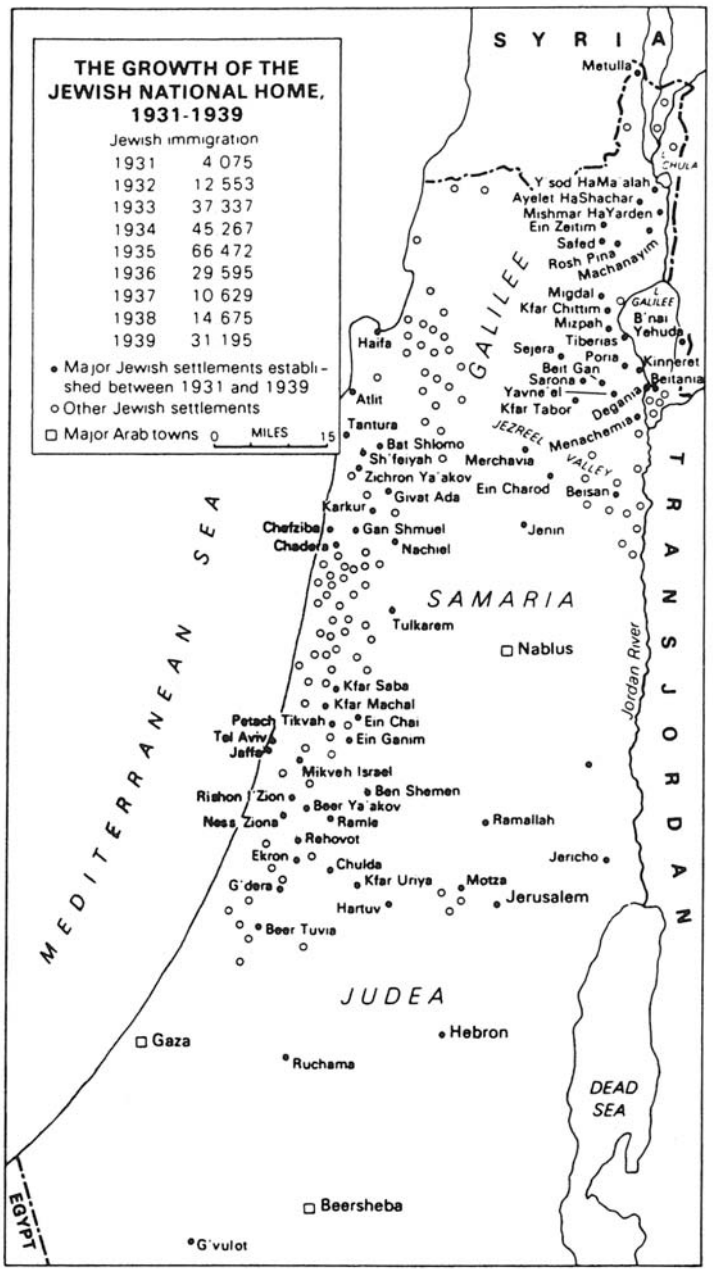
Map 10 **Revised "OETA" boundary, Autumn 1918. Source: Hof (1985)**



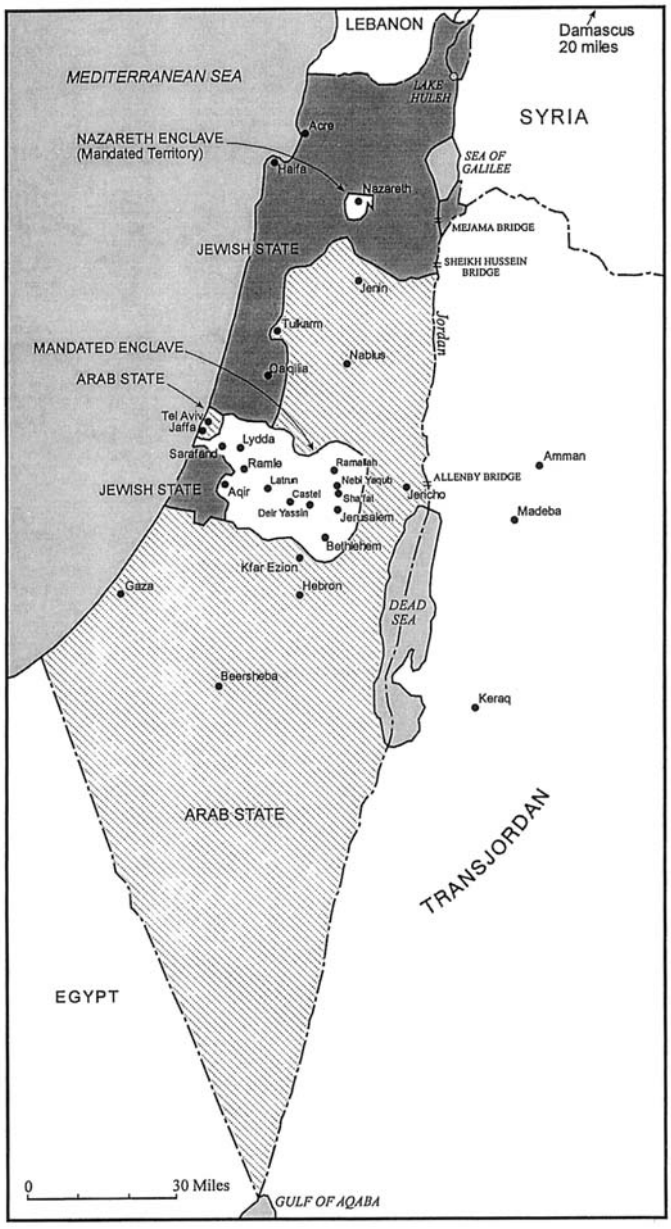
Map 11 **Disputed area, March–September 1919. Source: Hof (1985)**



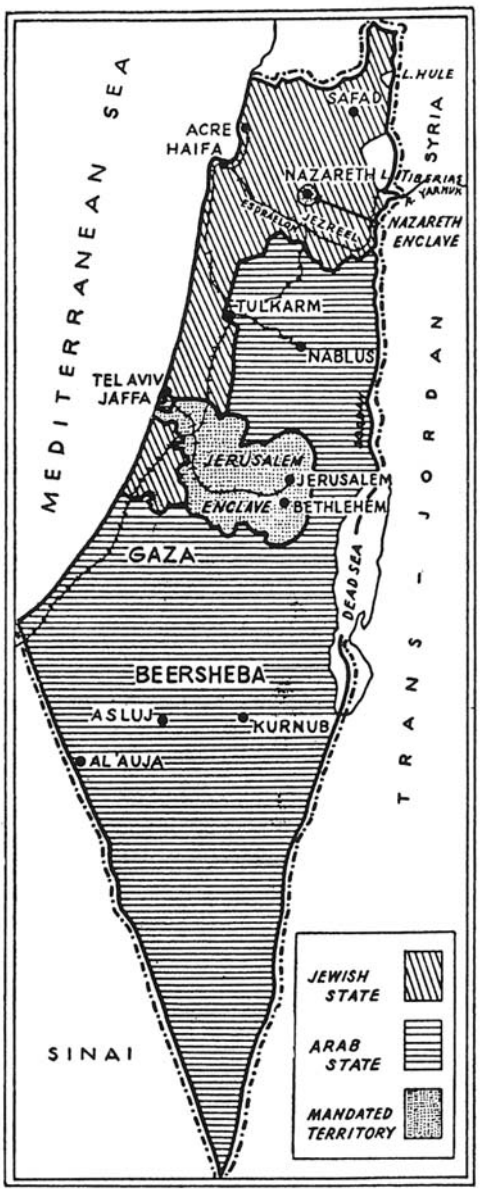
Map 12 **Banias, 1923. Source: British government publication [Newcombe (1923)]**



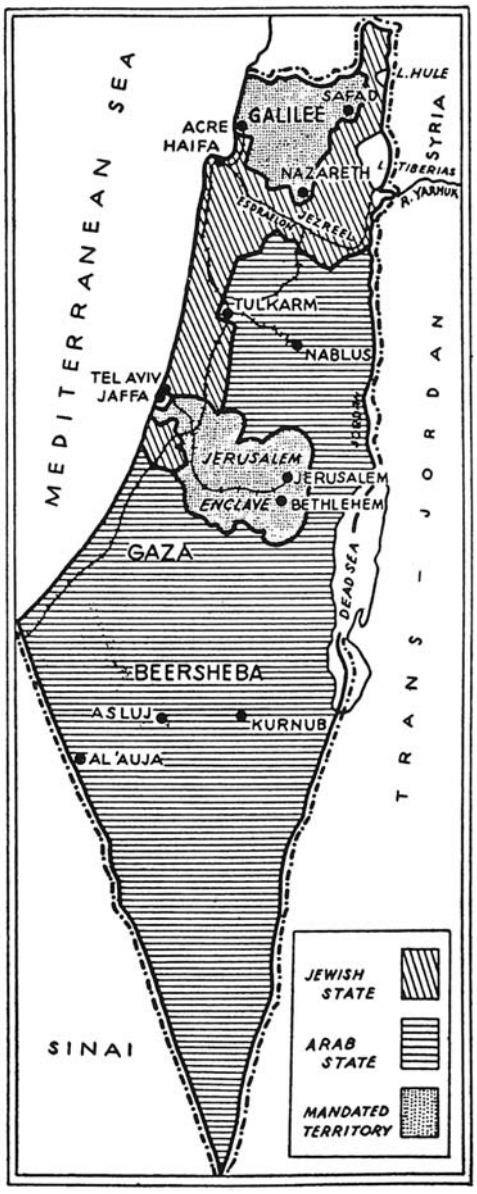
Map 13 **Growth of the Jewish national home, 1931–1939. Jewish immigration: 1931, 4,075; 1932, 12,533; 1933, 37,337; 1934, 45,267; 1935, 66,472; 1936, 29,595; 1937, 10,629; 1938, 14,675; 1939, 31,195. Source: Sachar (1979)**



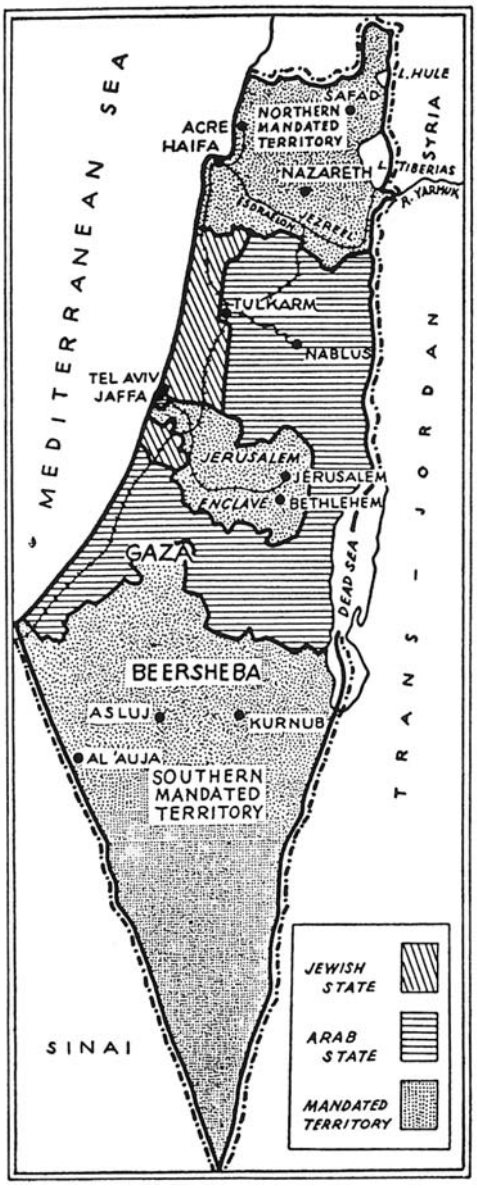
Map 14 **Royal Commission (Peel) plan for partition of Palestine, 1937. Source: Sachar (1979)**



