

## ENVIRONMENTAL QUALITY IN ISRAEL: A FORTY-YEAR PERSPECTIVE

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### **Updates and supplements**

The process of writing the National Scenario lasted nearly three years, but completing it took another year or so. As the report was being written, changes occurred in Israel and the world at large that, while not invalidating the forecasts, cannot be altogether disregarded. The data in several chapters have therefore been updated. This, however, is not enough, because even the revised information does not fully reflect the changes that have taken place in the past few years. Accordingly, the present chapter attempts to summarize the major developments in the field since the National Forecast was completed.

### **World and regional developments**

Several global developments in the late 1980s altered the existing philosophy concerning the relationship between development and environment. Most importantly, it is increasingly acknowledged that the environmental problems are global in scale, and, therefore, that global cooperation is needed to solve them. The major problems that led to the coalescence of this realization are climatic changes caused by the greenhouse effect and its implications, degradation of the stratospheric ozone layer, acid rain and the death of forests in the industrial countries, and the obliteration of the tropical forests and the concurrent degradation of the world genetic pool.

The report entitled Our Common Future-better known as the Brundtland Report, for the Prime Minister of Norway who headed the UN committee that prepared it-was published in 1987. This report called on states and international development agencies to examine their development policies and reformulate them in view of the principle of sustainable development. One of the applied principles of this report is that in order to succeed in coping with the environmental problems, we shall have to take account of them in development policy itself. Several countries responded to the challenge presented in the report, drawing up long-term national plans for thorough-going treatment of the environmental quality problems. Many of these reports were published in 1989 and 1990; many others are being prepared at the present writing. No longer are these environmental policy documents produced by agencies charged with protecting environmental quality; rather, they are national programs, the implementation of which is entrusted to heads of state. It would be a highly important development if Israel were to follow in the wake of the leading countries in this field, drawing up its own long-term national plan for sustainable development. Moreover, it would be a far-reaching turnabout if Israel's development agencies were to join forces with the environmental administration in safeguarding environmental quality. The term "environmental administration" as used in this document embraces all governmental agencies responsible for the formulation and application of national environmental policy.

Another perceptible upturn in interest and activity occurred in late 1990 with the approach of Eco 92, the UN world convention on development and environment, to be held in Brazil in 1992. Worldwide preparations for Eco 92, are being carried out on the levels of states, national and regional organizations, sectorial international agencies, and voluntary associations. Many regard this conference as a possible watershed in the world's attitude toward these matters; some even define it as a last opportunity to bring about peace between the world's population and its environment.

In Israel, the Brundtland Report (Our Common Future) was translated into Hebrew with the help of the Ministry of the Environment, which circulated it among numerous agencies in Israel. The Ministry also regularly monitors developments in these areas and stays in touch with the countries spearheading the process. Finally, Israel has taken its first steps toward the preparation of its position papers for Eco 92.

The best example of the coalescing global perspective is the greenhouse effect. This issue, long entrusted to scientists, has in the past two years, for the first time, reached the agenda of the political deliberations of heads of state. This attests to a growing consensus among scientists as to the causes and results of this phenomenon, and is a consequence of several exceptional climatic occurrences that characterized the second half of the 1980s. Some scientists believe that these occurrences, including above-average temperatures and the serious drought in the United States in 1988, are the first auguries of atmospheric warming. Most countries acknowledge today that the issue warrants immediate action, notwithstanding the uncertainty that still exists among scholars. This awareness has led to several declarations, such as those of Nordvaik and Bergen (1990), which constitute an initial phrasing of intentions by the industrial countries as to the need for and the content of an

international treaty in this regard. Here again, the target deadline for the conclusion of a framework treaty, at the very least, is Eco 92.

Were the present study to have been carried out in the past year, it would surely have included an important chapter on two major themes: an initial analysis of the effects of atmospheric warming on Israel, and Israel's sensitivity to future international treaties that may impede the promotion of national interests. The predicted climatic changes are liable to have far-reaching effects on Israel; one need only imagine all the implications of a northward advance of the desert line by tens or hundreds of kilometers. Israel's preparations for future developments in this regard are in their infancy. The first important step toward comprehensive national thought is the country's decision to host an international conference on this theme in early 1991.

An additional issue that confirms for all observers the atmosphere's sensitivity to human activity and the need for world cooperation is degradation of the stratospheric ozone layer. Activity in this regard on the scientific and international-negotiation levels began to accelerate rapidly in the second half of the 1980s. There is no doubt as to the reason for this acceleration: the unexpected discovery of a "hole" in the ozone layer over Antarctica, which has reappeared and actually grown from year to year. As the research effort to understand this phenomenon gained momentum, so did the political process. The first product of these efforts was the 1985 Vienna Covenant, which 23 countries have signed. The first applied derivative of this treaty was the 1987 Montreal Protocol, which is, in fact, the first exemplar of a multi-participant international agreement meant to cope with a global environmental issue. The Protocol sets interim and final deadlines for downscaling the production and use of several chlorofluorocarbons. Immediately after the protocol was signed, discussions were launched for the toughening of requirements and the setting of a deadline for a total ban of these substances. In the coming decade, too, this matter will evidently lose none of its centrality. Several countries, such as Switzerland, have voluntarily set objectives of their own, exceeding those of the Protocol in their stringency. Israel, while having declared its intent to ratify the Vienna Convention and Montreal Protocol, has thus far taken no real action to reduce the importation and use of the targeted substances. The impact on Israel, as on the other countries, will, of course, be great only if the efforts to arrest this dangerous process fail.

In view of regional phenomena such as acid rain, and world phenomena such as the greenhouse effect and the thinning of the ozone layer, it has become necessary to integrate long-term quantitative objectives into environmental policy. With respect to air quality, for example, one may assert that environmental policy has been set thus far on the basis of environmental standards, with no consideration given to the absolute quantity of pollutants emitted into the atmosphere. It is clear today that such an attitude responds to only some of the problems and that it should be viewed as a minimum objective, meeting direct pollution problems only. In this context, countries that suffer from acid rain have set long-term quantitative objectives for sulfuric acid. Among them are many European countries, known as the "30-Percent Club" because they set deadlines for a 30-percent reduction of absolute sulfuric acid emissions. They have proved that such objectives are not only attainable but can be met ahead of deadline. The Montreal Protocol is similarly structured, and the Climate Convention, too, if and when it is signed, is expected to set quantitative objectives on time-specific deadlines—chiefly for carbon dioxide—and will distribute the great task among the signatory countries on the basis of an agreed-upon paradigm.

In Israel, no long-term quantitative objectives have been set in any field; local environmental policy rests mainly on environmental standards. A palpable manifestation of this state of affairs surfaces in the country's air-quality reports, which fail to report worsening air quality even though the quantity of atmospheric pollutants emitted country-wide has grown from year to year.

Within the region, too, international environmental-quality activity picked up in the late 1980s, chiefly among various Mediterranean Basin auspices and agencies. The Mediterranean Action Plan, a framework for the implementation of the 1975 Barcelona Convention, has continued and expanded. In Israel, the Prevention of Marine Pollution from Land-Based Sources Law (1988) has gone into effect, as did regulations under Paragraph 14 of this law in 1990. In the authors' opinion, such legislation would not have been enacted in Israel had the country not committed itself to the Barcelona Convention.

In similar fashion, additional organizations are taking an interest in environmental quality in the Mediterranean Basin. For example, the World Bank and the European Investment Bank have drawn up a middle- and long-term investment plan for environmental quality protection projects. Israel is one of the beneficiaries of this activity, receiving several tens of millions of dollars in aid per year. In 1990 and 1991, for example, Israel will receive assistance for the construction of an organic substance incinerator at the Ramat Hovav toxic waste disposal site. The Nicosia Declaration of 1990 and the plan to set up a new organizational framework—a Conference for Security and Cooperation in the Mediterranean Basin (CSCM, 1990) are further evidence of the growth of international activity in our region. Israel is an active partner in all these initiatives, contributing from its experience in various areas of environmental quality and benefiting from financial aid in order to monitor seawater quality and carry out surveys.

The upturn in world and local environmental-quality activity motivates, promotes, and accelerates developments in Israel's environmental management. Because this momentum occurred as the scenario was being drawn up, the scenario devotes no special chapter to it. Nevertheless, its authors believe that this is only the beginning in both respects: the world level and the impact of world trends on Israel. Hence the impact of international action on local environmental quality will grow.

