



State of Israel



Ministry of Environmental Protection

STATE OF THE ENVIRONMENT IN ISRAEL INDICATORS, DATA AND TRENDS

2010



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State of Israel

Ministry of Environmental Protection

Office of the Chief Scientist

**State of the Environment
in Israel
Indicators, Data and Trends**

2010

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Foreword by the Minister of Environmental Protection

Environmental issues have long become central elements in the public discourse. The public in Israel is becoming more aware and conscious of its surrounding environment. The impact of the state of the environment on human health, quality of life and economic status is now clear and unequivocal. Questions relating to the state of the environment and the actions taken by the different authorities, foremost among them the Ministry of Environmental Protection, to promote a better environment are frequently placed on the public agenda and discussed by the media. The public seeks reliable and updated information which is based on scientific and comparative data on the state of environmental resources: land, air, water, sea and biodiversity.

Transparency, openness and accessibility of information are foundation stones in the trust I would like to create between the Ministry of Environmental Protection and the public in Israel. It is for this reason that I especially welcome this report which provides a comprehensive picture of the state of the environment in Israel and describes the quality of environmental resources, the processes of pollution and the means of treating the wastes produced by human activity.

This objective picture is presented by means of selected, clear indicators which include multi-annual data on different subjects that highlight trends and developments over time. In addition, the report provides the reader with comparative data for other countries. This information constitutes an accessible database for the general public and a reliable tool for effective decision making while promoting public discussion on the different issues.

This is a first of its kind report to be published in Israel in terms of the scope of its data, in line with advanced international standards on state of the environment reporting. It was prepared with the full cooperation of government ministries and the best experts in each field. It is our intention to continue to update this report with new indicators and data based on an ongoing process of study and consultation with a wide gamut of professionals.

I would like to express my thanks to all those who contributed to the preparation of this important document.

MK Gilad Erdan

Minister of Environmental Protection

Introduction by the Director General

This is the way of righteous people and people of good deeds, who love peace, rejoice in the good of humankind, and bring them close to the Torah, that nothing, not even a grain of mustard should be lost to the world, that they should grieve over any loss or destruction that they see, and if they can act to save anything from destruction, they will use all their might to do so."

(Sefer Hachinuch on Deuteronomy 20:19)

Sometimes we do not see the forest for the trees.

Environmental action and environmental management touch on every aspect of life, encompassing a multitude of subjects and fields. Similarly pollution takes a toll on the productivity of natural resources, on our health and well-being.

It is difficult to see the full picture and to assess the state of the environment. Are we moving in the right direction? Are our efforts bearing fruit? Is our system of stick and carrot – environmental enforcement on the one hand and incentives on the other hand – improving the state of our environment?

This report strives to provide some of the answers to these questions by relating to an unprecedented large number of indicators, most of them environmental, some of them economic and social. A review of these indicators provides a wide range of information about the state of the environment in Israel in such areas as waste recycling rates, water source quality, greenhouse gas emissions, and much more.

From the perspective of the Ministry of Environmental Protection, this document helps to outline trends in the state of the environment, the state of pollution and the state of environmental management. These trends can and must help define focus areas and priorities for the Ministry which will be reflected in annual and multi-annual work plans.

I would like to thank the editors of this publication for investing so much effort in its preparation and to express my gratitude to the many other contributors, both within and outside the Ministry, who provided information, comments and constructive criticism.

Att. Alona Sheafer (Karo)

Director General, Ministry of Environmental Protection

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Executive Summary

Management of environmental resources should be based on solid data on the quantity and quality of resources, the processes of pollution that damage them, the treatment of solid and liquid waste, and the improvement or deterioration trends demonstrated by these indicators.

This English document presents selected indicators based on a more comprehensive report in Hebrew which compiles data on more than one hundred different indicators dealing with the main environmental resources: land, air, water, sea and biodiversity. The following are the main findings of the full report:

Land

Land cover – The scope of built space in Israel totaled 1,147.5 square kilometers in 2007, or 5.3% of the country's land area. Built space in the Tel Aviv region constitutes two-thirds of the total space, while built space in the northern and southern regions ranges between 2%-6%. Some 83.5 square kilometers of built space were added between 1998 and 2007 throughout the country.

Contaminated land – As of 2008, some 1,195 contaminated sites were identified in Israel. The largest number of contaminated sites (316) was discovered in the Tel Aviv metropolitan area where the operations of numerous industrial plants and military and industrial workshops have caused land contamination and large-scale groundwater pollution. In most of the older **gas stations** which were checked (93%), soil contamination was discovered, and in 32% of the sites, groundwater pollution was also found. In the soils of the Western Galilee, aggregations of industrial **asbestos waste** exist due to the past dispersion of asbestos waste for soil stabilization and cover.

Radon – Areas sensitive to radon in Israel include: Arad, Ma'ale Adumim, Jerusalem, parts of Karmiel, and other localities overlying phosphatic soil, especially in the area of Mishor Adumim.