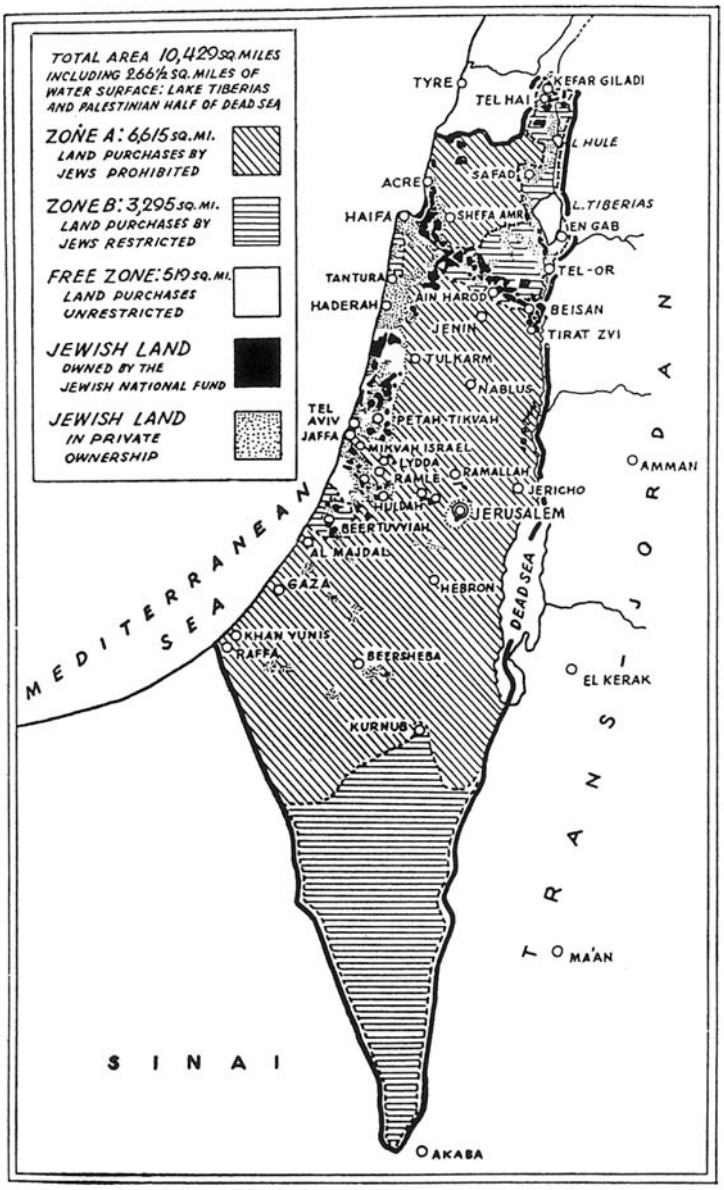
Map 15 **Woodhead Report: Palestine Partition Plan A, 1938. Source: Esco Foundation (1947)**



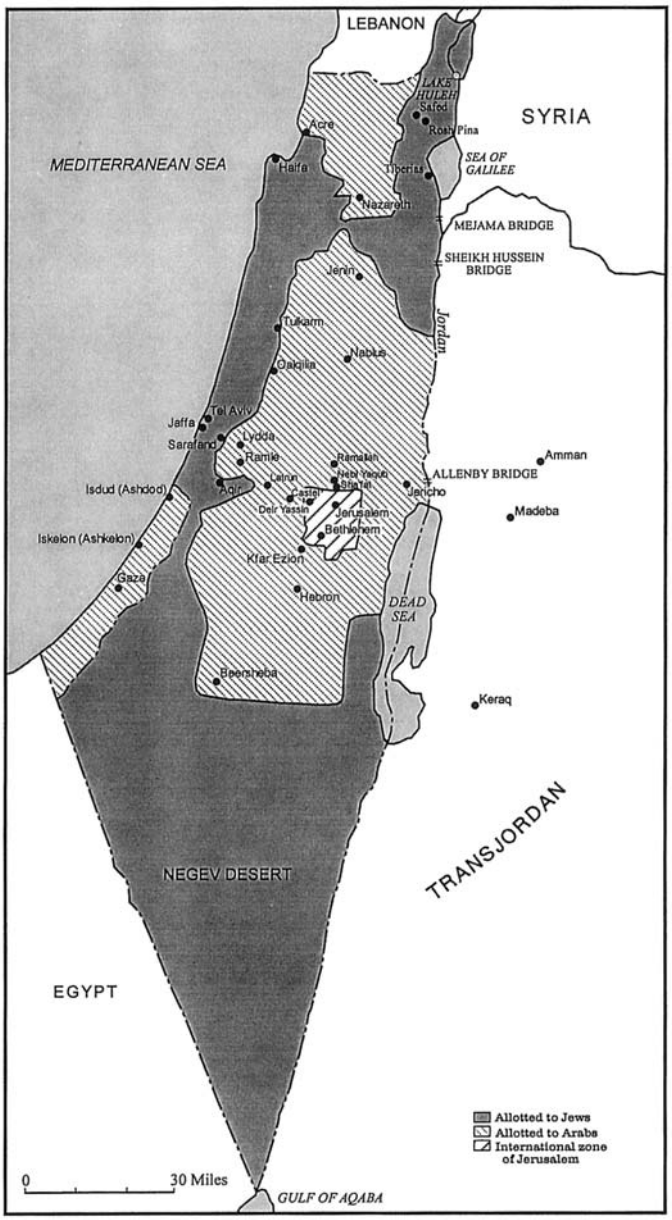
Map 16 **Woodhead Report: Palestine Partition Plan B, 1938. Source: Esco Foundation (1947)**



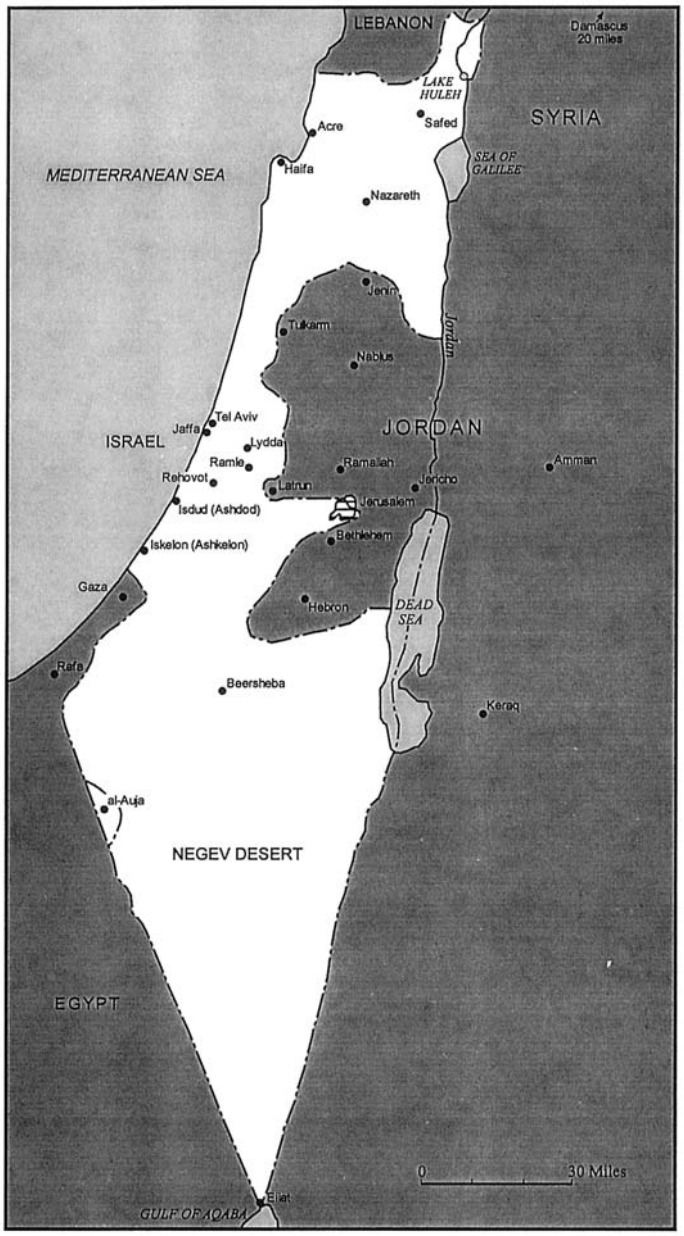
Map 17 **Woodhead Report. Palestine Partition Plan C, 1938. Source: Esco Foundation (1947)**



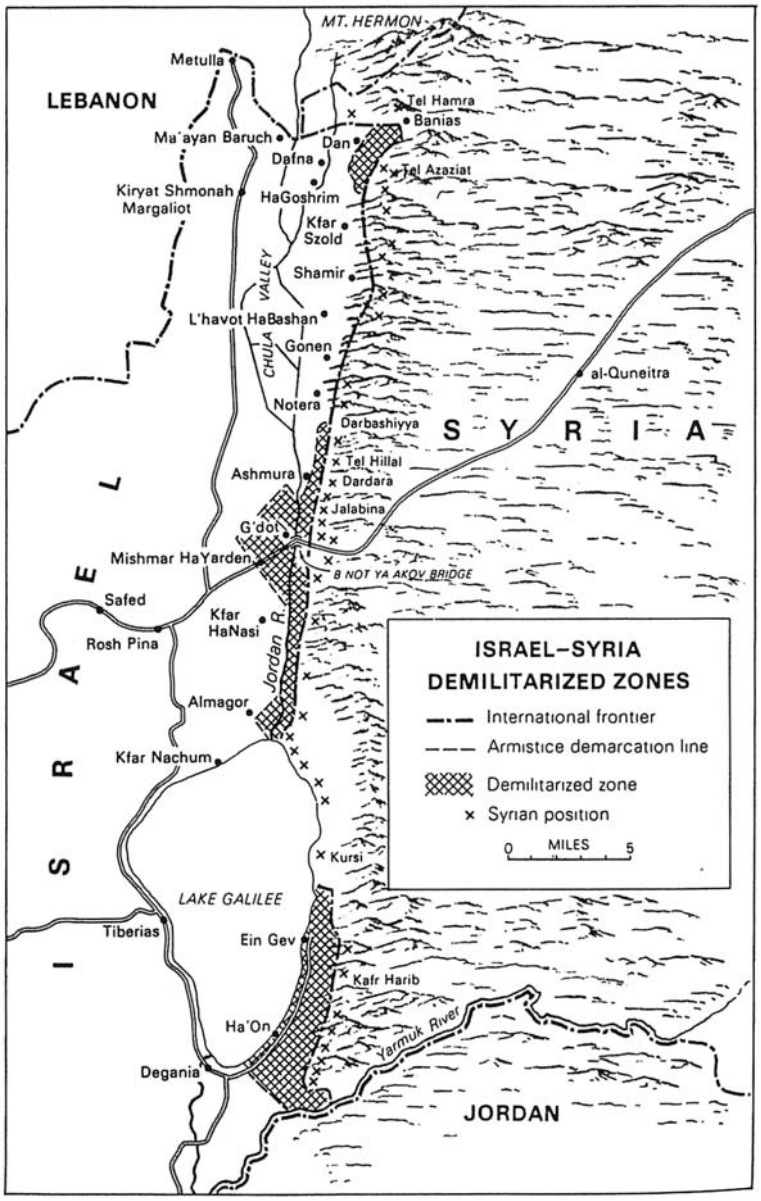
Map 18 **Palestine Land Transfer Regulations, February 1940. Total area 10,429 square miles, including 266.5 square miles of water surface (Lake Tiberius and Palestinian half of Dead Sea). Zone A (6,615 sq. miles): land purchases by Jews prohibited; zone B (3,295 sq. miles): land purchases by Jews restricted; free zone (519 sq. miles): land purchases unrestricted; Jewish land owned by the Jewish national fund or in private ownership. Source: Esco Foundation (1947)**



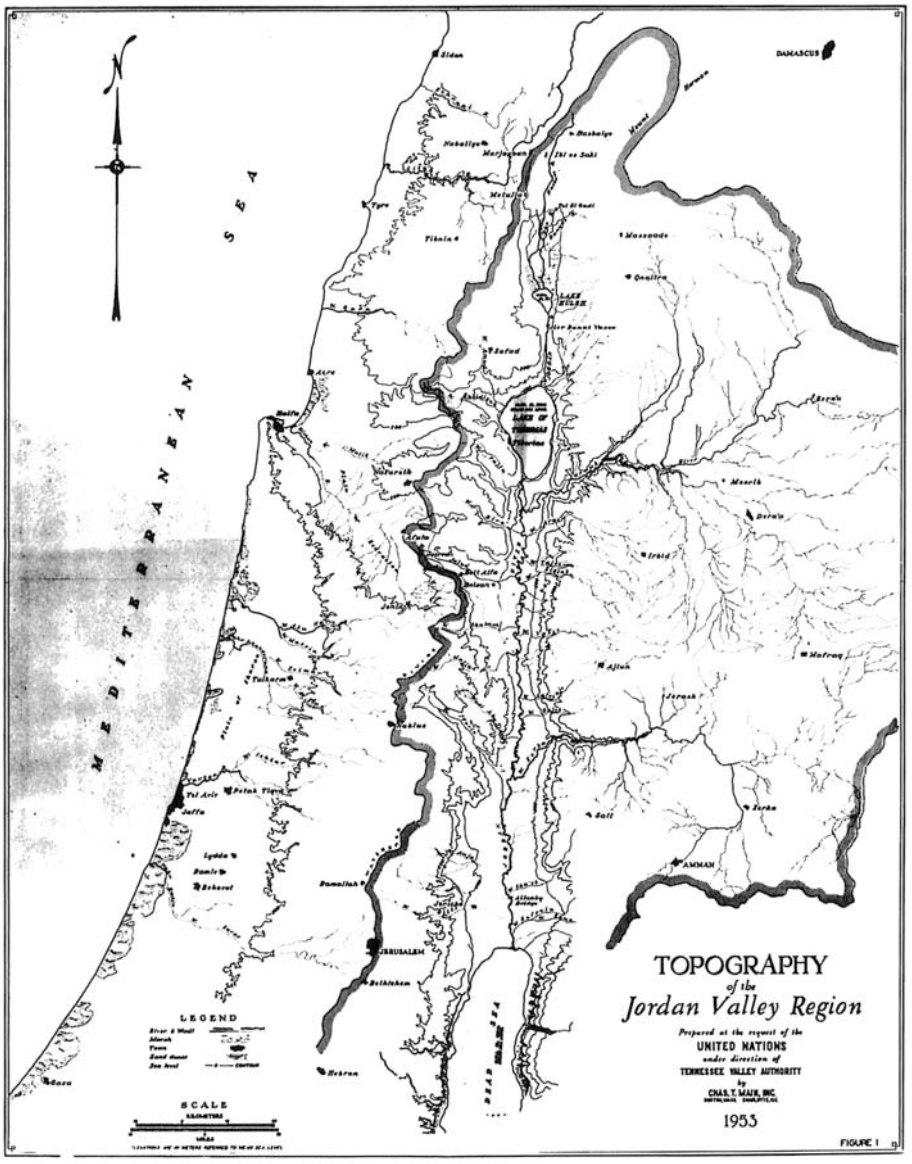
Map 19 **United Nations plan for partition of Palestine, November 1947. Source: Sachar (1979)**