## Population

The original demographic forecast drawn up for this work, completed in early 1988, failed to take account of the possibility of a wave of mass immigration. The forecast, reflecting the trends of the early 1980s, assumed that population growth would be propelled largely by natural increase, i.e., that immigration and emigration would cancel each other out. This assumption has been disproved with the onset of the present wave of immigration in late 1989. The previous forecast expected Israel's population to reach 6.4-7.1 million in the year 2025. To bring this section of the forecast up to date, a new forecast taking account of the present wave of immigration was prepared, according to which Israel will achieve a population of 6 million in the year 2000 and 8 million by 2025. This forecast, drawn up in August, 1990, and already shown to be unrealistically conservative, assumed an influx of approximately 500,000 immigrants in the coming five years, bringing the annual growth rate to 2.5-3.0 percent per year during the mass immigration period and about 1 percent per annum toward the end of the forecast period. Even after this adjustment, the population forecasts are clearly typified by great uncertainty, since the estimates of the total magnitude of this wave of immigration fluctuate between 250,000 and one million persons or even more.

The environmental implications of the present immigrations should be viewed across two horizons of time. In the immediate future, the immigration wave will create several environmental difficulties. The need for rapid construction and job creation has already led to several legislative amendments with respect to the planning of residential and industrial areas, including relaxation of licensing demands connected with the environment. Moreover, accelerated population growth in certain communities whose environmental infrastructures are seriously strained and, in some cases, malfunctioning, is liable to trigger the total collapse of these infrastructures. For example, Ashdod-an important destination for immigrant absorption-has a poorly functioning sewage treatment plant that fails to withstand present-day demands. The situation is similar in several other communities. A state of national emergency such as that brought about by this immigration, requiring a maximum of resource mobilization and national attention, will eclipse the environmental issue on the national scale of priorities for several years at least.

However, the immigration is environmentally favorable in one respect: occupationally skilled manpower. One of the characteristics of this immigration is its high proportion of scientists, academics, and technicians. In view of the present state of unemployment, it should be assumed that the number of immigrants referred to jobs in their fields of specialization in the public sector will grow, thus infusing the civil service with a substantial supplement of professionally trained personnel.

In the long term, this wave of immigration will also affect population dispersion. However, just as the magnitude of the immigration is shrouded in uncertainty, so are its implication on population distribution. In any event, no real change in present-day trends seems to be in the offing. The existing trend of a strengthening of the metropolitan core-an environmentally problematic trend by all accounts-may actually accelerate.

### **Environmental administration**

The original forecast included a sweeping reference to environmental administration. The forecast was written before the Ministry of the Environment was established; in several places it noted the absence of and the need for such a ministry, and even predicted the possible establishment of this body during the forecast period. Indeed, the Ministry of the Environment was established in December, 1988, as the study was in its final stages of preparation. This was a dream come true for numerous proponents of the environmental-quality cause in Israel; some expressed hopes of a genuine revolution in this area. Today, about two years after the decision to establish the ministry was taken, the new office is still being consolidated. Various ministries vigorously resisted the transfer of powers and resources to the new ministry, leaving the new ministry's responsibility and involvement insufficient in several crucial domains, e.g., solid waste, sewage, water sources policy, and the quality of potable water. The impact of the establishment of the new ministry on environmental quality in the distant future is hard to gauge today. In the opinion of the authors of the forecast, the establishment of the ministry is irreversible but does not assure revolutionary change. The birth pangs of the past two years attest that the very decision to establish a ministry is not enough; national recognition the importance of the matter and willingness to allocate the resources needed to see it through are also needed.

Nevertheless, the picture is not altogether negative. The establishment of the ministry was coupled with a centralization of power in certain fields, resulting today in full ministry responsibility for 13 laws. The establishment of the ministry also led to the founding of an environmental law-enforcement unit and a government-owned Environmental Quality Services Corporation, responsible for the operation of the toxic waste treatment site at Ramat Hovav.

The special problems that typify Israel's condition today-mass immigration, economic crisis, record unemployment rates, the intifada, and the Gulf crisis-compounded the institutional difficulties that accompanied the establishment of the ministry. All of these will continue to impede the development of Israel's environmental administration and the mobilization of national attention and resources required for the environmental cause, at least in the next five years.

### **Water**

The original forecast described several negative trends in the area of water quality and identified this matter as one of Israel's most problematic, if not the most problematic, environmental problem. The scenario also asserted that sweeping changes were needed in the management of Israel's water economy to mitigate and reduce the damage caused by these adverse processes. No real change of trend has

occurred in the past few years, but several developments suggest that the country is about to address itself, for the first time, to far-reaching decisions in this sensitive area.

The number of incidents of drinking water contamination has been rising in the past few years, attesting dramatically to the protracted and steady deterioration of the quality of potable water in Israel. The most salient of these incidents occurred in the summer of 1990, when the entire population of the Dan area (metropolitan Tel Aviv) was ordered to boil its drinking water for several days. As these incidents attracted prominent media exposure, the public began to lose its faith in the authorities to which the matter is entrusted. Acute manifestations of the public's attitude are the growing use of various home water purification appliances and, above all, the tremendous increase in consumption of bottled drinking water. Such a reality would have been considered a flight of the imagination only a few years ago.

Criticism of the management of Israel's water economy has been voiced for two decades but has undoubtedly become more strident in the past few years. The original scenario presented the major findings of the State Comptroller's Report on the country's water, its sources, and its allocation for various uses in 1987. The Ministry of Finance Budget Division and the Bank of Israel discussed the issue in reports of their own in 1988. Most recently (October, 1990), a report by a group of professors serves as the basis for discussions conducted in government circles today. All the reports repeatedly accuse the management of the country's water system of shortsightedness, overpumping, distorted pricing that perpetuated unreasonable demand by agriculture, allocation of treated sewage for irrigation without corresponding cutbacks in fresh water quotas, failure to act against water source pollution, and structural and/or organizational defects that mitigate against corrective action.

Initial indications of change have manifested themselves in the past few years. A process of reducing agricultural allocations of potable water and substitution of effluent for irrigation has begun, as warranted by the relentless growth of urban water consumption—a trend that surfaces in many forecasts, including that incorporated into this study.

The growing distress-originating, at least in part, in the protracted delay in effecting structural changes in water allocations—has brought several exceptional proposals to the fore in the past year, including large-scale desalination and even importation of water.

In the opinion of the authors of the scenario, this beginning suggests that action meant to correct past distortions may continue; this, of course, should be viewed as a favorable trend. One should bear in mind, however, that some of the existing problems cannot be solved by correcting water system mismanagement. One of these problems is the permeation of salts and pollutants—nitrates, pesticides, and heavy metals—into the coastal aquifer.

## **Executive summary**

### **Introduction**

The development scenarios point qualitatively and, in part, quantitatively, at the potential predictable burden Israel's environment faces. They do not, however, suffice to describe trends and prognoses in the areas of environmental quality and nature preservation. The major questions in this regard are whether the systems can withstand the effects of development without undergoing long-term change and whether the pollutants and degradation will exceed society's "red lines". To answer these questions, we must study the systems themselves, identify the changes affecting them over time, and examine the ability of environmental management to affect these trends. Accordingly, the following predictions concerning Israel's environmental future rest on three major bases: 1) development scenarios, 2) environmental quality scenario, and 3) the impact of environmental management.

### **Development Scenarios**

The development trends and scenarios focus on areas identified as having major impact on environmental quality and nature preservation. Accordingly, they serve as an estimate of sorts of the potential future strain on the environment, its intensity, and its attributes.

#### **Changes in social, economic, and spatial variables**

Changes in these variables, of course, have no direct impact on environmental quality. They do, however, determine the scale of activities that impact on the environment, along with their nature and spatial distribution. The size of the population, its distribution, and the layout of towns and settlements, the employment base, the structure of the economy, technological progress, standards of living, and consumption patterns—all these will have a major impact on the nature, distribution, and intensity of activities that may cause environmental pollution and degradation.

The predicted population size is of utmost importance, because even today Israel is a very densely populated country by world standards, a circumstance that already leaves its imprint on environmental quality. Israel's population is expected to reach 5.1-5.4 million by the year 2000, with growth rates gradually decreasing until near-stability at 6.4-7.1 million is attained by the end of the forecast period (2025). The annual growth rates will be 1.2-1.3 percent until the year 2000, 1 percent through 2010, and 0.5-0.6 percent in 2025. Household size will

diminish during this period, and the growth rate of households will exceed that of population by 10-15 percent. The rates of natural increase will be equal among most population groups. The population will age and its education level will rise. Average population density will reach 305-335 persons per square kilometer in the year 2025, making Israel one of most densely populated countries in the world. This itself is a matter of major environmental significance. Moreover, if the desert areas remain as sparsely populated (more or less) as they are today, effective density in the settled areas will be much greater. This forecast does not take account of the massive Soviet immigration, which will not change the downtrend in growth rates but will increase two absolute measures at the end of the forecast period: average density and the size of the population once it attains stability.

The country-wide spatial trends characteristic of the past decade underscore the failure of Israel's population-dispersion policy. Population growth has been arrested in the urban localities of the Negev, including Beersheva, and the entire area suffers from a protracted negative migration balance. The same is true of some urban localities in northern Israel. By contrast, the Dan area metropolitan core and its satellite towns are growing at rates substantially higher than those stipulated in the population dispersion plan. Consequently, two forecasts are presented. One predicts a continuation of present trends, driven chiefly by market forces; the other predicts that the downtrends in the peripheral areas will be halted if not reversed, on condition that the government takes far-reaching measures. The contained massing of population on the coastal plain has significant environmental implications.