Air

In 2008 exceedances of **fine respirable particles** were recorded in all of Israel's monitoring stations.

Sulfur dioxide concentrations dramatically decreased in recent years due to improved fuel quality in power plants and industry and due to the switch to natural gas in the Ashdod power plant.

In 2008, an increase in **ozone** concentrations was noted in the Western Galilee, Afula, Modi'in, Jerusalem and Ramat Hovav, and a decrease in ozone concentrations was recorded in monitoring stations in the Haifa region.

Nitrogen oxide concentrations in transportation monitoring stations, situated near major traffic arteries, have shown a downward trend since 2000. However, in 2008, annual exceedances of nitrogen dioxide were measured in all transportation and general monitoring stations in Israel.

Concentrations exceeding the upper threshold value for **lead** were measured in industrial areas near emission sources, and high concentrations of **benzene** were measured near traffic arteries and fuel storage areas.

Carbon monoxide values were low.

Recent years have witnessed a significant decrease in pollutant emissions to the air from power stations and even steeper declines in the specific emission of different pollutants per unit of electricity production. Similarly, in 2007-2009 total hourly emissions of particulate matter (PM₁₀) to the air from **point sources** (industry and power plants) decreased along with decreases in hourly emissions of non-methane volatile organic compounds (NMVOC) to the air from fugitive sources. Despite a 30% growth in kilometers traveled between 2000 and 2008, emissions of carbon monoxide, nitrogen oxides, hydrocarbons and particulate matter from transportation sources decreased by 40%-45%.

Greenhouse gases – Between 1996 and 2007, greenhouse gas emissions to the air (carbon dioxide, nitrous oxide and methane) in Israel grew by 14 million tons. Between 2000 and 2007, a significant reduction in the specific emission per capita (0.82 tons) of greenhouse gases was measured. On the other hand, in 2007, an increase relative to 2006 was noted (0.11 tons). The main source of carbon dioxide emissions is fuel combustion, mostly for electricity production and fuel refining. The second source is fuel combustion for transportation and, to a lesser extent, fuel combustion for the manufacturing and construction industries. The main source of methane emissions to the air is municipal waste (between 75% and 78%).

Water

Freshwater consumption for all uses decreased from 1,591 million cubic meters (MCM) in 1996 to 1,309 MCM in 2002, with a slight increase in 2008 to 1,337. Agriculture's part decreased over the past decade from 43% of the total freshwater for consumption in 2001 to 36% in 2008, while the part of the domestic sector in total freshwater consumption increased from 37% in 1996 to 57% in 2008. The agricultural sector supplemented its water requirements by increasing its effluent reuse. Relative to other developed or industrial states worldwide, Israel makes use of nearly all its renewable water sources for domestic, agricultural and industrial consumption. This

has adversely impacted on freshwater sources and wetlands and on the flora and fauna that persist in them.

The **Kinneret (Sea of Galilee)**, Israel's only freshwater reservoir, is marked by a variable flow regime. Consecutive rainy years are followed by consecutive drought years. The wide variability in the quantity of water available to the lake causes sharp fluctuations in water levels. Drought years are generally characterized by little precipitation and by decreased recharge of the main aquifers, thereby increasing the need to pump water from the Kinneret and further aggravating the decline in water level. The decrease in water level and its fluctuations exert pressure on the lake's ecosystem. The concentration of **salts** in the water increased steadily between 1998 and 2002, then decreased in 2004, and returned to a steady trend of increase until 2008. The concentration of **chlorophyll** is a little higher in the spring than in the autumn due to a massive increase in algae in the spring compared to the summer. Similarly, concentrations of **nitrogen and phosphorus** in the water, which are critical for algae development, are higher in the spring than in the autumn. The concentration of **fecal bacteria** in the Kinneret waters is higher than permitted by Israel's drinking water standard (0 total coliforms per 100 ml). Over the past decade there has been a dramatic decrease in the **fishing catch** in the Kinneret, which endangers the lake's ecological balance.

The extent of pollution in different parts of the country is impacted by the level of industrialization and urbanization. The prevalence of drinking water **wells** which comply with the drinking water standard, but in which traces of pollutants are found, is relatively high in the center of the country and low in the north. In the south, where population density is sparse, the percent of polluted wells is very low.

The quantity of **treated wastewater** increased from 354 MCM in 1998 to 471 MCM in 2008. In this period, the quantity of wastewater treated to at least secondary level grew from 223 MCM to 416 MCM. The percent of effluents reused for irrigation purposes in Israel in 2008 was the highest in the world (82% of the total municipal wastewater). In 2007-2008, the quantity of municipal wastewater **sludge** increased commensurate with the increase in wastewater quantity. In 2008, 109,131 tons of sludge (dry weight) were disposed in Israel from 46 municipal wastewater treatment plants. Some 46% of the sludge was discharged to sea from the Dan Wastewater Treatment Plant (Shafdan) serving the Tel Aviv metropolitan area. Some 49% of the sludge was disposed for agricultural use as Class A sludge and the rest was landfilled.