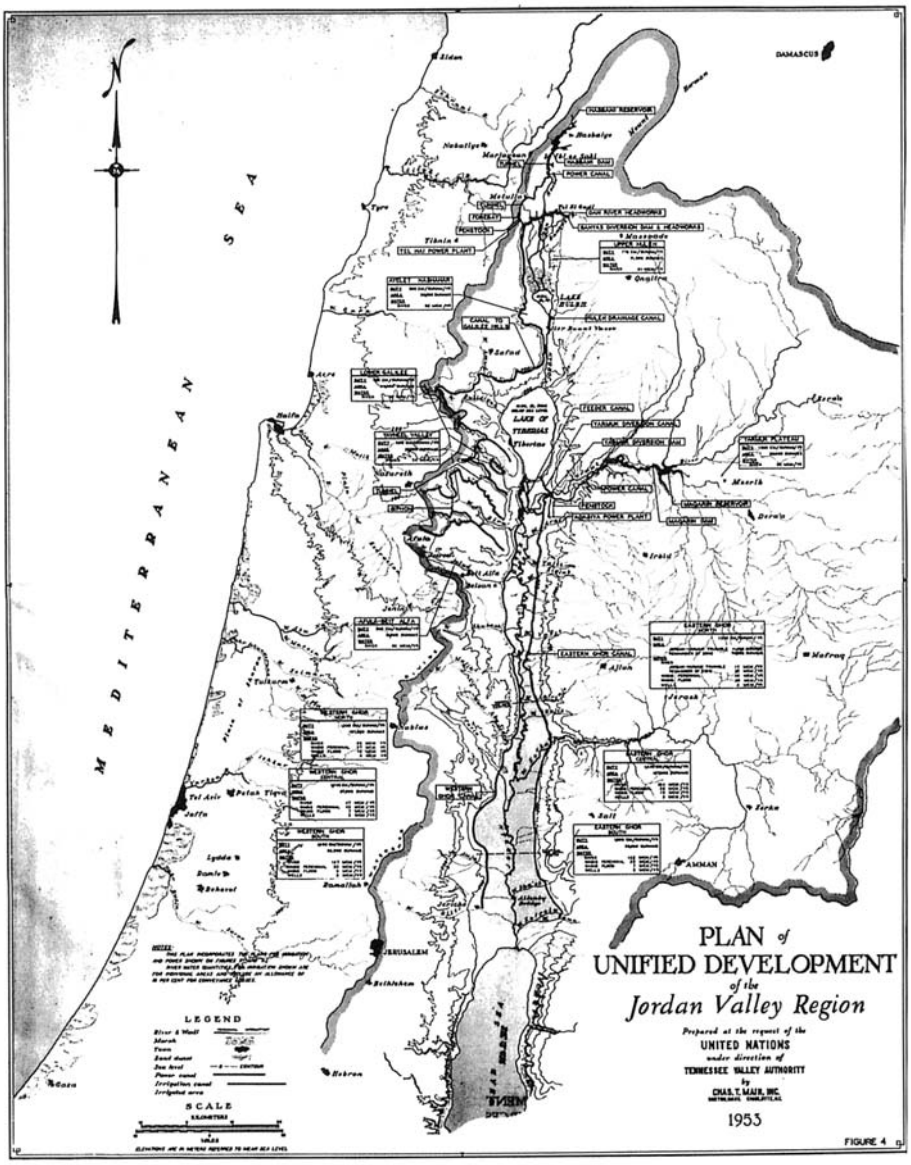
Map 20 **Rhodes armistice demarcation line, 1948. Source: Sachar (1979)**



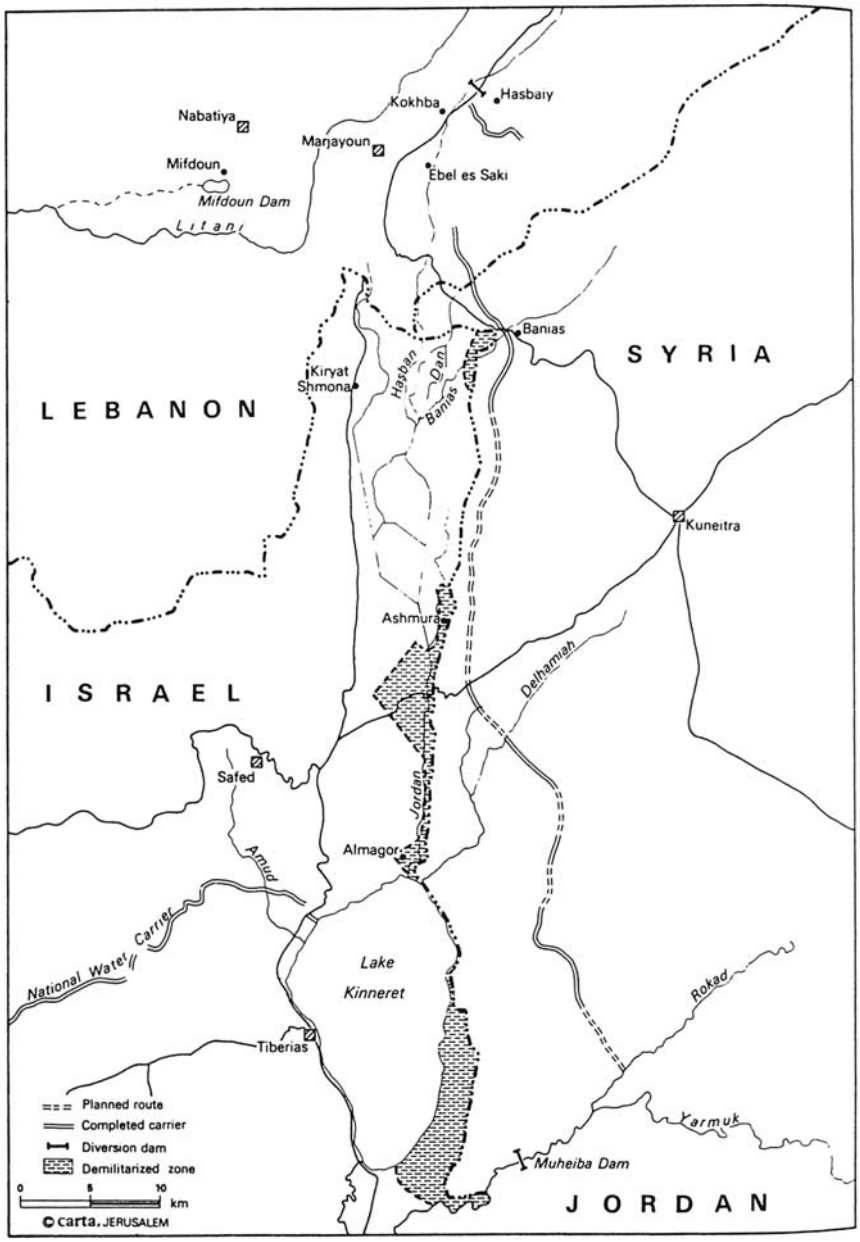
Map 21 **Israel–Syria demilitarized zones, 1948–1967. Source: Sachar (1979)**



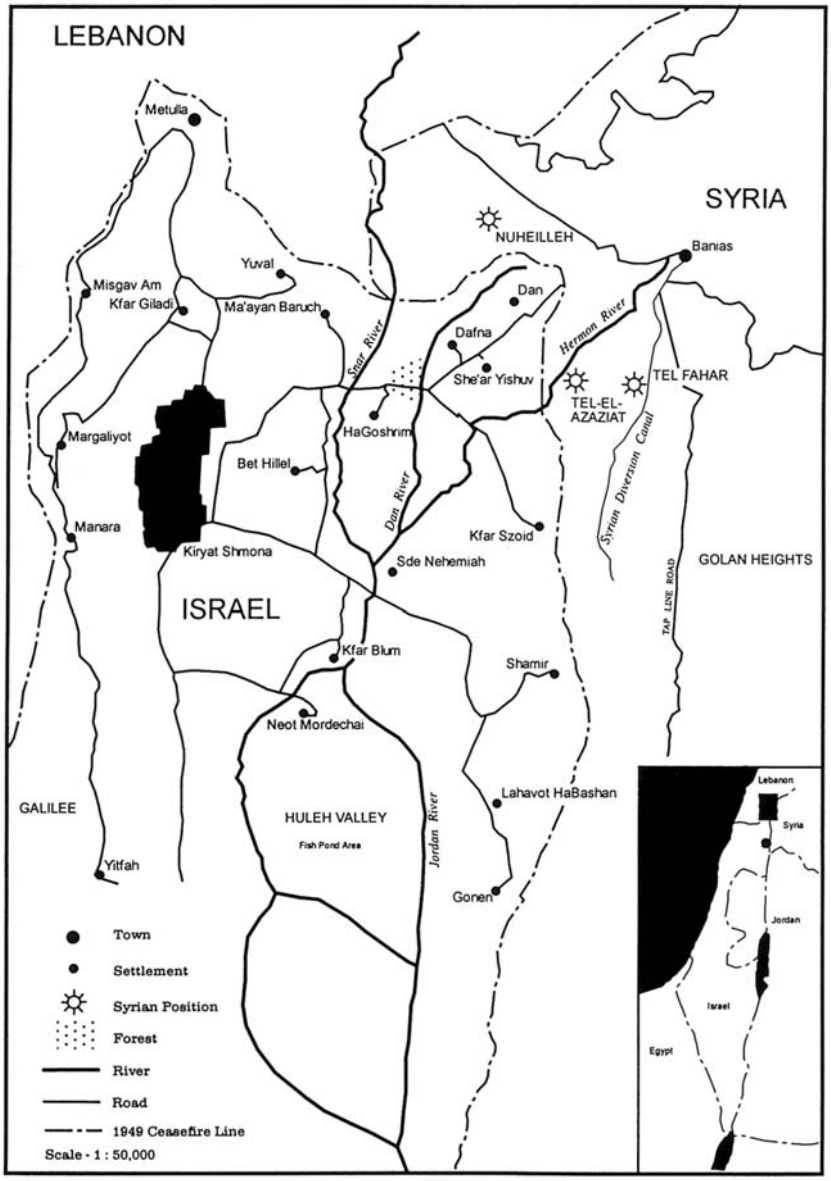
Map 22 **Topography of the Jordan Valley region, Main Plan. Source: Main (1953)**



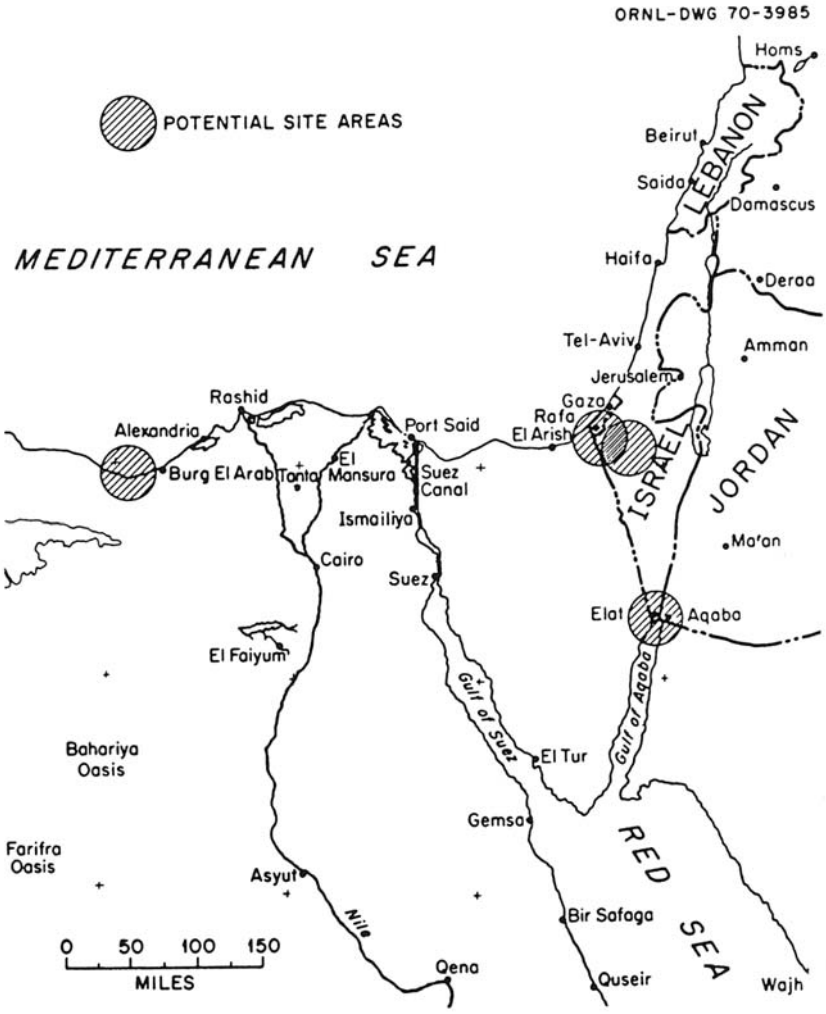
Map 23 **Plan of unified development of the Jordan Valley region, Main Plan. Source: Main (1953)**