With respect to jobs, the rate of persons employed in agriculture will continue to decrease. Employment in the services will grow, especially in the areas of finance and the production, processing, and transmission of information. No substantial change is expected in the proportion of persons employed in industry. The rate of women's employment will also continue to rise, the average work week in hours will continue to decrease, and the changeover to a five-day workweek will be completed.

As for the structure of the economy, the share of agriculture in GDP will decrease and that of industry will grow substantially. Within industry, high-tech is expected to spearhead economic growth country-wide. Per-capita GDP, too, will increase, either doubling or tripling (depending on the forecast used) by the year 2025.

As a crude generalization, total activity, embracing both production and consumption, is expected to grow by a factor of three or four, if not more, by the end of the scenario period in 2025, even as the population growth curve levels off.

It is this growth that creates the potential of future strain on the environment, as manifested in increased demand in virtually every area: land for all the aforementioned activities, energy, water for domestic and industrial use, raw materials used in roadbuilding and construction, industrial products, agricultural products, recreation and tourism services, transportation, etc.

Israel is one of the developed Western countries that are presently making the transition to a post-industrial society, an information society, or, in Alvin Toffler's phrase, a Third Wave society. Israel, however, differs from most of these countries in that its population growth is not yet complete and its standard of living is relatively low. Accordingly, Israel's transition to the Third Wave will be coupled with concurrent substantial economic growth. In another two generations, as Israel's population levels off and its standards of living rise, the country's components of economic activity and consumption patterns will be different from those familiar in the affluent countries today, and the condition of these countries' environments should not be used as a basis for a forecast of environmental quality situations in Israel. At no stage, for example, is Israel expected to suffer from the air pollution levels that still characterize the metropolitan areas of the affluent Western countries.

## **Sectoral trends**

The sectorial forecasts provide an overview of specific areas of activity, expected changes, and direct environmental implications.

### **Water system**

Water policy has a massive impact on the criteria of water quality. Because of Israel's chronic water shortage, the water system is the gravest problem facing the country's environmental administration. The water problem is exceedingly complex, characterized chiefly by low per-capita potential, geopolitical controversy surrounding several sources on which the system relies today, nearly total exploitation of natural potential, uneven geographic distribution of water sources, relatively high production costs, geographic proximity of important water sources to polluting activities, and the influence of political factors on water policy. These attributes combine to cause the overuse of and a large accumulated deficit in the ground water reserves; it will take many years of constraint to restore the aquifers' intended equilibrium. Therefore, in view of the expected growth of population, standards of living, and economic activity, sweeping changes in future water policy will be needed. Household and urban consumption will continue to increase, as a result of population growth and the expected rise in standards of living, from 460 million m<sup>3</sup> in 1985 to 610-710 m<sup>3</sup> in the year 2000 and 910-1100 m<sup>3</sup> in 2025. Industrial consumption, too, will continue to grow, from 104 m<sup>3</sup> in 1985 to 120-160 m<sup>3</sup> in 2000 and 150-200 m<sup>3</sup> in 2025. In other words, by the end of the forecast period the two sectors together will account for about half of all water consumption in Israel. This trend will create a growing shortage of water for agriculture because, as stated, the natural sources have been almost fully exploited. The major source of additional water supplies in substantial

quantities will be treated sewage, which will increasingly replace fresh water in irrigation. According to the forecast, the growth of total sewage used for irrigation will grow from 60 million m<sup>3</sup> in 1985 to 260-300 m<sup>3</sup> in 2000 and 430-500 m<sup>3</sup> in 2025. Marginal water of other kinds, too-brackish water, floodwater, and urban and agricultural runoff-will be pressed into service for irrigation. The total quantity of marginal water used for agriculture, including treated sewage, is expected to increase from 350 million m<sup>3</sup> in 1985 to 700 million m<sup>3</sup> in 2000 and 1,050 million m<sup>3</sup> in 2025. Israeli agriculture will have to adjust to these qualitative circumstances, as to the absolute decrease in the total annual quantity of water available. According to the most optimistic forecast, agriculture will have access at the end of the forecast period to a quantity of water similar to that utilized today, but at lower levels of quality. These changes and their ramifications will fuel the additional reforms needed in Israel's water system management. In view of the exceedingly high level of exploitation of this vital resource, with no adherence to the principle of sustainable utilization, Israel's water quality problems are bound to worsen.

### **Agriculture**

Between 1948 (when Israel was established) and the early 1960s, cultivated land area increased from 1.5 million dunams to 4 million. The growth rate has slowed substantially since then; in fact, the area of cultivated farmland reached 4.4 million dunams in the early 1980s, has not grown since, and is not expected to change in the long term. The distribution of cultivated land does change somewhat because of the rezoning of cultivated land in central Israel offset by the development of land for agricultural use in peripheral areas. While this process will cause no far-reaching change in the future distribution of cultivated farmland, the preparation of marginal lands in mountain and desert environments may lead to unsustainable use and erosion and salinity damage. The area of land under irrigation has grown steadily. Although this process has not yet played itself out, here too no further significant growth in this regard conditional on an increase in agricultural water productivity. Another indicator of relative stability in agriculture is the substantial decrease in the annual growth rates of farm output, from an average of 6 percent in the past 25 years to 5 percent in the early 1980s and 1 percent at the end of the previous decade. Growth in some areas of farm mechanization, such as tractors, has stopped altogether. Thus the major factors affecting environmental quality in agriculture will evidently be the extent of use of fertilizers, the extent of use and the types of pesticides, and the quantity and quality of irrigation water. The impact of environmental management in these domains has been negligible thus far, agricultural environmental standards have hardly been implemented, and existing laws are rarely enforced. In view of these shortcomings, the future in this regard will depend largely on how well the environmental administration succeeds in penetrating and wielding its influence in this problematic area. Additional factors that should have positive effects are technological developments in pest control, as dictated by international agencies, and stringent standards imposed by overseas markets regarding permissible quantities of pesticide residues and other pollutants in farm produce.

### **Industry**

According to the forecast, growth in this domain will exceed that of any other economic sector. Industrial output will grow by a factor of five to seven by the year 2025. The proportions of various industries within the sector will change, most saliently in high-tech activities (the chemical and electronics industries). Chemicals, rubber, and fuel, which accounted for 15.6 percent of industrial output in 1985, will claim 30.6 percent in 2025; metals and electronics will increase from 35.7 percent to 49.4 percent during the same period. The geographic dispersion of industrial activity will increase, chiefly as a result of the industrialization of the rural sector.

The output of the Dead Sea extraction plants will continue to grow, although such growth is limited by the availability of suitable evaporation areas. In the phosphate industry, enriched raw material will account for a smaller proportion of output vis-a-vis finished products, and the quantity of enriched raw material produced may even decrease in absolute terms. Oil shale may be utilized for the production of electricity and perhaps even oil.

The output of plants producing raw materials for construction and road building will also grow, most of the increase taking place at existing quarries. Shortages of most materials required by this industry are not expected. Two exceptions to this prognosis are coastal dune sand and kurkar, which will be depleted during the forecast period. To replace them, the aggregate quarries are expected to increase their output. Industry's handling of the environmental issue has improved substantially in the past 15 years. Environmental requirements are increasingly enforced in plants that previously caused nuisances. Environmental quality considerations are integrated into the planning of new plants in a manner that ensures the prevention of hazards. Unlike the state of affairs in agriculture, the environmental administration is equipped to cope with the problems presented by industry; moreover, its influence on the way the industries operate is growing. Thus the future development in this sector, too, will be challenged by the rapid changes in technology, materials, and wastes, and also by geographic dispersion and a proliferation of small plants.

### **Tourism and recreation**

Israel's great tourism potential originates in its tremendous variety of historical and archaeological sites of universal importance, holy places of the three monotheistic religions, and a broad range of unique natural and recreation attractions. The world tourist population will grow substantially, and Israel, along with many other tourism countries, will profit from the boom. Domestic tourism and recreation activity, too, is on the upswing. According to the optimistic forecast, the number of tourists entering Israel will grow from 1.2 million in 1985 to 7.5 million at the end of the forecast period in 2025, or one tourist per year for every Israeli citizen. Other attributes of the tourism industry will grow at similar rates. Such an upturn will make Israel one of the world's most crowded tourism countries. The volume of domestic recreation and

tourism activities, too, will grow significantly with the abbreviation of the work week and the rise in standards of living. Obviously the tourism infrastructure, both at existing tourism sites and at places that have not yet experienced tourism development, will have to expand commensurately. According to the forecast, for example, significant growth in the number of Mediterranean marinas will occur; the Mediterranean Coastal Master Plan foresees 14 such facilities with a total of 10,000 moorings. The bathing beaches on the Mediterranean, by contrast, are capable of handling the expected increase in demand through the end of the forecast period; no need to infringe upon coastal nature reserves and other protected areas is foreseen. Tourism development, like industrialization, is expected to permeate the rural sector, which may come to view this activity as a partial solution to its economic distress. In this context, two kinds of activity are liable to cause environmental degradation: development of tourism infrastructures without consideration of the environment and its resources, and the pressure of visitors at the various sites. Historical, archaeological, and certain natural attractions are already suffering from overload in terms of both environmental capacity and visitor pleasure. This strain will progressively increase until it affects most of the country's recreation and tourism sites. Israel's planning authorities have always been sensitive to the matter of tourism development, and the overall picture is favorable even though several mistakes have been made. The professional caliber of tourism project planners is high and is steadily improving. Both Israeli recreationers and overseas tourists insist on high aesthetic criteria. In a similar vein, tools to evaluate the impact of tourism development have been developed, facilitating decision-making in these matters. In addition to attention to the visual dimension, the installation of high-quality, anti-pollution environmental infrastructures is an integral part of tourism development today. In the future, too, this topic is expected to command the attention it deserves.

### **Electricity production**

Electric power plants are sources of massive environmental impact. Demand for electricity in Israel has grown from 543 million kilowatts in 1950 to 2,205 million in 1960, 6,610 million in 1970, 12,089 million in 1980, 15,010 million in 1985, and 18,761 million in 1988. This growth is evident in various economic sectors including agriculture, industry, mining and quarrying, pumping of water, private and public consumption, and trade and services. Growth in industry and household consumption has been especially salient in the past few years, and this process will unquestionably continue in the future as well. Today's installed capacity stands at 4,062 megawatts (1988) and, according to demand forecasts, will increase to 11,200 megawatts by the year 2017. Several feasible scenarios have been offered as to the geographical dispersion, the technologies, and the fuels used to generate this installed capacity. The most reasonable is the coastal-coal scenario, according to which most of Israel's electricity will be produced in four major Mediterranean coastal sites in Haifa, Hadera, Ashdod, and Ashkelon using modern coal-burning technologies. In addition to these four major facilities, the scenario envisages 3,200 installed megawatts produced at inland facilities using indigenous energy sources—oil shale, solar energy, wind, and pumped storage. This scenario does not include the construction of a nuclear power plant. The burning of heavy fuel oil will stop gradually during the forecast period; the four coastal sites will burn coal only. According to this scenario, the Reading power station in Tel Aviv will be shut down and not replaced.

The major environmental challenge connected with this forecast concerns the relations that coalesce between the environmental administration, the Israel Electric Company, and the Ministry of Energy. The paradigms of cooperation that these agencies have developed in the past decade give reason for optimism.

### **Transportation**

All major transportation variables are still growing perceptibly. The total number of motor vehicles increased from 34,000 in 1951 to 70,000 in 1960, 266,000 in 1970, 539,000 in 1980, and 776,000 in 1985. Because Israel's motorization level has not yet caught up with that of the industrialized West, the country's motor vehicle inventory should continue to grow along with the population and the standard of living. According to our forecast, the number of motor vehicles will grow by an annual average of 5.9 percent until the year 2000 and 2.5 percent in 2000-2025. Consequently, 3.74 million motor vehicles will be plying Israel's roads at the end of the forecast period, a figure 4.5 times greater than the present number. The motorization level will increase from 188 vehicles in 1985 to 361 in the year 2000 and 534 in 2025. The total cumulative travel distance of all motor vehicles will increase from 14 billion kilometers in 1985 to 30 billion in 2000 and 53 billion in 2025. An alternative scenario that envisages substantial growth in the rate of public transport use reduces these figures to 28 billion and 48 billion kilometers, respectively. Even today the growth rate of the transport variables is rapidly outstripping that of road infrastructure. Even though the forecast expects paved road surface to increase from 84.5 million square kilometers in 1985 to 118 million in 2000 and 170 million in 2025, the gap will continue to widen.

These growth rates will turn overland transport into one of environmental management's major issues. This industry will be affected inter alia by legislation and standards enacted in the developed countries and by anti-pollution (air and noise) technological improvements devised by overseas motor vehicle manufacturers.

Aviation activity, too, will increase substantially. International landings in Israel will grow from 10,000 in 1985 to 17,700 in the year 2000 and 23,000 in 2025. A higher forecast speaks of 35,000 landings in the year 2025. Passenger volume will grow from 3.1 million in 1985 to 9.2 million in 2025 (or as many as 14 million according to the higher forecast). Similarly, air freight volume will increase markedly, from 143,000 tons in 1985 to 427,000 tons in 2025 (or 674,000 according to the higher forecast). Even so, it will probably not be necessary to build an additional international airport; Ben-Gurion will suffice.

In maritime transport, freight tonnage will increase from 16.3 million in 1985 to 39 million in 2025 (or 60.3 million under the higher forecast). To accommodate this growth, it will be necessary only to expand today's ports (Haifa, Ashdod, and Eilat); no new ports will be needed.

The environmental administration is already participating in long-term planning for the expansion of the airport and the marine ports, and no change in this situation is expected.

Aviation and shipping are two additional areas in which international standards will positively affect their environmental performance.

### **Distribution of population and communities**

As stated, Israel's population dispersion policy has failed. The characteristic spatial trends of the past decade is the accelerated growth of the Tel Aviv metropolitan area and, most saliently, of the outer suburbs encircling its core, exceeding the objectives of the population dispersion plans. Population growth in the "development towns" of the Negev and the Galilee, by contrast, has virtually ground to a halt. Many of these towns are suffering from a negative migration balance that neutralizes natural increase in some cases and exceeds it in others, causing the population of the latter towns to decrease in absolute terms. These trends are not expected to change substantially in the near future. Because the national spatial policy will aspire at the most to halt the desertion of the peripheral areas, the establishment of new cities in Israel is not in the offing. The metropolitan areas are adopting the characteristics of suburban society, characterized inter alia by the spread of low-rise residential building, commuting, and growing dependency on private cars. These overarching trends will clearly exacerbate the potential environmental strain on the coastal plain, both because of the growing proportion of Israel's population that makes its home there and because of the environmental significance of the metropolitan structure and suburbanization, including the attendant transportation burden. Evidently, however, today's policy of protecting farmlands will not be abandoned, and the tools invoked today to prevent serious incursions in this regard will be available in the future.

Rural settlement is another area in which Israel's present map is more or less final. no further major change will occur in the population of agriculture-based rural settlements, nor will a large number of new farm settlements be established as in the past. However, the trend that typified the 1980s will continue, i.e., the establishment of nonfarming rural community settlements, some not dependent on local employment at all. The experience of the past decade shows that such settlements may sink roots even in topographically difficult environments, suggesting the possibility of landscape degradation. The existing farm settlements will undergo major changes. The rate of employment in agriculture will continue to drop; that of alternative employment will rise. Industrialization, a highly successful process on the kibbutzim, is spreading to the moshav sector too, where tourism and recreation services are developing and off-the-farm employment is becoming more prevalent. The traditional structure of kibbutzim and moshavim is progressively changing; new organizational models will develop in the future. These changes may be coupled with far-reaching environmental implications, both positive and negative, and will present environmental management with one of its major challenges.

### **Defense system**

In view of the scale of defense system activities, the small dimensions of the country, and the importance of defense, this system plays a major role in environmental impact. Defense system activities include construction, industry, training, routine security, production of various wastes, and the quarantining of land throughout the country, including areas of high environmental sensitivity and proximity to major population centers. All told, defense activities affect approximately half of the country's territory.

One can hardly expect defense system activity to decrease during the forecast period, even if the peace process advances. Nor can one reasonably assume that the system will demand and affect less land. However, the system is displaying growing awareness of and sensitivity to environmental quality issues, and is making perceptible efforts to solve environmental problems on two levels: the planning and building stages and the care and use of environmental facilities. Civilian environmental management, too, will presumably exercise its authority vis-à-vis the defense system in its contexts of activity.

### **Environmental quality scenarios**

A review of the trends in the various areas of environmental quality reveals a broad mix of positive, negative, and static situations. In some areas, positive trends have long been perceptible. In others, the first indications of a positive trend have come to light recently. In still others, a change for the better is expected in the near future, when new laws and regulations go into effect and policy principles adopted today begin to pay off. Even where the trends are negative, the characteristics of the situation are diverse.

The major conclusion flowing from the analysis of the trends and forecasts is that Israel's environmental quality will improve in certain areas and regress in others. Because there is no way to weigh trends in different areas against each other, it is hard to venture an answer to the question of whether the overall quality of our environment will be better or worse in the future.

To permit readers to reach their own conclusions, we provide the forecasts below, sorted by the direction of trends.