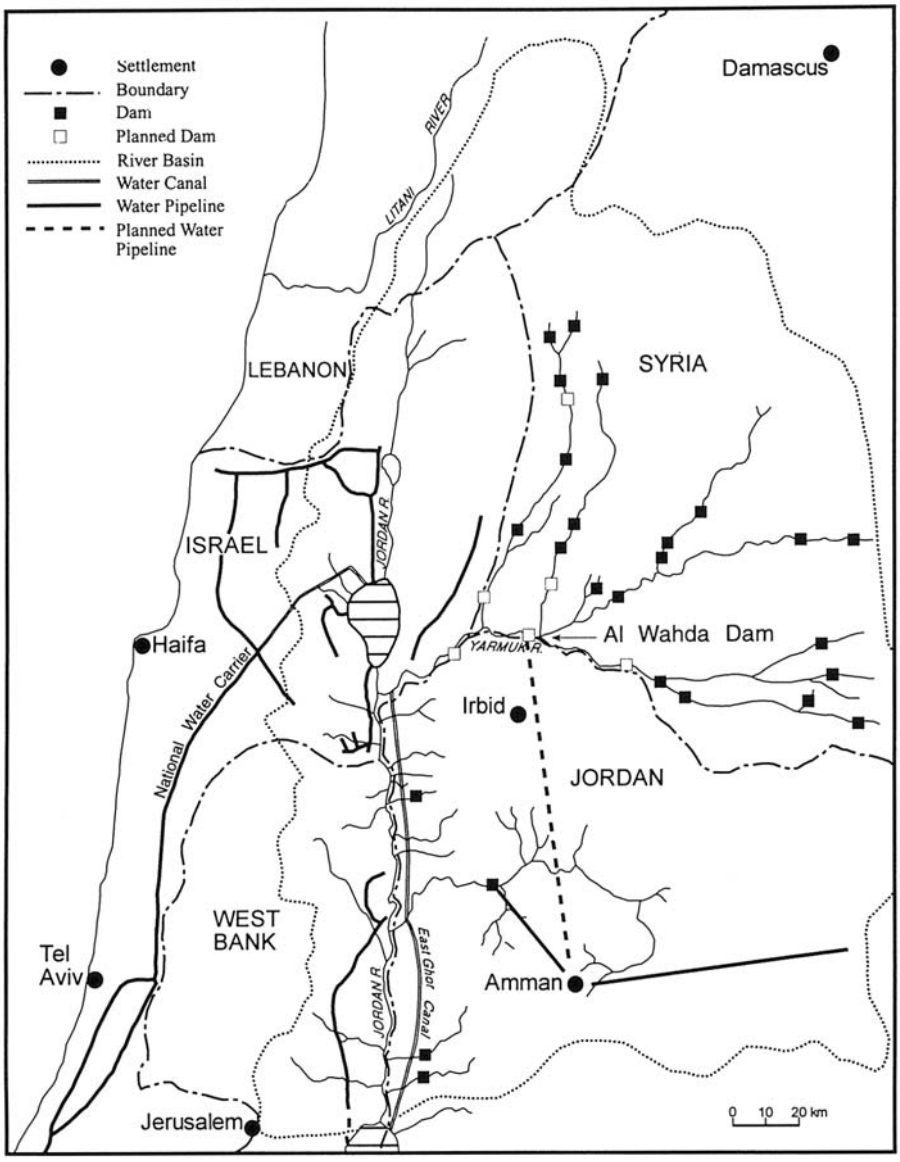
Map 24 **Jordan–Yarmuk river system. Source: Gruen (1991)**



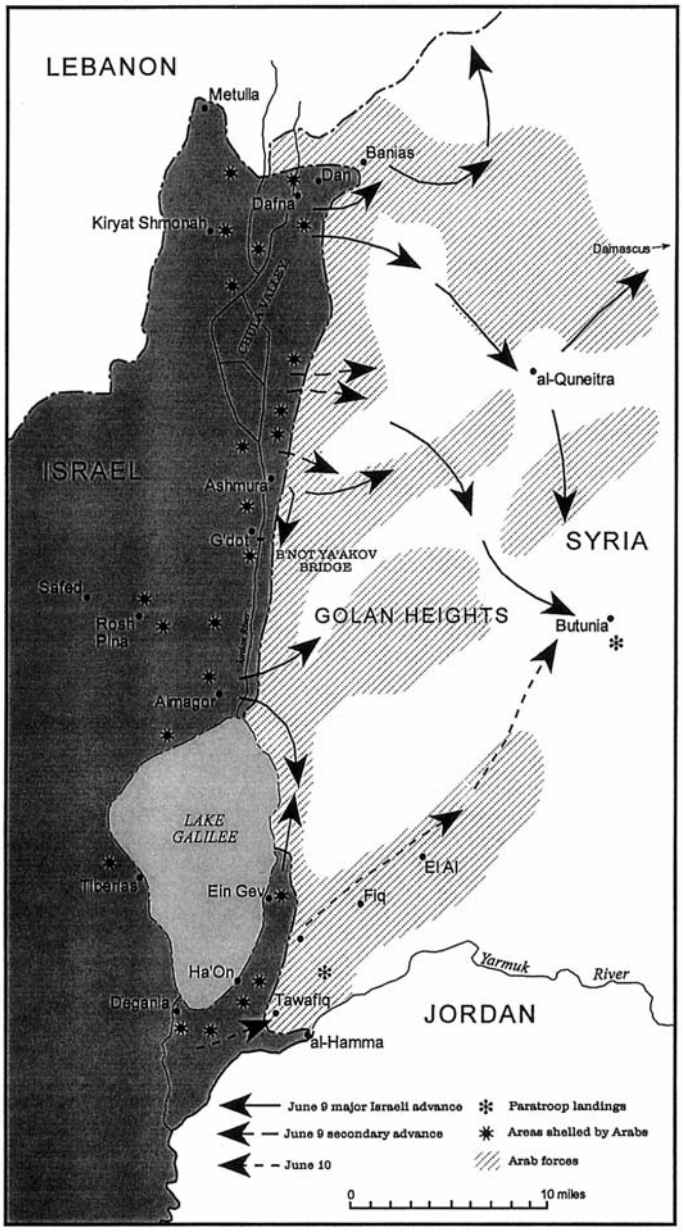
Map 25 **Tank battles, Nuheilleh and surrounding areas, 1965. Source: Argaman (1990)**



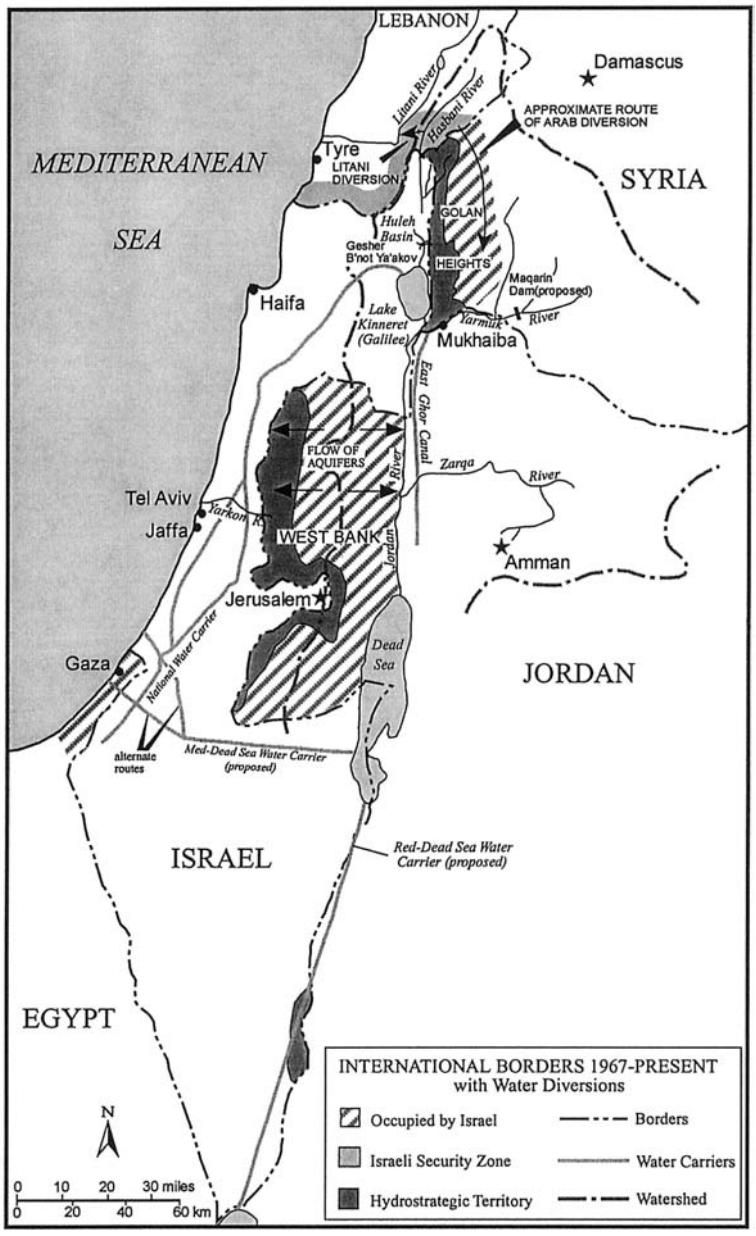
Map 26 **Agro-industrial complex site areas, 1967. Source: Oak Ridge National Laboratories (1967)**



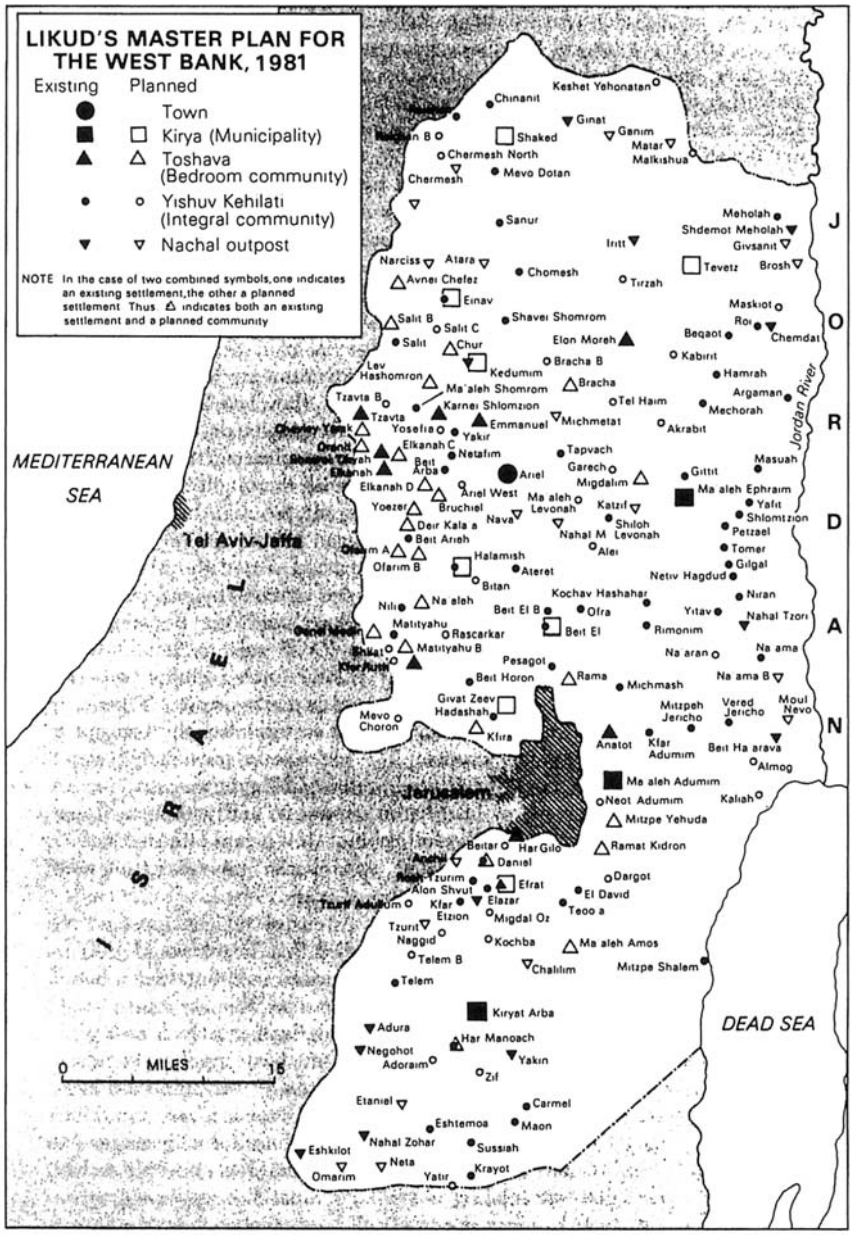
Map 27 **Syrian impoundments. Source: Sofer and Kliot (1988)**