## Negative trends

### Deterioration of the quality of major water sources

The long-term trend regarding the quality of Israel's major water sources is one of deterioration. Salinity and concentrations of nitrates, bacterial contaminants, and other chemical pollutants will all increase. This trend is most salient in the Pleistocene aquifer on the coastal plain, where water quality has deteriorated so gravely that some sections have become unfit as sources of drinking water. If the trend continues, additional parts of the aquifer will reach this condition and others will become unsuitable for other uses such as agriculture. This is the result of intensive activity on the coastal plain, where the major polluters are agriculture (fertilizers and pesticides), urban and industrial effluent, and waste disposal sites. The deterioration process is exacerbated and accelerated by overpumping. The development forecasts point at an increase in the pollution potential of these sources, and in view of the expected growth in use of treated effluent for irrigation, with the environmental risk this poses, the chances of arresting the trend are not great. Far-reaching changes of policy concerning the exploitation of this aquifer, coupled with sweeping reform of agriculture policy, may help slow pace of deterioration. Water quality in the deep karst aquifer, too, is deteriorating perceptibly. The condition of this aquifer is not as grim as that of the coastal aquifer, but the strain on this water source is expected to grow significantly, because the watershed of this aquifer is along the mountaintops, an area still awaiting economic development.

### Deterioration of air quality

Total emissions of the major air pollutants (sulfur, carbon, and nitrogen oxides, plus ozone) will increase from three major sources—energy production, transportation, and industry—because activity in these three areas still awaits considerable growth. Some of the increase in activity, however, will be offset by technological solutions and changes in the composition of fuels. The trend will probably be negative at the beginning of the forecast period; later on, however, activities will not expand as quickly and the impact of technological and administrative measures will grow, thus slowing the deterioration of air quality and, perhaps, even reversing the trend.

Importantly, it may reasonably be assumed that air quality in Israel, despite the deterioration, will not violate existing standards in most parts of the country most of the time. Israel is not facing the prospect of air pollution rates of the kinds accepted in most developed countries until recently. Neither have indications of acid rain, one of the toughest environmental quality problems in Europe and North America, occurred in Israel thus far. Information on other pollutants is partial or totally lacking; no trends can be described. This is said mainly with respect to various toxic gases emitted in the course of industrial activity. Industrial development forecasts point at growing potential of pollution from these sources, but one surmises that the environmental administration will know how to cope.

### Increased emission of hazardous substances

World trends in the area of future technologies, and local trends concerning industrial and agriculture development, point at growth in the use, production, and transport of hazardous substances in all walks of life (including households) and all parts of the country, coupled with growth in the production, transport, and need to dispose of toxic wastes. These trends have in fact been present since the country was established and have accelerated in the past 15 years, as manifested inter alia in the growth in speed of accumulation of toxic wastes. Thus far, no assessment has been drawn up of the quantities of toxic wastes discharged into Israel's domestic waste sites and open spaces (with the exception of an initial estimate appearing in this work, which speaks of the uncontrolled discharge of 400,000 tons of industrial toxic waste between 1948, when Israel was established, until the end of the 1970s; even this estimate provides no information on the composition and locations of disposition of these wastes). Thus it hardly need be said that nothing has been done to clean up such sites and mitigate the risks they present. In the past few years, too, Israel has experienced several chemical accidents that, miraculously, caused no large-scale damage. Despite the establishment of the National Toxic Waste Treatment Site at Ramat Hovav and legislation requiring the disposition of all toxic waste there, it is believed that about half of the toxic wastes generated in Israel are discharged into the environment without control and that the quantity is growing from year to year. Solutions will be found for most of the large producers of toxic wastes but not for small producers and private households. Thus the discharge of toxic wastes into the environment will continue on one scale or another, past accretions of toxins will seep into groundwater, the number of hazardous substance transport accidents will, grow, and the public will increasingly be exposed to hazardous substances in daily life. To prevent chemically hazardous environmental damage, all agencies that generate, treat, and use these substances will have to demonstrate growing responsibility, singly and collectively.

### Increase in the discharge of domestic waste

Population growth, rising standards of living, and changes in consumption patterns are generating protracted growth in the quantity of domestic waste discharged into the environment. This is a long-term trend that has persisted since the country was established; in view of the development forecasts, it will continue into the future too. The recycling of domestic wastes is in its infancy in Israel, and as yet there is no assurance of future development that would elevate recycling to a substantial scale and reduce the quantity of wastes discharged into the environment. Israel, unlike several developed countries, still has neither the policy nor the means to reduce these quantities. The adverse environmental impact of this trend is exacerbated by the absence of advanced, strict environmental standards governing the disposal sites, as,

for example, a requirement for the artificial sealing of the beds of disposal sites, collection and treatment of effluent, collection and utilization of methane gas, covering and sealing of the site when their use is terminated, and monitoring and control of water quality around the site when it is in use and for a protracted period after it is closed. Even if these tough standards are adopted in the future and applied to new disposal sites, pollutants will continue for several decades to seep into groundwater from existing sites and others that have been shut down, chiefly along the coastal plain.

### **Growth in the quantity of construction wastes disposed in the public domain**

The enactment of the Maintenance of Cleanliness Law has given environmental management the legal tool it needs to solve the problem of construction waste. However, implementation of the law, i.e., the establishment of special disposal sites for such wastes in every local authority jurisdiction, is still very small in scale. Therefore, the trend remains negative. The quantity of construction wastes haphazardly disposed at irregular sites, along the shoulders of roads, and in areas forbidden under municipal bylaws, continues to grow. This activity causes grave visual degradation of landscape and open areas, especially in and on the outskirts of towns and settlements.

### **An upturn in landscape degradation**

Physical development on one scale or another, coupled with perceptible landscape degradation, has reached almost every corner of the country. Defense system activity, too, spans the country and has a perceptible impact on the proliferation of landscape degradation. The forecast points at substantial growth of this kind of damage in the future, as rural development spreads in all its aspects: regional road systems, infrastructure facilities such as power and water lines, sewage installations, light- and heavy-industrial zones, and others. In the 1980s, rural development expanded into areas of high landscape value, chiefly in the northern part of the country. One cannot assume that the trend will come to a halt soon. Engineering facilities in these areas (communications, wind energy, et al.) and the road systems they need are also expected to increase, even though they are not connected with rural development. The development of Arab localities, too, will depart from past paradigms and contribute to the proliferation of landscape degradation and the gradual disappearance of traditional landscapes in and around these localities. Because natural restoration is rather slow in Israel, and since man's action to restore landscape is small in scale and fails to keep up with the pace of damage, the trend in this regard is negative. Consequently, the areas of natural, undamaged landscape and other highly valued landscapes, such as the traditional rural ones, will continue to decrease.

### **Greater degradation of singular environmental phenomena**

The extensive development sweeping all parts of the country has resulted in the serious degradation not only of landscapes but of singular environmental systems, threatening some of them with extirpation. Thus, for example, the coastal dune environment, with its characteristic flora and fauna, is gradually disappearing; the coral reefs in the Gulf of Eilat have been seriously damaged, placing their future existence at grave risk. Several animal species, some endemic, have been driven to extinction, and there are reasonable grounds to assume that this process will not come to a total halt in the future. The process is irreversible for endemic species and difficult to reverse even for species that still exist in several parts of the country. No fewer than 54 species and vertebrates have been designated as being at risk of extinction in the Mediterranean part of Israel; another 29 have been so defined in the desert area.

Highly attractive and unique natural systems, especially springs, small rivers, and desert ponds, are already overburdened with visitors in two senses: the ability of the natural system to withstand these pressures without undergoing changes, and the pleasure of visitors who seek an experience in primeval nature. In the future, as recreation activity in natural surroundings intensifies, these sensitive systems are expected to come under greater pressure.

### **Further degradation of rivers**

The coastal rivers are the most seriously degraded of Israel's natural systems. Few contain natural water, this resource having been exploited by the country's water system. Some have dried up; others carry sewage of various grades of treatment, industrial effluent, agricultural runoff. Large quantities of pollutant-intensive silt have built up on the river bottoms. Although the rivers are flushed out by floods every few years, this rids them of only some of these pollutants. The banks of the coastal plain rivers have been damaged by roadbuilding, the spraying of pesticides in the struggle against mosquitoes, and the disposition of various wastes (domestic, construction, agriculture) and junked cars. In their present state, these systems may be said to have been destroyed.

High-quality water that still reaches the rivers awaits further exploitation, chiefly by the impoundment of floodwaters upstream. Furthermore, larger quantities and higher qualities of treated effluent will be exploited for agriculture. Because some of the rivers are totally reliant on such effluent, the drying and degradation of the flora and fauna ecosystems along their banks is expected to accelerate. Worst off will be those rivers that have been only moderately harmed today; the expected improvement in the area of effluent and wastes will not be sufficient. The condition of the coastal plain rivers will change significantly only insofar as extensive restoration is undertaken, including the allocation of high-quality water for the rivers, cleaning of the courses, a total ban on the discharge of effluent into the courses, the repair of landscape degradation, removal of wastes, and revitalization of flora and fauna. To ensure the success of such a restoration effort, it will be necessary to make sweeping changes in priorities, organizational frameworks, and the ability of environmental management to overcome all obstacles and

constraints in this domain. Since no breakthrough has been made thus far, the trend is negative and will remain so, at least at the beginning of the forecast period.

The condition of the Jordan River south of Lake Kinneret, too, is expected to deteriorate. Even today, the water in this part of the Jordan is highly saline; as soon as various water projects are completed—mainly those of Jordan and Syria—the flow of the Yarmuk River, presently the major source of high-quality water for this system, will be reduced or altogether stopped. Because the quantity of fresh water in the lower Jordan will decrease, the concentrations of pollutants from various sources—saline water from the special carrier built runoff from both banks—will grow. The Jordan will never return to its natural state.

### **Increase in forest fires**

The past few years have witnessed marked growth in the areas of scrub forest and pasture that go up in flame. The major reason for this increase, it would seem, is the growing prevalence of nationalistically motivated arson. There are additional causes, such as defense system maneuvers, irresponsible behavior by visitors and sightseers, and burning of garbage and agricultural waste at the fringes of the forest and scrub land. Because the major factor is geo-political, no change for the better may be expected the short and intermediate range.

## **Positive trends**

### **Toughening of requirements as to pollutant ingredients in fuels**

The trend in legislation and standards with respect to reducing pollutant quantities in fuels used by transportation, industry, and energy production has gained strength in the past few years. Thus, for example, growing numbers of industries are required to burn low-sulfur fuel, and the fuels used in electricity production and oil refining have come under similar restrictions. Rules and regulations have been established for the use of low-sulfur coal in power stations. According to the scenarios, constraints such as these will soon apply to a growing number of users, and the terms of the requirements will be toughened, i.e., the maximum permitted quantities of pollutants in fuels allowed for use will be reduced. As for transportation fuels, tough lead standards were recently and are being enforced, and unleaded gasoline is expected to become compulsory soon. The changeover to lead-free fuels in Israel was precipitated by changes in the structure of motor-vehicle engines.

These trends have a major impact on the total quantity of pollutants emitted into the atmosphere, and, less directly, on air quality as measured at certain points. One cannot, however, determined with precision today whether these changes will offset the growth in the quantity of pollutants originating in the increase in the quantity of fuels consumed.

### **Toughening of air-quality standards**

In Israel, as around the world, air-quality standards are being toughened. For example, the maximum emissions permitted at the first four units of the power plant in Hadera (1,400 megawatts) are less than half of the Israeli standard, and this maximum was not modified when, in 1989, an expansion of capacity at the site to 2,500 megawatts was approved. The Israeli environmental standards for several pollutants—sulfur dioxides, carbon monoxide, lead particles, and ozone—are in the final stages of stringent revision which, if approved, will force the various polluters to comply.

### **Measures for short-term improvement in air quality**

The enactment of various measures meant to improve air quality as measured in several areas is expected. Air quality in Haifa, for example, will improve when the quantity of sulfur in the fuels consumed at the existing power plant and oil refineries is reduced; this will happen in March, 1990, when the new personal orders go into effect. As long as no additional power station is constructed in Haifa, there is a chance that this change for the better will be maintained. Plans in the Ashdod area call for the extension of smokestacks at the local power plant, which burns heavy fuel oil. Here, too, the possibility of implementing a program for the use of lower-sulfur fuels in critical periods is being explored. Accordingly, measured levels of air pollution in Ashdod, too, are expected to show substantial improvement. As before, the change will be more-or-less permanent as long as no new electricity production units are added.

### **Increase in the proportion of sewage impounded**

This trend manifests itself chiefly in the establishment of impoundment systems for domestic and industrial sewage in several localities, thus removing the sewage from the built area. This is a long-term trend that will presumably continue in the future until it is taken to nearly full completion. In the rural areas, the discharge of a certain quantity of sewage by way of septic tanks will evidently continue in the long term; by all appearances, however, this quantity will not exceed one or two percent of all sewage country-wide. nationwide.

In this regard the greatest change will occur in the non-Jewish communities, where the trend is still in its infancy. The beginnings of intensive development in this context are already evident today, and the results are expected in the near and intermediate future.

### **Increase in the proportion of sewage treated**

This trend is characterized by the establishment of new facilities for the treatment of impounded sewage in communities or areas where sewage had previously been untreated; the expansion of existing facilities; and growth in the quantities of sewage impounded by the existing systems. The overall quantitative manifestation of this trend is the growing proportion of treated sewage relative to all sewage generated each year country-wide. This proportion has grown from 26 percent in the early 1970s to 81 percent in 1987, and the trend will undoubtedly continue until the rate approaches 100 percent. Activities today include the expansion of the treatment plant serving Metropolitan Tel Aviv and the connection of additional municipalities to it; the construction of new facilities in Jerusalem and a plant for treatment of the sewage of Nahariya and Acre; and the improvement and overhaul of existing facilities, such as that of Kiryat Gat. These and additional projects should soon be completed. In all, the process will presumably be culminated in the intermediate future, meaning that most impounded effluent in Israel will be treated in a modern engineering facility. Israel has an additional, non-environmental reason to make sure this process is carried through: the growing shortage of water for diverse uses and the possibility of using treated sewage for irrigation and agriculture.

### **Improvements in the collection and burying of domestic waste**

Trash collection has improved in the past 15 years, as manifested in the introduction of modern containment devices such as collection tanks and dumpsters of various sizes, all adjusted for modern collection technologies. This ensures a more orderly collection and prevents the environmental nuisances that typified the more diffuse methods previously used.

A major change has taken place in the transport of wastes, with the establishment of transfer stations where garbage is unloaded from municipal collection vehicles into regional transport vehicles, where it is hauled in concentrated form to regional burial sites. Further improvement has occurred in the covering of waste transport vehicles, making incidents of garbage flying from these vehicles increasingly rare. The construction of transit stations is in full swing and is connected with another trend, i.e., a decrease in the number of dumps, a factor that increases transport distances. The most extreme manifestations of this change are programs for the disposition of waste generated by Metropolitan Tel Aviv and other jurisdictions to distant dumps in the Negev. These programs will entail the use of several transit stations and, perhaps, a terminal for the transfer of garbage to a fixed-rail system.

The greatest change in this regard, one with substantial environmental implications, is the changeover to a small number of official regional disposal sites, replacing the local garbage dumps that had caused major environmental degradation. Approximately 30 such sites have been selected within the framework of a national garbage disposal master plan, with careful attention paid to the minimization of potential groundwater degradation. The garbage at these sites is covered with a layer of soil every day, and additional measures to prevent environmental hazards are taken.

Each of the aforementioned trends points at significant accomplishments. However, much remains to be done until the objectives are attained in full. The most troubling problems in this area is the disposition of garbage from Metropolitan Tel Aviv and Haifa, and also the quality of operations at the dumps.

### **Improved cleanliness in the public domain**

Official activity for the maintenance of cleanliness in public spaces has increased perceptibly in the past ten years. Trash receptacles have been installed, growing use is made of special vehicles to clean sidewalks and streets, and in "cleanup campaigns" in open areas are increasingly frequent. All of these, and changes in the public's habits in its treatment of public spaces, have improved the level of cleanliness in the public domain. An increase in standards of living, the public's demand for a better-kept environment, educational and informational activities, and stepped up enforcement of the Cleanliness Preservation Law ensure the maintenance of these achievements and a strengthening of the trend in the future.

Improvement has also been noted in the removal of wrecked cars. Most of these are hauled to a municipal site, where the orderly junking and recycling of these vehicles is gradually expanding. This trend is expected to gather momentum as the recycling system expands, leading to the further improvement of hygiene in the public domain.

### **Visual improvement of the cityscape**

Israeli cityscapes are looking better, for several reasons. The local authorities are acting in various ways to help improve the appearance of the urban landscape, e.g., by creating stylized pedestrian malls, paving promenades such as those along the Tel Aviv shore and near the Abu Tor and East Talpiot neighborhoods of Jerusalem, and designing and beautifying town entrances. Cleanup campaigns for house facades, the setting of visual criteria for business signs, and the installation of street furniture—benches, trash receptacles, direction and business signs, bulletin boards, bus stops, streetlighting, street flowerpots, and architectural floor tiling—are attracting greater lay and professional attention, thus making a maximum contribution to the improvement of street appearance. Perceptible progress has also been made in the quality and extent of public gardening.

Great visual progress has also been made in public and private residential building, as manifested in new residential neighborhoods and construction areas. The planning of neighborhood structure and public gardening, the diversification of architectural styles and building materials, and the quality of construction, all combine to contribute to the total visual impression of these built environments.