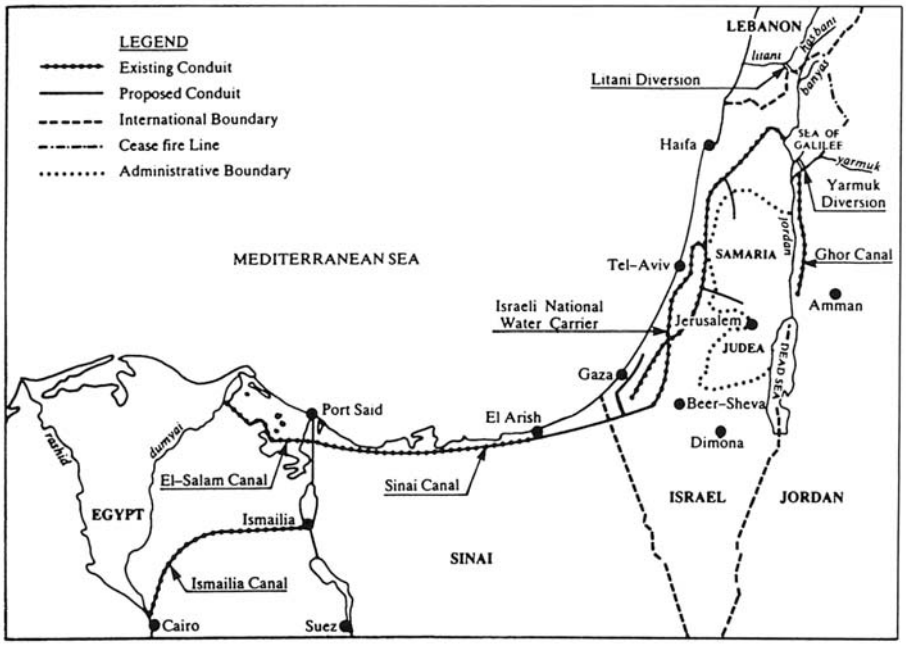
Map 28 **Battle for the Golan Heights, 9–10 June 1967. Source: Sachar (1979)**



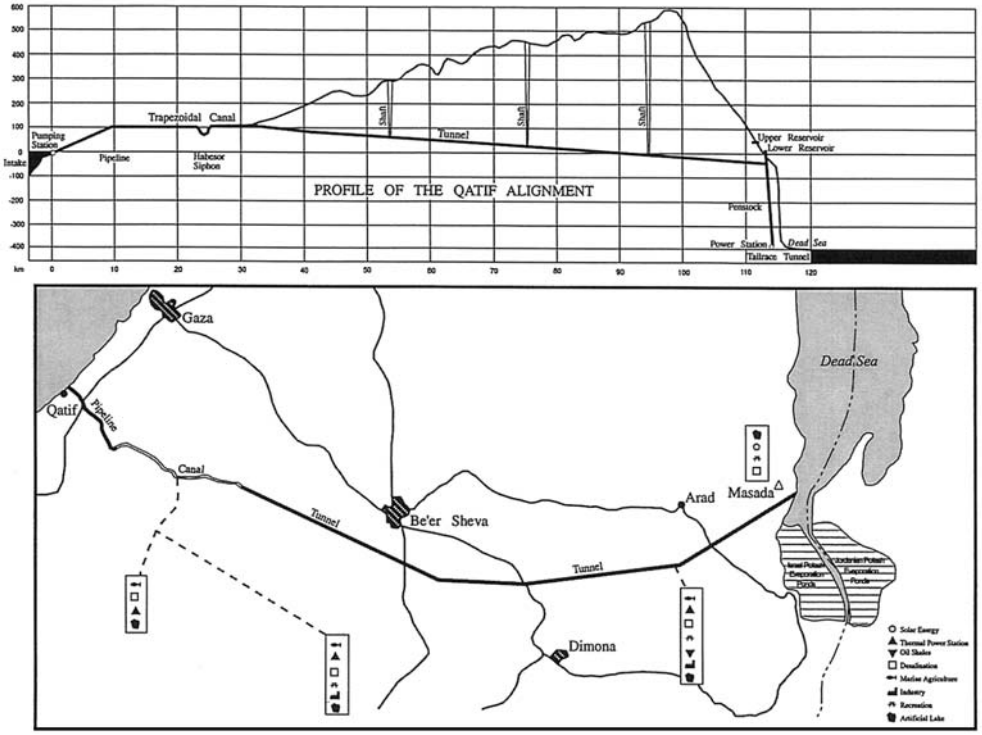
Map 29 **Hydrostrategic territory**



Map 30 **West Bank settlements, from Likud's Master Plan for the West Bank, 1981. Source: Sachar (1987a)**



Map 31 **Potential interbasin water transfers. Source: Kally (1986)**



Map 32 **Med–Dead Canal. Source: Mediterranean–Dead Sea Co. (1983)**

Appendix II: Zionist boundaries, 1919

APPENDIX II

Statement of the Zionist Organization regarding Palestine.

Third day of February Nineteen hundred and nineteen
Third day of Adar Five thousand six hundred and seventy nine.

Proposals to be presented to the Peace Conference.

The Zionist Organization respectfully submits the following draft resolutions for the consideration of the Peace Conference:

1. The High Contracting Parties recognise the historic title of the Jewish people to Palestine and the right of the Jews to reconstitute in Palestine their National Home.
2. The boundaries of Palestine shall be as declared in the Schedule annexed hereto.
3. The sovereign possession of Palestine shall be vested in the League of Nations and the Government entrusted to Great Britain as Mandatory of the League.
4. (Provision to be inserted relating to the application in Palestine of such of the general conditions attached to mandates as are suitable to the case.)
5. The mandate shall be subject also to the following special conditions:
   (I) Palestine shall be placed under such political, administrative and economic conditions as will secure the establishment there of the Jewish National Home and ultimately render possible the creation of an autonomous Commonwealth, it being clearly understood that nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities in Palestine or the rights and political status enjoyed by Jews in any other country.
   (II) To this end the Mandatory Power shall *inter alia*:
      (*a*) Promote Jewish immigration and close settlement on the land, the established rights of the present non-Jewish population being equitably safeguarded.
      (*b*) Accept the co-operation in such measures of a

Council representative of the Jews of Palestine and of the world that may be established for the development of the Jewish National Home in Palestine and entrust the organization of Jewish education to such Council.

(c) On being satisfied that the constitution of such Council precludes the making of private profit, offer to the Council in priority any concession for public works or for the development of natural resources which it may be found desirable to grant.

(III) The Mandatory Power shall encourage the widest measure of self-government for localities practicable in the conditions of the country.

(IV) There shall be for ever the fullest freedom of religious worship for all creeds in Palestine. There shall be no discrimination among the inhabitants with regard to citizenship and civil rights, on the grounds of religion, or of race.

(V) (Provision to be inserted relating to the control of the Holy Places.)

The Boundaries of Palestine.

SCHEDULE.

The boundaries of Palestine shall follow the general lines set out below:

Starting on the North at a point on the Mediterranean Sea in the vicinity South of Sidon and following the watersheds of the foothills of the Lebanon as far as JISR EL KARAON, thence to EL BIRE, following the dividing line between the two basins of the WADI EL KORN and the WADI ET TEIM, thence in a southerly direction following the dividing line between the Eastern and Western slopes of the HERMON, to the vicinity West of BEIT JENN, thence Eastward following the northern watersheds of the NAHR MUGHANIYE close to and west of the Hedjaz Railway.

In the East a line close to and West of the Hedjaz Railway terminating in the Gulf of Akaba.

In the South a frontier to be agreed upon with the Egyptian Government.

In the West the Mediterranean Sea.

The details of the delimitations, or any necessary adjustments of detail, shall be settled by a Special Commission on which there shall be Jewish representation.

Statement.

THE HISTORIC TITLE.

The claims of the Jews with regard to Palestine rest upon the following main considerations:

1° The land is the historic home of the Jews; there they achieved their greatest development; from that centre, through their agency, there emanated spiritual and moral influences of supreme value to mankind. By violence they were driven from Palestine, and through the ages they have never ceased to cherish the longing and the hope of a return.

2° In some parts of the world, and particularly in Eastern Europe, the conditions of life of millions of Jews are deplorable. Forming often a congested population, denied the opportunities which would make a healthy development possible, the need of fresh outlets is urgent, both for their own sake and in the interest of the population of other races, among whom they dwell. Palestine would offer one such outlet. To the Jewish masses it is the country above all others in which they would most wish to cast their lot. By the methods of economic development to which we shall refer later, Palestine can be made now as it was in ancient times, the home of a prosperous population many times as numerous as that which now inhabits it.

3° Palestine is not large enough to contain more than a proportion of the Jews of the world. The greater part of the fourteen millions or more scattered through all countries must remain in their present localities, and it will doubtless be one of the cares of the Peace Conference to ensure for them, wherever they have been oppressed, as for all peoples, equal rights and humane conditions. A Jewish National Home in Palestine will, however, be of high value to them also. Its influence will permeate the Jewries of the world; it will inspire these millions, hitherto often despairing, with a new hope; it will hold out before their eyes a higher standard; it will help to make them even more useful citizens in the lands in which they dwell.

4° Such a Palestine would be of value also to the world at large, whose real wealth consists in the healthy diversities of its civilisations.

5° Lastly the land itself needs redemption. Much of it is left desolate. Its present condition is a standing reproach. Two things are necessary for that redemption—a stable and enlightened Government, and an addition to the present population which shall be energetic, intelligent, devoted to the country, and backed by the

large financial resources that are indispensable for development. Such a population the Jews alone can supply.

Inspired by these ideas, Jewish activities particularly during the last thirty years have been directed to Palestine within the measure that the Turkish administrative system allowed. Some millions of pounds sterling have been spent in the country particularly in the foundation of Jewish agricultural settlements. These settlements have been for the most part highly successful.

With enterprise and skill the Jews have adopted modern scientific methods and have shown themselves to be capable agriculturalists. Hebrew has been revived as a living language; it is the medium of instruction in the schools and the tongue is in daily use among the rising generation. The foundations of a Jewish University have been laid at Jerusalem and considerable funds have been contributed for the creation of its building and for its endowment. Since the British occupation, the Zionist Organization has expended in Palestine approximately £50,000 a month upon relief, education and sanitation. To promote the future development of the country great sums will be needed for drainage, irrigation, roads, railways, harbours and public works of all kinds, as well as for land settlement and house building. Assuming a political settlement under which the establishment of a Jewish National Home in Palestine is assured the Jews of the world will make every effort to provide the vast sums of money that will be needed.

Hundreds of thousands of Jews pray for the opportunity speedily to begin life anew in Palestine. Messengers have gone out from many places, and groups of young Jewish men proceeding on foot have already reached Trieste and Rome on their weary pilgrimage to Zion.

The historic title of the Jews to Palestine was recognised by the British Government in its Declaration of November 2nd 1917, addressed by the British Secretary of State for Foreign Affairs to Lord Rothschild and reading as follows:

"His Majesty's Government view with favour the establishment in Palestine of a National Home for the Jewish people, and will use their best endeavours to facilitate the achievement of this object, it being clearly understood that nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities in Palestine or the rights and political status enjoyed by Jews in any other country."

The French Government gave its support to the British Declaration to M. Sokolow as follows:

Ministre des Affaires Etrangères de la
République Française

"Monsieur, LE 14 FÉVRIER 1918.

"Comme il avait été convenu au cours de notre entretien le samedi 9 de ce mois, le Gouvernement de la République, en vue de préciser son attitude vis-à-vis des aspirations sionistes, tendant à créer pour les juifs en Palestine un foyer national, a publié un communiqué dans la Presse.

"En vous communiquant ce texte, je saisis avec empressement l'occasion de vous féliciter du généreux dévouement avec lequel vous poursuivez la réalisation des vœux de vos coreligionnaires et de vous remercier du zèle que vous apportez à leur faire connaître les sentiments de sympathie que leurs efforts éveillent dans les pays de l'Entente et notamment en France.

"Veuillez agréer, Monsieur, les assurances de ma considération très distinguée.

"(Sgd) S. PICHON."

ENCLOSURE.