The facades of commercial buildings, including signs and display windows, show major improvement in the quality of architectural design and levels of cleanliness and upkeep. This is most evident in the prestige urban areas.

The individual, too, is doing much to improve the appearance of the cityscape. Resident involvement in the revitalization of residential building facades is growing, the quality of private gardening is improving, and "hanging" rooftop gardens are becoming more prevalent. Awareness of the visual blights caused by various rooftop appliances, such as the tanks of solar water heaters, is growing; the practice now is to conceal them. The "forest of antennas" phenomenon on condominium rooftops is gradually disappearing as central antennas come into greater use.

These positive trends are most evident in city centers, new neighborhoods, and major travel arteries, which constitute the towns' showcases.

These new norms indicative of the public's demands, rising standards of living, and the urge to emulate and compete ensure that this trend will continue into the future.

### **Improvement of beach cleanliness and water quality**

This is unquestionably one of the major changes for the better. In this case one may speak of a regarded environment that has been more or less revitalized. The Mediterranean shore was once beset for protracted periods by grave oil and tar pollution, coupled with high levels of chemical and microbial contamination originating in raw sewage dumped into the sea in large quantities, along with industrial wastes. The disposal of domestic and construction waste along the shores, compounded by maritime refuse, completed the sad picture. The beaches were in critical condition. Some were closed for recreational use because they failed to meet sanitation standards; the use of others was exceedingly unpleasant. In all of these regards, substantial improvement has occurred in the past ten years. The quantity of tar on the beaches has decreased by a factor of 150, the discharge of the sewage into the sea has largely stopped, and the dumping of refuse onto the beaches has diminished significantly. The rehabilitated beaches again serve the public on an appropriate level of environmental quality and cleanliness, meeting international water-quality standards. These achievements appear to be sustainable in the long run; some of them, such as the cessation of the discharge of sewage into the sea and reduction of the quantity of tar pollutants, are irreversible. As for industrial wastes, an improvement is expected in the near future when the Prevention of Effluent Discharge from Land-Based Sources Law goes into effect, and the dumping of refuse on the beaches should stop altogether when the regional disposal sites and the special construction-waste sites are brought into use. The possibility of reducing marine waste, however, does not seem to exist.

### **Expansion and formalization of toxic waste treatment**

The National Toxic Waste Treatment Site at Ramat Hovav began to operate in the early 1980s. At first the facility was used for collection and storage, but by the mid-1980s various treatment and neutralization activities began to take place there. Increasing quantities of waste are gathered at the site each year, and a growing proportion of all such waste generated in Israel is brought there. However, because of the massive growth in total quantity of toxic waste generated in Israel, the volume of uncontrolled discharge is increasing.

It appears today that the Ramat Hovav site, after its protracted birth pangs, is on the way to success. This development, perhaps the best guarantee that today's positive trend will continue, as manifested in the transfer of responsibility for the site, and for the issue in general, to the Environmental Quality Services Corporation, thus ensuring future growth in the number of Ramat Hovav users.

The installation of new facilities is expected in the near future, including an incinerator that will permit the site to treat substances that have merely been stored thus far. The Toxic Waste Law, presently being drawn up, will also help strengthen these trends once it goes into effect.

### **First indications of improvement in organizational readiness for response to chemical disasters**

In the past few years, decision makers on the highest government echelons have become increasingly aware of the need to devise frameworks to cope with chemical accidents, and coordinated activity for the establishment of such frameworks is under way. Action has been taken to define the various agencies' spheres of responsibility, databases of hazardous substances have been improved, and alert systems for immediate response have been constructed.

These are merely the initial indications of change. Activity in this regard is expected to develop further for various reasons, including the concentration of competence for the matter with the Ministry of the Environment.

### **Expansion of protected areas**

With the implementation of the National Parks, Nature Reserves, and National Sites Law, 1963, the process of declaring protected areas under this law has begun and is in full swing; the map of Israel's protected areas is augmented each year with new parks and reserves. Once all the proposed reserve and park areas are declared as such under the law, approximately 20 percent of the country's land area will be protected—25-30 percent if planted and natural forest areas tended by the Jewish National Fund are included. This is a highly significant achievement, although it does not protect these areas from degradation. As stated, the trend is expected to continue and reach completion within ten years. The greatest change is expected when the large reserves in the Negev are declared.

#### **Revitalization of natural vegetation in the Mediterranean coastal hills**

After a protracted period of felling, overgrazing, and burning that brought the natural ecosystem to a nadir, natural vegetation in the Mediterranean hill areas is making a comeback. This process actually began in Israel's formative period, when sheep grazing was brought under control (including an absolute ban in certain protected areas) and when the uncontrolled felling of trees was prohibited. Thus areas that had been laid bare, along with other areas that were covered with bush and scrub forest, are now profusely vegetated with scrub or, in certain cases, mature forest. These processes have transformed the appearance of the landscape in many areas of Galilee and the Carmel range. Thus far no real attempts have been made to intervene in and direct the process of natural revitalization; in many cases the result is the formation of dense vegetation patterns that are highly sensitive to the spread of fire.

Revitalization in most of the country's mountain areas will continue, and initial attempts to create a management system channeling the process onto more desirable paths will be made in some locations.

#### **Afforestation trends**

Several trends characterize Israel's planted forests. Although the planted area will grow by 15,000-20,000 dunams per year, there is no agreement whether this trend is positive or negative. Beyond the quantitative issue, several incontrovertibly positive trends will typify future afforestation. Future planting will focus on urban outskirts and strips of forest along coastal-plain rivers. These will serve as interurban buffers, obstructions to urban sprawl on the coastal plain, and parks for active recreation by city dwellers. The future development of coastal parks is another measure meant to disrupt the urban continuity. Additionally, emphasis will be placed on afforestation in the northern and western negev for land preservation purposes. Greater use will be made of planted buffers between major focal points of environmental hazard such as quarries, roads, and industrial areas. Afforestation will serve purposes other than the traditional ones, e.g., rehabilitation of various kinds of landscape degradation, including the revitalization of quarries and the stabilization of wandering dunes and the banks of rivers and gullies. As the country's mature pine forests age, revitalization efforts including new planting and replantation of natural vegetation will be carried out. This trend expresses a change in Jewish National Fund philosophy; the JNF now acknowledges the disadvantages of the traditional approach, based mainly on homogeneous, densely planted pine forest.

#### **Areas of no evident progress, no unequivocal trend, or mixed trends**

##### **Recycling of domestic waste**

Israel's rate of materials reclamation from domestic refuse is very low. In fact, the only material sorted and separated at source is paper, and even this is done at a rate much lower than that of most Western countries. Although the expansion of recycling has been Israel's declared policy for 20 years, and even though several local authorities have attempted to make a breakthrough, no far-reaching development in this regard has occurred in recent years. Thus there is no real basis for conjectures about the future. However, since the cost of disposing of the waste of Metropolitan Tel Aviv is expected to rise in the near future, some increase in the volume of materials recycled may be attained. This, too, is hard to estimate.

##### **Construction waste**

Although the Maintenance of Cleanliness Law explicitly prescribes the setting aside of a special site or sites for the disposal of construction waste, very few local authorities have complied and no systematic effort has been made to exploitation the reuse potential of this waste for infrastructure, landscape revitalization, and so on. Thus, construction waste is still a common aesthetic blight on the outskirts of Israeli towns.

##### **Reclamation of abandoned domestic waste disposal sites**

Thus far no deliberate, systematic effort has been made either to identify the locations of abandoned domestic waste sites or to pinpoint the environmental problems they cause. For example, the extent to which they endanger groundwater and pollute surrounding soil are not known. In any case, no real attempt has been made thus far to treat and reclaim these sites. With the growing sensitivity to groundwater pollution on the coastal plain, a turnabout in this regard may yet occur.

##### **Activation of dumps for domestic wastes**

The only progress made in this context is in the daily covering of domestic wastes with soil; even this is being done on a small and insufficient scale. Other environmental requirements invoked today in developed countries—sealing of site beds, impoundment and appropriate treatment of leachate, collection of methane gas for use as an energy source, monitoring of nearby water sources—are still not required in Israel and are therefore not applied. The adoption of approaches and technologies regularly applied in other countries by Israel's environmental administration may bring about a turning point in this area, too.

### **Readiness for large-scale maritime disaster**

The past decade has witnessed substantial improvement in Israel's readiness to handle pollution caused by small-scale marine accidents and mishaps; in this regard, it may be said that Israel is adequately girded. By contrast, no real progress has been made in the country's readiness to deal with marine pollution on a large scale. Because such readiness is tremendously expensive, no change whatsoever is in the offing. Therefore, Israel's coasts are unprotected against large-scale chemical or oil pollution, and the only avenue that offers prospects of success in coping with this problem is international cooperation.

### **Noise pollution**

The trend is mixed. On the one hand, professional treatment of noise hazards in excess of standards is gradually improving, and the monitoring tools and professional familiarity with solutions have immeasurably improved the environmental administration's ability to cope with exceptional noise. This favorable process is expected to continue. However, overall growth of activity and the spread of development into previously undeveloped areas have led to an increase in the general background noise that is permitted by standards and to which the population of Israel is exposed.

### **Water quality in lake Kinneret**

No long-term downtrend in the quality of the water of Lake Kinneret is evident. An equilibrium seems to have been reached among the activities in the Kinneret drainage basin, environmental measures taken to reduce the flow of pollutants into the lake, and the ways in which the lake is used as a reservoir. The use of planning tools such as the National Kinneret Coast Master Plan, organizational tools such as the Kinneret Administration, and follow-up and monitoring tools applied with respect to the lake, such as the Kinneret Research Laboratory, will apparently sustain this equilibrium in the coming years as well.

### **Greater use of treated sewage in agriculture**

Again, the trend is mixed. On the one hand, treated sewage is being put to increased use in agriculture. In fact, it is the major substitute for the potable water that is increasingly reallocated for household and industrial use each year at the expense of agriculture. This is a powerful motivation for the treatment of sewage, assuring future improvement in the quality of treatment. In this sense, Israel's chronic water shortage is an environmental advantage. On the other hand, the environmental implications of the use of treated sewage for irrigation are not altogether clear. Moreover, Israel lacks an efficient mechanism that would enforce environmental criteria in the use of treated sewage, as to both the composition of the sewage and the types of crops.

### **Restoration of wildlife in natural habitats**

In order to restore wildlife in erstwhile parts of the natural ecosystem, Israel has established two wildlife preserves: one for desert wildlife (Yotvata) and one for typical Mediterranean wildlife (Carmel). The intent is to encourage reproduction as a way of maximizing the survival prospects of this wildlife and its impact on the management of the ecosystems. One such attempt has been made thus far: the releasing of burros in the Ramon Crater. It is still too early to assess the results. No similar attempt has been made in the Mediterranean habitat and, according to conventional assessments, there is no chance of such an attempt taking place in the near future. In the longer term, too, the largescale presence of restored wildlife in Israel's Mediterranean environment should not be expected.

### **Areas in which information is lacking**

There are several areas in which the levels of monitoring, testing, follow-up, and scientific research are too small in scale to permit an assessment of the state of the environment and the level of risk to which the public is exposed. In these regards, then, no trends can be indicated. This group of topics includes pesticide residues in food, soil pollution, specific pollutants in groundwater, specific atmospheric pollutants, and environmental radiation.

## **The spatial aspect of the environmental forecasts**

### **The coastal plain**

This part of the country will come under the greatest environmental strain, because it is characterized by high population density; a concentration of industrial, transportation, energy production, and agriculture activities; and the generation of large volumes of waste and sewage. Because of its proximity to one of the most important groundwater aquifers in the country's water system, the coastal plain is also an area of special sensitivity.

The major problems are air pollution, groundwater pollution, and noise. Their solution will require close cooperation between the environmental administration and the local authorities.

### **The Negev**

Because the Negev is sparsely populated, endowed with available and relatively inexpensive land reserves, and at relatively low risk of groundwater pollution, there is a trend to divert pollution and risk factors to this part of the country. Several of these factors are the national Toxic Waste Disposal Site at Ramat Hovav, concentrations of chemical industries, plans to divert domestic waste from northern to southern sites, designation of sites for future nuclear power plants, plans to construct inland fossil-fuel power plants, programs for the exploitation of vast land reserves for solar energy generation, existing and planned engineering facilities, irrigation with treated effluent and other kinds of marginal water, extensive defense system activity, and the extraction of raw materials such as phosphates and Dead Sea minerals.

The major problems are exposure to hazardous substances and landscape degradation. The Negev is liable to acquire a stigma as the country's "back yard," and a solution to the problems depends mainly on national-level authorities.

### **Galilee**

Galilee will be characterized by rapid population growth and a substantial increase in standards of living, chiefly among the non-Jewish population. This will trigger building activity at a pace unprecedented in this area, coupled with grave landscape degradation. In the Jewish communities and infrastructures in Galilee, the trends of the 1980s will presumably continue. This area will also be exposed, as it has in the past, to the extensive exploitation of raw materials for mining and quarrying, defense, tourism development, and industrialization of the Jewish and Arab rural areas.

The major problems are water pollution and landscape degradation. The major challenge will be the introduction of environmental management in the Arab sector and among the Jewish rural settlements.

### **Policy, environmental management, and national priorities**

Environmental quality trends are not random. Israel's future environmental quality will be determined by policies reflecting the standing of the environmental issue on the national scale of priorities. According to the development forecasts, as stated, potential environmental strain will increase by a factor of three or more during the forecast period. Despite positive trends in certain areas, as spelled out in this abstract, the trends in other exceedingly important domains, such as water quality, solid wastes, hazardous substances, and degradation of natural ecosystems, are negative, long-term, and in some cases irreversible. It may therefore be said that development in Israel is not following a sustainable path.

Assuming that sustainable development is one of Israel's long-term objectives, the country's national development policy is in need of modifications if not a turnabout. In the present study, the authors of the forecast intend neither to propose such an alternative policy nor specify the practical objectives needed to set development on a sustainable course. Rather, they attempt to assess the chances of the occurrence of such a turnabout, or, alternatively, the factors affecting such a possibility.

Below are several factors that may affect development and environmental policies:

#### **Exogenous factors**

In several parts of this study the authors predict that world developments will affect environmental quality activities in Israel. The developed countries are in the midst of a protracted expansion and intensification of attention to environmental issues. This wave has undoubtedly affected and will continue to affect developments in Israel, which will be asked to sign and comply with international treaties and agreements on various environmental matters. These will dictate policy in these regards, at least in part.

Worldwide scientific research. The efforts of scholars and scientists help identify environmental problems and assess various risks, policy options, and technological solutions. Scientific activities of these kinds are benefiting from great momentum and growing research budgets, all of which will have a major impact on human understanding of environmental problems in the world at large and in Israel too.

Environmental quality standards. Such measures, legislated and applied in other countries, affect what is done in Israel. Even when they are

not compulsory under international agreements, they serve as yardsticks for emulation. The standards being set in the developed world are increasingly stringent, and there is reason to assume that the worldwide trend will affect developments in this country.

International trade: the manufacture and use of certain substances will be banned worldwide, and the use of environment-friendly technologies will become mandatory. The impact of these developments will be felt in Israel with regard to both importable and exportable products.

Environmental management tools: Environmental management agencies around the world are developing more effective methods of action and management in the handling of environmental issues; again, these models of change are bound to affect developments in Israel.

International organizations and institutions: international agencies-especially development finance institutions such as the World Bank and the European Investment Bank increasingly prefer environment-friendly projects or investment vehicles. In a similar vein, a new area of investments in solutions to environmental problems is taking shape. This trend is already beginning to affect activities in Israel.

Non-governmental organizations are having a growing impact in international institutions and decision-making processes. The ascendancy of these organizations will project onto the status and modus operandi of corresponding agencies in Israel.

Exposure to information: the Israeli public, via the world media, is increasingly exposed to environmental quality information; this affects the level of awareness, understanding, and attitude of the public to such issues in this country.

### **Endogenous factors**

The environmental administration. This rubric includes all governmental agencies responsible for the formulation and application of national environmental policy. Because the environmental administration has a major impact on decision-makers, the stronger it becomes the greater the chances of a turnabout in development and environmental policy will be. The construction of Israel's environmental administration began when the state was founded, and its development has advanced steadily, and its spheres of influence expanding, to the present day. The "crown jewel" in this relentless progress was the establishment of the Ministry of the Environment in 1989, and all trends, encouraged and bolstered by the aforementioned exogenous factors, indicate that this process will continue.

The public. Even "ordinary people" may exert a major impact on policy. This capability has been utilized only in part in Israel, manifested chiefly in the issue of nature preservation. There seems to be great potential here, but the direction in which it will develop is hard to estimate. The public has to reorder its values and drastically modify its environmental behavior. Progress in the political process and economic improvement may focus greater public attention on the environmental cause.

Leaders and decision-makers: the authors of the study believe that the country's leaders relegate the environment to a low level of priority. Admittedly, the leadership is preoccupied with the country's difficult, complex existential problems in the areas of defense, economy, and society. However, the establishment of the Ministry of the Environment should be viewed as a watershed that pegged the environmental issue on a new and higher level of status. First indications of initial change have appeared among national echelon decision-makers with respect to the issue of water and agriculture, although it would be premature to issue long-term prognoses on this basis.

All of these factors are interrelated in complex and multidirectional ways; the details of these relations cannot be explored here. The authors of the forecast believe that the exogenous factors listed above will have a major and favorable effect on developments in Israel. A significant turnabout in the field of policy, however, will be attained only after the country's existential problems, on which Israel focuses most of its attention, are mitigated.

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