PARIS, LE 9 FÉVRIER 1918.

Monsieur Sokolow représentant des organisations Sionistes, a été reçu ce matin, au Ministère des Affaires Étrangères, par M. Stephen Pichon, qui a été heureux de lui confirmer que l'entente est complète entre les gouvernements français et britannique en ce qui concerne la question d'un établissement juif en Palestine.

The Italian Government has declared its approval on the same lines. The President of the United States has expressed his sympathy with the Zionist aspirations in the spirit of Mr. Balfour's declaration. The Governments of Japan, Greece, Serbia, China and Siam, have added their approval to the declaration.

GREAT BRITAIN AS MANDATORY OF THE LEAGUE OF NATIONS.

We ask that Great Britain shall act as Mandatory of the League of Nations for Palestine. The selection of Great Britain as Mandatory is urged on the ground that this is the wish of the Jews of the world and, the League of Nations in selecting a Mandatory will follow as far as possible, the popular wish of the people concerned.

The preference on the part of the Jews for a British Trusteeship is unquestionably the result of the peculiar relationship of England to

the Jewish Palestinian problem. The return of the Jews to Zion has not only been a remarkable feature in English literature, but in the domain of statecraft it has played its part, beginning with the re-admission of the Jews under Cromwell. It manifested itself particularly in the 19th century in the instructions given to British Consular representatives in the Orient after the Damascus Incident; in the various Jewish Palestinian projects suggested by English non-Jews prior to 1881; in the letters of endorsement and support given by members of the Royal Family and Officers of the Government to Laurence Oliphant; and finally, in the three consecutive acts which definitely associated Great Britain with Zionism in the minds of the Jews, viz.—The El Arish offer in 1901; the East African offer in 1903, and lastly the British Declaration in favour of a Jewish National Home in Palestine in 1917. Moreover, the Jews who have gained political experience in many lands under a great variety of governmental systems, whole-heartedly appreciate the advanced and liberal policies adopted by Great Britain in her modern colonial administration.

It may be stated without doubt that all of these things account for the attitude taken by the Jews with reference to the Trusteeship, as evidenced by the following:

On December 16th 1918, the American Jewish Congress composed of delegates representing 3,000,000 American Jews adopted the following resolution:

"The American Jewish Congress instruct their delegation to Europe to co-operate with representatives of other Jewish Organizations and specifically with the world Zionist Organization, to the end that the Peace Conference may recognise the aspirations and historic claims of the Jewish people with regard to Palestine, and declare that, in accordance with the British Government's Declaration of November 2nd 1917 endorsed by the Allied Governments and the President of the United States, there shall be established such political administrative and economic conditions in Palestine, as will assure under the trusteeship of Great Britain, acting on behalf of such League of Nations as may be formed, the development of Palestine into a Jewish Commonwealth; it being clearly understood that nothing shall be done which shall prejudice the civil and religious rights of existing non-Jewish communities in Palestine, or the rights and political status enjoyed by Jews in other countries."

Similar action was taken in Jaffa in the month of December 1918 by a conference of representatives of the Jewish population in Palestine and on January 4th 1919 by Jewish Congresses representing about 2,000,000 Jews of the reconstituted States of Austria-Hungary and of Poland.

BOUNDARIES.

The boundaries above outlined are what we consider essential for the necessary economic foundation of the country. Palestine must have its natural outlets to the seas and the control of its rivers and their headwaters. The boundaries are sketched with the general economic needs and historic traditions of the country in mind, factors which necessarily must also be considered by the Special Commission in fixing the definite boundary lines. This Commission will bear in mind that it is highly desirable, in the interests of economic administration that the geographical area of Palestine should be as large as possible so that it may eventually contain a large and thriving population which could more easily bear the burdens of modern civilised government than a small country with a necessary limitation of inhabitants.

The economic life of Palestine, like that of every other semi-arid country depends on the available water supply. It is therefore, of vital importance not only to secure all water resources already feeding the country, but also to be able to conserve and control them at their sources.

The Hermon is Palestine's real "Father of Waters" and cannot be severed from it without striking at the very root of its economic life. The Hermon not only needs re-afforestation but also other works before it can again adequately serve as the water reservoir of the country. It must therefore be wholly under the control of those who will most willingly as well as most adequately restore it to its maximum utility. Some international arrangement must be made whereby the riparian rights of the people dwelling south of the Litani River may be fully protected. Properly cared for these head waters can be made to serve in the development of the Lebanon as well as of Palestine.

The fertile plains east of the Jordan, since the earliest Biblical times, have been linked economically and politically with the land west of the Jordan. The country which is now very sparsely populated, in Roman times supported a great population. It could now serve admirably for colonisation on a large scale. A just regard for the economic needs of Palestine and Arabia demands that free access to the Hedjaz Railway throughout its length be accorded both Governments.

An intensive development of the agriculture and other opportunities of Trans-Jordania make it imperative that Palestine shall have access to the Red Sea and an opportunity of developing good harbours on the Gulf of Akaba. Akaba, it will be recalled, was the terminus of an important trade route of Palestine from the days of

Solomon onwards. The ports developed in the Gulf of Akaba should be free ports through which the commerce of the Hinterland may pass on the same principle which guides us in suggesting that free access be given to the Hedjaz Railway.

PROPOSALS TO THE MANDATORY POWER.

In connection with the Government to be set up by the Mandatory of the League of Nations until such time as the people of Palestine shall be prepared to undertake the establishment of representative and responsible Government, proposals will be made in due course to the Mandatory Power to the following effect:

1. In any instrument establishing the constitution of Palestine the Declarations of the Peace Conference shall be recited as forming an integral part of that constitution.

2. The Jewish people shall be entitled to fair representation in the executive and legislative bodies and in the selection of public and civil servants. In giving such representation the Mandatory Power shall consult the Jewish Council hereinafter mentioned.

Neither law nor custom shall preclude the appointment of a citizen of Palestine as chief of the executive.

3. That in encouraging the self-government of localities the Mandatory Power shall secure the maintenance by local communities of proper standards of administration in matters of education, communal, or regional activities. In granting or enlarging local autonomy regard shall be had to the readiness and ability of the community to attain such standards. Local autonomous communities shall be empowered and encouraged to combine and co-operate for common purposes.

4. Education without distinction of race shall be assisted from public funds.

5. Hebrew shall be one of the official languages of Palestine and shall be employed in all documents, decrees and announcements and on all stamps, coins and notes issued by the Government.

6. The Jewish Sabbath and Holy Days shall be recognised as legal days of rest.

7. All inhabitants continuing to reside in Palestine who on the day of , 19 , have their domicile in Palestine, except those who elect in writing within six months from such date to retain their foreign citizenship, shall become citizens of Palestine, and they and all persons in Palestine or naturalised under the laws of Palestine after the day of , 19 shall be citizens thereof and entitled to the protection of the Mandatory Power on behalf of the Government of Palestine.

LAND COMMISSION.

Recognising that the general progress of Palestine must begin with the reform of the conditions governing land tenure and settlement, the Mandatory Power shall appoint a Commission (upon which the Jewish Council shall have representation) with power:

(*a*) To make a survey of the land and to schedule all lands that may be made available for close settlement, intensive cultivation and public use.

(*b*) To propose measures for determining and registering titles of ownership of land.

(*c*) To propose measures for supervising transactions in land with a view of preventing land speculation.

(*d*) To propose measures for the close settlement, intensive cultivation and public use of land, where necessary by compulsory purchase at a fair pre-war price and further by making available all waste lands unoccupied and inadequately cultivated lands or lands without legal owners and state lands.

(*e*) To propose measures for the taxation and the tenure of land and in general any progressive measures in harmony with the policy of making the land available for close settlement and intensive cultivation.

(*f*) To propose measures whereby the Jewish Council may take over all lands available for close settlement and intensive cultivation.

(*g*) In all such measures the established rights of the present population shall be equitably safeguarded.

THE JEWISH COUNCIL FOR PALESTINE.

1. A Jewish Council for Palestine shall be elected by a Jewish Congress representative of the Jews of Palestine and of the world, which shall be convoked in Jerusalem on or before the First day of January, 1920, or as soon thereafter as possible by the Provisional Jewish Council hereinafter mentioned.

The Jewish Congress shall determine its functions as well as the constitution and functions of the Jewish Council in conformity with the purpose and spirit of the Declarations of the Peace Conference and of the powers conferred by the Mandatory Power upon the Jewish Council.

2. The Jewish Council shall be recognised as a legal entity and shall have power:

(*a*) To co-operate and consult with and to assist the Government of Palestine in any and all matters affecting the Jewish people

in Palestine and in all such cases to be and to act as the representative of the Jewish people.

(*b*) To participate in the development and administration of immigration, close land settlement, credit facilities, public works, services and enterprises, and every other form of activity conducive to the development of the country. The organization of Jewish education to be entrusted to such Council.

(*c*) To acquire and hold real estate.

(*d*) To acquire and exercise concessions for public works and the development of natural resources.

(*e*) With the consent of the Jewish inhabitants concerned or their accredited representatives, to assess such inhabitants for the purpose of stimulating and maintaining education, communal, charitable and other public institutions (including the Jewish Council) and other activities primarily concerned with the welfare of the Jewish people in Palestine.

(*f*) With the approval of the Mandatory Power and upon such terms and conditions as the Mandatory Power may prescribe, to administer the immigration laws of Palestine in so far as they affect Jewish immigration.

(*g*) With the approval of the Mandatory Power, to issue bonds, debentures, or other obligations, the proceeds of any or all of which to be expended by the Jewish Council for the benefit of the Jewish people or for the development of Palestine.

(*h*) The Jewish Council shall hold all of its property and income in trust for the benefit of the Jewish people.

3. A Provisional Jewish Council of representatives of the Zionist Organization, of the Jewish population in Palestine, and of such other approved Jewish organisations as are willing to co-operate in the development of a Jewish Palestine shall be formed forthwith by the Zionist Organization. Such Provisional Jewish Council shall exercise all of the powers and perform all of the duties of the Jewish Council until such time as the Jewish Council shall be formally constituted by the Jewish Congress.

4. Finally when in the opinion of the Mandatory Power, the inhabitants of Palestine shall be able to undertake the establishment of representative and responsible government, such steps shall be taken as will permit the establishment of such government through the exercise of a democratic franchise without regard to race or faith; and the inhabitants of Palestine under such government, shall continue to enjoy equal civil and political rights as citizens irrespective of race or faith.

THE ZIONIST ORGANIZATION.

The foregoing proposals with reference to Palestine are submitted to the Peace Conference by the Zionist Organization. This Organization in the present form dates from the year 1897, when the first Zionist Congress was held at Basle, Switzerland, under the leadership of Theodor Herzl. This Organization absorbed at that time all Zionist Organizations which had been in existence previously. The Zionist Movement is supported by Jews in every country where there are Jewish Mass Settlements, i.e., in Eastern Europe, in the United States of America, in Western Europe, in all the British Colonies, in the Argentine, in Siberia, in Shanghai, in Morocco, and in Tunis. Zionist Federations actively engaged in furthering the principles for which the movement stands, are to be found in all these countries.

The supreme body which controls the activities of the Organizations in the different countries consists of delegates elected by the various local Shekel payers (poll tax) by a democratic franchise, and this body meets biennially.

Through the several financial agencies which the Zionist Congress has created to enable it to carry forward its work in Palestine, the Organization and associated bodies have raised and have expended in Palestine since its inception, millions of pounds. Notwithstanding the fact that since 1913 no meetings of the Congress have been held the Organization has greatly increased its enrolled membership, and has the support of hundreds of thousands of Jews who sympathise with the aims of the movement, and contribute to its funds. Since the war, the centres of political activity have been transferred to London and the United States of America.

In the Allied countries the conduct of the political activities of the Organization has been entrusted to Dr. Chaim Weizmann and M. Nahum Sokolow, members of the Executive. In the United States of America the Provisional Executive Committee for General Zionist Affairs, created at the outbreak of the war, has been replaced by the Zionist Organization of America, the Honorary President of which is Louis D. Brandeis, Associate Justice of the Supreme Court of the United States. Zionists are to be found at the head of all the greater Jewish national institutions which depend upon mass opinion for moral and financial support; and in addition they take a prominent part in all the Jewish National Councils established in the new States in Eastern Europe.

APPENDIX II

CONCLUSION.

In every part of the world on the Day of Atonement the Jews pray that "all nations may be united by a common bond, so that the will of God may reign supreme throughout the world". In the fulfilment of this prayer, the Jews hope that they will be able to take an honorable place in the new community of Nations. It is their purpose to establish in Palestine a government dedicated to social and national justice; a government, that shall be guided like the community of old by that justice and equality which is expressed in the great precept of our Lawgiver: "There shall be but one law for you and the stranger in the land".

ALL OF WHICH IS RESPECTFULLY SUBMITTED.
Rothschild (Lord Walter Rothschild).

ON BEHALF OF THE ZIONIST ORGANIZATION.
Nahum Sokolow. Chaim Weizmann.

ON BEHALF OF ZIONIST ORGANIZATION OF AMERICA.
Julian W. Mack.
Stephen S. Wise.
Harry Friedenwald.
Jacob de Haas.
Mary Fels.
Louis Robison.
Bernard Flexner.

ON BEHALF OF THE RUSSIAN ZIONIST ORGANIZATION.
Israel Rosoff.

ON BEHALF OF THE JEWISH POPULATION OF PALESTINE IN ACCORDANCE WITH MANDATE RECEIVED.
Nahum Sokolow.
Chaim Weizmann.

Appendix III: Hydronationalism

THE ISRAEL MINISTRY OF AGRICULTURE

Presents:

ISRAEL-THE LAND AND ITS SIGNIFICANCE

THE QUESTION OF WATER-SOME DRY FACTS

Water is an extremely scarce resource in Israel. In fact, it is in many ways the limiting factor on the country's future development.

At present all the known sources of supply are being almost fully exploited - and in some cases even dangerously **overexploited**.

The country's natural water supply originates from three major sources:

★ The Jordan River catchment area
★ Two major underground water-bearing geological structures called **aquifers**.
- The Mountain (or Yarkon-Taninim) Aquifer
- The Coastal Aquifer

The latter two sources constitute subterranean reserviors, containing approximeately 60 per cent of Israel's water supply. The waters they store are affected, directly and indirectly, by civilian and ecological activity in Judea and Samaria - as to both the quantity and the qunlity of the water.

The Physical Implications

★ Excessive pumping or uncontrolled sewage and waste disposal in Judea and Samaria are liable to cause serious *depletion*, *salination* and *pollution* of the aquifiers. Relinquishing the western slopes of the Judean and Samarian hills will create a situation in which the fate of the national water supply could be determined by the actions of whatever Arab authority controlled the evacuated areas after withdrawal.

★ Any exploitation or pollution of the aquifiers (particulary the Mountain Aquifier) by the **Palestinian** authorities would, by the principle of connecting vessels, have an immediate and significantly detrimental effect on the **Israeli** water supply. Given the present critical scarcity of water in Israel, even with all the available sources of supply at her disposal, withdrawal and the relinquishing of control of a substantial portion of these sources could leave the country in a potentially desperate plight.

★ It is important to note that the mortal dangers implict in such a situation could arise, even **without** there being any malicious intent on the part of the Arabs. They could result with equal severity from simple municipal mismanagement, poor planning, lack of knowledge or plain neglect. However, whatever the reasons may be, Israel may easily find herself facing irreparable damge to the supply of one of her most vital strategic sources - a situation which would, in a most tangible way, endanger her continued existence

The Political Implications

★ The crucal issue to be considered in any political solution regarding the future of Judea and Samaria is the question of who **will have final authority in resolving issues in dispute.** This is especially acute in the case of water resources, as any proprosed Palestinian political entity, whether sovereign or autonomous, would have no water resources at all, other than those upon which Israel is so critically dependent for her day-to-day survival.

★ This intense interdependence and the scarcity of water supplies accentuate even more the severity of the problem of **authority**. For under such conditions, even if some sincere and trustworthy Palestinian party could be found with whom an agreement could be made, the problem of allocating such a vital and scarce shared resource would make disputes almost inevitable.

★ Who would have the final say as to where drilling sites were to be located? How much water is to be pumped from them without irreparably damaging the aquifiers? Where potentially polluting industries should or should not be established within the evacuated areas? In cases of disagreement, whose will is to be imposed on whom? How could Israel secure its vital interests without imposing impossible restrictions on the Palestinians' freedom to resolve their own domestic issues? Conversely, how could the Palestinians be given freedom to safeguard their legitimate domestic issues, without gravely endangering Israel's vital interests?

★ Moreover, even if all disputes were resolved, however unlikely such a possibility may be, and some fragile compromise were to be reached, Israel's future would be completely dependent upon the honoring of that compromise agreement not only by the Palestinian party who **signed** it, but also by any **successor** who may come to power in the future. Clearly, the many extreme and militant elements, who undoubtedly oppose any agreement with Israel, together with the enormous socio-economic difficulties that any Palestinian administration would face, make very likely the overthrow of the original Palestinian regime and its replacement by some other regime, far more hostile to Israel. Such a successor regime would, of course, be highly unlikely to honor the compromise so vital to Israel's continued existence, especially as it would constitute the very justification for the overthrow of its predecessor!!!

★ Finally, relinquishing control over Judea and Samaria will leave Israel without any legal, moral or practical means to prevent the repatriation of almost a million Palestinians resident in refugee camps in surrounding Arab countries, whether by their own free will or by forcible "transfer" by their reluctant Arab "hosts." Such a wave of poverty-stricken humanity would generate an impossible strain on the already over-extended water supply and inadequate sewerage system, endangering even further Israel's vulnerable and fragile source of life.

★ It is difficult to conceive of any political solution consistent with Israel's survival that does not involve complete, continued Israeli control of the water and sewerage systems, and of the associated infrastructure, including the power supply and road network, essential to their operation, maintenance and accessibility.

This is an important point to ponder for those advocates of Israeli concessions who believe the Jews should have a viable independent state in their ancient homeland. It is important to realize that the claim to continued Israeli control over Judea and Samaria is not based on extremist fanaticism or religious mysticism but on a rational, healthy and reasonable survival instinct.

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The criticism levelled at the publication of the advertisement dealing with the country's water problem focuses on two major allegations:

1. The subject matter was not within the scope of the Ministry's activities

2. The advertisement constituted party-biased election propaganda

Both allegations are totally groundless.

1. <u>The Nature of the Subject Matter</u>

a) The national water system <u>in its entirety</u> (including Tahal - National Water Planning, Mekorot - National Water Supplier, and the Water Commissioner) are all subordinated to the Ministry of Agriculture. Therefore the Ministry has a <u>duty</u> to warn the public of imminent dangers to the national water system whether the origin of these dangers be ecological processes or possible policy decisions.

b) This duty continues to exist even if in the past the Minister's own party happened to point to these dangers whilst it was in opposition. Moreover it continues to exist even if it is difficult to reconcile the <u>hydrological facts</u> with <u>ideological opinions</u> of parties holding views opposed to those of the Minister's party.

c) The allegation that the question of authority and control over the water sources in Judea and Samaria is of no concern to the Ministry of Agriculture is totally without foundation. For example the former (Labour Party) Minister of Agriculture Katz-Oz related to precisely this issue in the very same spirit as expressed in the advertisement.

In a letter dated 14/5/89/ to Premier Shamir titled "The Security of the State of Israel's Water Today and in the Future" Katz-Oz proposed that the government "prepare a legal and political basis to insure continued Israeli control and administration of the water sources in Judea and Samaria, whatever the political situation in the future."

d) Just how vital the issue of control of the water sources in Judea and Samaria is for the activities of the Ministry of Agriculture is reflected in the following excerpt from the Water Commissioners report to the Israeli Government. The report entitled "Political Arrangements in Judea, Samaria and Gaza, and their Influence on the Security of the Water of the State of Israel" (May 89) states:

The water sources of Judea and Samaria are intimately interconnected with the principal water sources of Israel ... the quantities reaching Israel are exploited entirely as high quality groundwater, and constitute approximately half of the country's supply of drinking water.... It is physically possible to increase the rate of pumping in

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Judea and Samaria in the North and West regions to such a degree so as to cause the halt of pumping operations inside Israel....An additional danger to the groundwater in Judea and Samaria arises from sewerage and other sources of pollution which will contaminate the water in the western regions..."pp1-2.

e) These facts have immediate impact on agricultural policy and its planning. In a publication: " A Proposed Rehabilitation and Development Program for Agriculture" by the Ministry's Council for Planning and Development of Agriculture and Rural Settlements, and the Jewish Agency, it is stated, under the heading "The Water System - Aims and Development Program" as follow :

The principles formulated for the water system are:

1. Preservation of the various water sources, both as regards quality and quantity, and the prevention of over-exploitation.

2. Ensuring the supply of drinking water to the population in the quantity and quality required.

f) Clearly, from the report of the Water Commissioner ((d) above) it is impossible to preserve, ensure water supplies or prevent over-exploitation of the system, if one does not have complete control over the water sources in Judea and Samaria (because of the principle of connecting vessels - see (i) below).

(g) The former Minister of Agriculture was aware of this fact and suggested together with his aforementioned proposal to ensure continued Israeli control over the water sources in Judea and Samaria (c) above) that Israel "prevent any increase of the pumping operation in Judea, Samaria and Gaza.

h) How serious an influence the loss of control of the water sources would be, has been stressed by members of the academic community. In a memorandum to the Minister of Agriculture titled "The Water System - Its Condition and Cure" Prof. Szlavski of the Faculty of Agricultural Engineering of the Haifa Technion writes:

"The mountain water sources are controlled mainly by Arab settlements, a significant portion of which are over the Green Line. The past wars over water are liable to be a pale shadow of future wars over water..."

In the Globes daily (22.8.) the professor asserts:

"There is no doubt that the two populations, that inhabiting the mountains ridges (of Judea and Samaria) and that inhabiting the coast are supplied from the same water source. Those charged with the

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responsibility for the water system and its planning must take account of this fact... The concern is not only about unrestrained exploitation by those inhabiting the mountains. The is also a problem of the pollution of the water. The population of Judea and Samaria have no central sewerage system or sewerage treatment. The is no doubt that this sewerage contaminates the source of water used by us.

(i) Support for this position is voiced by Matti Hagai of Tel Aviv University in this thesis :Water Management in Israel:Views on National Planning". He writes:

Anyone who controls the water sources of Judea and Samaria can dry out, if he so wishes, wells in the coastal plain, Harod Valley and Bet She'an valley, by the principle of connecting vessels ....

(j) In somewhat more sever tones the (left-wing) Ha'aretz newspaper warns:

Anyone who controls the water source of the West Bank can, quite simply dry out the coastal plain in Israel. Control of the two major aquifers, drilling of deep bore-holes and subsequent intensive pumping in Western Samaria and in the Jenin and Tubas area are liable to leave the Jewish farmers of the Sharon without irrigation water, and the fields of the Jezre'el Valley devastated.

from "Water - The Bone of Contention" Reuven Pedazur 25.4.89.

Clearly the prospect of Jewish farmers in the Sharon being left without irrigation water and devastated fields in the Jezre'el Valley are matters of very real and legitimate concern to the Ministry of Agriculture and one which it should address openly. When the Minister charged with the responsibility for both the national water system and the nation's agriculture sees potential dangers arising from possible future policy decisions, who if not that Minister should alert the public?

k) It is true that the advertisement analyzes implications and dangers involved in future political arrangements, but only in so far as they impinge on the question of water. However this is no more than an elaboration and explanation justifying former Minister Katz-Oz's claim to ""prepare a legal and political basis to insure continued Israeli control and administration of the water source in Judea and Samaria whatever the political situation in the future."

From the above it is quite clear that the subject matter of the advertisement - i.e. the control of the water sources in Judea and Samaria -was, and still is, one of the vital issues in the Ministry's field of activity. Bringing vitally important but little known facts, and their implications to the knowledge of the public is not only a real public

service but a moral responsibility. The concealment or playing down of these facts (quite probably for political reasons) constitutes a grave dereliction of duty by those formerly charged with the fate of nation's water system.

Clearly one cannot negate the right of a Minister to make public the covert policy of his predecessor simply because this policy is in line with the Minister's publicly stated views on the subject prior to his taking office.

2. The advertisement constituted party-biased election propaganda

This allegation is extremely difficult to comprehend since:

a) There is no reference at all, neither explicit nor implicit, to any political party whatsoever, much less any call to solicit votes for any specific party.

b) There are several parties, both in the coalition and the opposition, which could enlist the contents of the advertisement to support their political views.

c) The contents of the advertisement deal overtly with policy issues previously handled covertly by a Minister of Agriculture from the Labour party, whose declared political platform is very different from that of the present Minister's party.

d) It would be absurd to prevent a ministry from elaborating aspects of its policy, and its rationale, on the grounds that incumbent minister had, prior to taking office, voiced his opinion on matters for which the ministry has responsibility.

e) The sensitivity of the national water system to whatever happens to the water sources in Judea and Samaria is an indisputable (and undisputed) hydrological fact. Therefore, the importance of control of the water sources in these areas is an inevitable corollary of this sensitivity. Illumination and articulation of these facts, and their implications, can in no way be considered political propaganda.

If there is any political aspect to the advertisement, it is in no way related to party partisan vote soliciting, but rather to the creation of public understanding concerning future initiatives of the Ministry in an area of its responsibility, initiatives which it considers essential in preventing the water issue in Israel from being transformed from an extremely grave problem into an insoluble one.

Consequently the Ministry of Agriculture is of the opinion the matter of the control and administration of the water sources in Judea and Samaria as one of vital importance to the existence of the State of Israel in general,

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and its agriculture in particular.

Exposing these facts and their implication to the public even by unconventional means is both a public service and a public duty.

Appendix IV: PRINCE Political Accounting System

PRINCE Political Accounting System

The views of each political entity regarding a possible interbasin water transfer are likely to be dependent on the individual relationships among the entities as well as on attitudes toward ''target entities.''

To summarize the political positions of each of the players, I use a Political Accounting System (PAS) as described by Coplin and O'Leary (1974; 1976) and incorporating modifications for hydropolitics by Frey and Naff (1985). Each player's political attitude (Issue, Power, and Salience) is ranked for each of the feasible coalitions. Issue Position is scored from -3 to $+3$, reflecting, respectively, strongly negative and strongly positive attitudes towards each coalition.

In the case of hydrologic disputes, power can include riparian position and legal strength as reflected in a water-sharing treaty, as well as the more traditional military and political aspects, and is ranked from 0 to 3 to reflect increasing levels of power. Issue Salience is, simply, how important a proposal is to a political entity, and is also rated from 0 to 3 to show increasing salience. This measure includes also a summation of internal forces, many of which are described by Endtner (1987).

While I recognize both the general lack of enthusiasm for quantitative political analysis, and the elementary and subjective nature of the PAS (see, for example, Ascher [1989] for a thorough critique of the PRINCE method), I feel that its inclusion in the model is a useful first step in an attempt to incorporate political considerations in an interdisciplinary model.

Once each component is evaluated for each player for participating in each coalition, multiplication across will give a measure of a player's overall level of support or opposition to a proposed coalition. Adding these values for each actor involved will provide a ranking value for the proposal as a whole, which can be compared with the values for other coalitions, a higher number reflecting greater likelihood of support.

Coplin and O'Leary (1983) suggest a Modified PAS that provides an absolute measure to estimate the likelihood of a coalition being established. This is achieved by calculating $A/(A+B+C)$, where A is the total scores of all the players in support, B is the absolute value of the total scores of those in opposition, and C is one-half the value of those with a neutral position.

Results of the PRINCE Political Accounting System, as applied to a series of possible coalitions for interbasin water transfers to the Jordan River watershed, are shown in table AIV.1 (from Dinar and Wolf 1992). The results are reported in chapter 4.

Table AIV.1 **Results of the PRINCE Political Accounting System applied to possible coalitions for interbasin water transfers to the Jordan River watershed: Modified political accounting systems for the regional game**

Riparian and target entities	Issue position	Power	Salience	Total	Probability
Coalitions		(EG), (IL), (GS), (WB)[a]			1.00
Coalition		(EG; IL)			0.23
Nile Basin					
Egypt	−2	3	3	−18	
Sudan	−3	2	2	−12	
Ethiopia	−2	2	2	−8	
Targets					
Israel	+2	2	3	+12	
Gaza	−1	1	1	−1	
West Bank	−1	1	1	−1	
			Total	−28	
Coalition		(EG; GS)			0.89
Nile Basin					
Egypt	+2	2	3	+12	
Sudan	+2	1	2	+4	
Ethiopia	−1	2	2	−4	
Targets					
Israel	+1	2	3	+6	
Gaza	+3	1	3	+9	
West Bank	+2	1	1	+2	
			Total	+29	
Coalition		(EG; IL; GS)			0.64
Nile Basin					
Egypt	+1	2	3	+6	
Sudan	−2	2	2	−8	
Ethiopia	−2	2	2	−8	
Targets					
Israel	+2	2	3	+12	
Gaza	+3	1	3	+9	
West Bank	+2	1	1	+13	
			Total		
Coalition		(EG; IL; WB)			0.64
Nile Basin					
Egypt	+1	2	3	+6	
Sudan	−2	2	2	−8	
Ethiopia	−2	2	2	−8	

Table AIV.1 (continued)

Riparian and target entities	Issue position	Power	Salience	Total	Probability
Targets					
Israel	+2	2	3	+12	
Gaza	+2	1	1	+2	
West Bank	+3	1	3	+9	
			Total	+13	
Coalition		(EG; IL; WB; GS)			0.73
Nile Basin					
Egypt	+1	2	3	+6	
Sudan	−2	1	2	−4	
Ethiopia	−2	2	2	−8	
Targets					
Israel	+2	2	3	+6	
Gaza	+1	1	2	+2	
West Bank	+1	1	2	+2	
			Total	+14	
Coalition		(IL; GS)			0.0
Coalition		(IL; WB)			0.0
Coalition		(IL; WB; GS)			0.0

Source: Dinar and Wolf (1992)
a. (EG), Egypt; (IL), Israel; (GS), Gaza; (WB), West Bank.

Appendix V: JRDNRVR. BAS projection model

JRDNRVR. BAS projection model

The model used to project water supply and demand into the future is a fairly straightforward extrapolation model. Initial conditions for population, population growth, water supply, and current use are used to forecast future water demand as a function of population. Initially, future water supply is assumed to remain constant.

To allow for some flexibility for management purposes, the model is designed to be interactive, allowing a user to input a variety of technical and policy assumptions. The model takes these user-input variables and calculates population, water supply, and per capita water availability for Israel, the West Bank, Gaza, and Jordan, over a 30-year time horizon. The model calculates a low-demand forecast, assuming that future urban consumption (personal and industrial) will grow in proportion to current use, and a high-demand scenario, allowing 100 m^3 per person per year for urban use. Implicit in these calculations is the assumption that growth in agriculture will come through greater water efficiency and technology, and not through increased allocations to that sector.

Explicit assumptions include the accuracy of the initial conditions, growth rates, and water supply figures, and that these values will remain constant over time.

The input screens are as follows:

Appendix V

JRDNRVR.BAS
A COMPUTER PROJECTION MODEL

The Mideast is the site of both severe water shortage and of intense, often violent, political conflict. Because water scarcity and political tensions have been shown to be inextricably linked in that arid and volatile region, it is crucial to understand the political consequences of hydrological actions as well as the hydrological ramifications of political decision-making.

JRDNRVR.BAS generates future water supply and demand figures for Israel, the West Bank, Gaza, and Jordan, based on current patterns. You, the "hydro - strategic" planner, can make a series of technical and political assumptions to make the model fit a variety of future scenarios.

The two types of state variables are for water supply and populations. The base assumptions for the model are as follows:

-- Israel	Current population - 4,600,000 Pop. growth rate - 1.6% Annual water budget - 1800 MCM/yr.
--West Bank:	Current population - 900,000 Pop. growth rate - 3.4 % Annual water budget - 110 MCM/yr.
-- Gaza	Current population - 600,000 Pop. growth rate - 3.4% Annual water budget - 130 MCM/yr. Water potential - 70 MCM/yr.
-- Jordan	Current population - 3,300,000 Pop. growth rate - 3.5% Annual Water budget - 870 MCM/yr. Water potential - 870 MCM/yr.

The model assumes that these variables are constant into the future but you can change any of the values by answering the questions which follow.

User's notes: --Percentages should be in decimal form (eg.10% = 0.1),
--Current values will be given in parentheses for reference,
--use y and n for yes and no,
--the time-frame considered is 1996-2025

Would you like to skip the user's section and run the base model (y,n)?

I. POPULATION

Israel anticipates between one and two million Soviet immigrants over the next decade.
How many would you like to assume actually arrive (0-2,000,000)?

There are 2.2 million Palestinians registered world-wide as refugees. In the event of an autonomous Palestine on the West Bank, many of these refugees would likely immigrate to the area.
Would you like to assume that such an entity is created (y,n)?

Would you like to change the growth assumptions, due for example to increased religious fundamentalism or, alternately, to better family planning (y,n)?

II. WATER SUPPLY

Water supply is a combination of groundwater, surface water, and wastewater-reclamation. These values are considered constant unless changed as follows:

--Groundwater and surface water can be assumed to fluctuate around a normal (Gaussian) distribution based on actual rainfall data. (Only Israeli and West Bank supplies, both dependent on surface water, will fluctuate.)

Would you like to assume such a distribution (y, n)?

--Reclamation and water-saving technology such as drip-irrigation has been effectively adding to water supply at an approximate rate of 1%/yr. over the last decades. The model only incorporates advances made to date.

Would you like to assume that such advances are made into the future (y,n)?

--Large-scale technical options which exist for the near future include water imports and desalination projects. Israel, for example, is negotiating to import 40 MCM/yr. by the bargeload from Turkey.
Two options are open to you:

1) To leave the model as is, without incorporating these projects.
2) To incorporate such projects by country, size and year.

NOTE: The model will delineate the `water barrier' level to aid in planning. According to Falkenmark (1989) this is the amount of water per capita which a population in this region needs to fulfill its minimum hydrologic requirements. One strategy might be to run the model as is once to note the year in which `water stress' occurs, then run it again `building' water projects as needed to alleviate the problems.

Please indicate the option desired (1-2)?

Would you like such a project built in Israel (y, n)?
In what year would you like the project completed?
How large should the project be (MCM/yr.)?
Would you like another such project in Israel (y,n)?

Would you like such a project built on the West Bank (y,n)?
In what year would you like the project completed?
How large should the project be (MCM/yr.)?
Would you like another such project on the West Bank (y,n)?

Would you like such a project built in Gaza (y,n)?
In what year should you like the project completed?
How large should the project be (MCM;yr.)?
Would you like another such project in Gaza (y,n)?

Would you like such a project built in Jordan (y,n)?
In what year would you like the project completed?
How large should the project be (MCM/yr.)?
Would you like another such project in Jordan (y, n)?

RUN PROGRAM

Appendix VI: Med–Dead/ Red–Dead desalination project

Med–Dead/Red–Dead desalination project

The Med–Dead or Red–Dead Canal would allow desalination units of varying sizes, and using different methods, all along its route. The most likely locations and methods are listed in table AVI.1. The sizes and cost per unit water are not included, as such values are highly variable and dependent on site, energy costs, financing arrangements, and the salinity of the source water. Estimates usually range from US$1 to US$2/m^3 plus the cost of delivery (see, for example, Glueckstern 1991).

In determining an order of priorities for water delivery, one might consider per capita availability as a factor along with cost of delivery and economic efficiency. For example, a lower current per capita availability for Gaza might suggest targeting that entity for initial water supplies, other factors being equal. Once per capita availability reaches that of the West Bank, the next lowest, that entity might receive allocations until availability reaches that of Jordan and then Israel.

Kally (1989) and others make the important point that the desalinated water itself does not have to be delivered to its destination, but ''in-kind'' transfers can be made instead. The most common example is water desalinated on the Mediterranean coast supplying Gaza or the Israeli grid in the Negev, in exchange for the transfer of a similar amount of Jordan River or Yarmuk water to the West Bank or Jordan.

Table AVI.1 **Med–Dead or Red–Dead Canal as desalination project: The most likely locations of units and methods of desalination**

	Considerations	
Location	Technical	Economic
Intake site (Gaza/Tel Aviv or Aqaba/Eilat: two large-scale units recommended)	Should be first built Could be dual-purpose multi-effect distillation Could spawn small-scale solar ponds with brine and sea water	Price of desalination could drop if brackish groundwater piped in
Outflow site (Dead Sea: three large-scale units)	Three power sources are available: (1) hydropower; (2) head differential for reverse osmosis; (3) large-scale solar lake	Brackish water available close by and three clean power sources should help viability
Along canal route	Several small-scale solar ponds and/or dual-purpose power stations could be built as needed over time	Brackish water and/or Saudi support for fuel would be beneficial

Sources

Interviews (carried out 1989–1992)

United States

Valerie Amiel, World Bank
Imad Badran, Embassy of Jordan
Senator Howard Baker
Cal Burwell, formerly of Oak Ridge National Laboratories
Dwayne Chapman, Cornell University
Jerry Delli Priscoli, US Army Corps of Engineers
Abdel Azim El-Gazzar, Egyptian Embassy
Arun Elhance, US Institute of Peace
Yossef Elkanna, Israeli Embassy
Steve Grumman, US Department of State
Fred Hof, US Department of State
Allen Kieswetter, US Department of State
Ambassador Samuel Lewis, US Institute of Peace
Steve Lintner, World Bank
Joyce Starr, Global Water Summit Initiative
Ardy Stoutjesdijk, World Bank
Karen Stuart, US Department of State
Ismail Turkoz, Turkish Embassy
Alvin Weinberg, past Director of Oak Ridge National Laboratories
Gordon Wolman, Johns Hopkins University

Israel and the West Bank

Joseph Alpher, Jaffee Center for Strategic Studies
Meier Ben-Meier, former Water Commissioner
Pedro Berliner, Ben-Gurion University
Menahem Cantor, former Water Commissioner
Shmuel Cantor, Mekorot
Rahamim Cohen, Mekorot
Nader El-Khatib, Palestinian Hydrology Group
Pinhas Glueckstern, Mekorot
Zeev Golani, Mekorot
Shlomo Gur, Planning and Development, Ltd
Jad Isaac, Applied Research Institute
Arye Issar, Ben-Gurion University
Elisha Kally, engineer
Avraham Katz-Oz, former Minister of Agriculture

Gamal Khativ, teacher, town of Ghajar
Chuck Lawson, US Embassy in Tel Aviv
Avraham Nadal, Mekorot
Avraham Ofir, Israel Desalination Engineering
Haim Paldi, engineer
Reuven Pedhatzor, journalist, Jaffee Center
General (retired) Arye Shalev
General (retired) Avraham Tamir
Avner Turgeman, Mekorot
Yehoshua Schwartz, Tahal
Martin Sherman, Ministry of Agriculture
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