Sea

Mediterranean Sea – In 1981-2008 a reduction in mercury concentrations was noted in Haifa Bay stations which are located at a water depth of 3 meters and 6 meters. Beginning in 1997 cadmium and mercury concentrations decreased in the Kishon River sediments, and beginning in 1996, lead levels in sediments along the coast decreased. The **marine fish** catch is experiencing a downward trend, which began in

2001 and continued until 2004. In 2005, 2006 and 2007 both increases and decreases occurred.

Red Sea – The state of the **coral reef** in the Gulf of Eilat is stable, and sharp changes or trends cannot be determined. Coral cover in the Eilat reef was higher in 2007 and 2008 than in 2004-2006. The deep mixing of the Gulf of Eilat waters in 2008 led to high **nutrient** values in the shallow water which, in turn, caused algal bloom.

Dead Sea – The decline in water **level** in the Dead Sea currently exceeds a meter per year. This leads to the appearance of sinkholes, accelerates channeling and erosion processes around the Dead Sea, and causes shoreline retreat and severe ecological impacts.

Biodiversity

The number of identified species at **risk of extinction** is small. A survey of alien species identified some 200 alien species, 50 of which are aggressive **invasive** species. There are many invasive animal species in Israel – both vertebrates and invertebrates. Among vertebrates, the highest numbers of invasive species are among Mediterranean fish and birds.

Radiation

Average levels of **non-ionizing radiation** in localities in the vicinity of powerful broadcasting stations are some 650 nanowatts per square centimeter, mostly originating from AM radio broadcasting (some 90%). In large cities and other localities with cellular base stations, average measured levels range between 60 nanowatts per square centimeter to 80 nanowatts per square centimeter. Some 60% of the exposure in these localities is attributed to cellular base station and the rest to more distant radio stations (AM and short wave). The lowest levels, less than 20 nanowatts per square centimeter, were measured in localities without cellular base stations and in open areas in the Golan Heights. Most of the exposure in these areas (some 90%) originates in distant radio stations (AM and short wave).

Noise

Between 2000 and 2008 a moderate increase was recorded in the number of people exposed to noise from urban and interurban **roads**. The number of people exposed to **aircraft** noise did not increase during this period.

Waste

The quantity of **solid waste** in Israel has reached 11,300 thousand tons per year. Of this, some 4,400 thousand tons per year are **municipal waste**, some 1,600 thousand tons per year are **industrial waste** and about 4,000 thousand tons per year are **construction and demolition waste**. The average quantity of municipal waste per person in Israel was 1.6 kilograms per day in 2008, or 585 kilograms per year, similar to quantities in some European countries. Packaging constitutes between 15%-20% of the weight of municipal and industrial waste. In 2008, 12.5% of the municipal waste was recycled, 25% of the municipal and industrial waste was recycled, and 45.5% of the construction and demolition waste was recycled. All of Israel's coal ash is recycled, mostly for the construction industry.

As of 2004, the quantity of **hazardous waste** which is transferred for treatment is estimated at 300,000 tons per year. Some 65% of this waste is disposed by means of incineration and evaporation, landfilling, physico-chemical treatments and biological treatment. Between 30%-40% of Israel's hazardous waste undergoes recovery, and a small amount is exported for treatment abroad. There has been a sharp increase in the quantity of **asbestos waste** which is transferred to authorized landfills in recent years.



PART I

BACKGROUND INFORMATION



Chapter 1

Geographical Characteristics

The total area of Israel is approximately 22,000 square kilometers (sq km), of which 21,643 sq km are land areas. About half of the land area in the south and east of the country is desert with less than 200 millimeters (mm) of rain per year (multi-annual average). The northern and western parts of the country are characterized by a Mediterranean climate with precipitation ranging between 300 to 900 mm per year (multi-annual average).

The Sea of Galilee (Lake Kinneret) is the only freshwater lake in Israel. Spanning some 164 sq km, it is the only surface water body which serves as a major source of water in the country.

The length of Israel's Mediterranean Sea coast, which constitutes the country's western border, is 194 km. The length of the Red Sea coast at the southern edge of the country, which constitutes a passage to the Indian Ocean, is 11 km.

The salt-laden Dead Sea is the lowest point on earth: 417 meters below sea level.

Table 1.1
Geophysical Characteristics

Region	Area (sq km)		Coastal Length (km)
Israel total	22,072	Mediterranean Sea	194
Sea of Galilee area	164	Dead Sea	121
Dead Sea area*	265	Sea of Galilee	54
		Red Sea	11

* Including the southern basin used as an evaporation pond fed by the waters of the northern basin.

Source: Central Bureau of Statistics; Environmental Data Compendium Israel 2006, Central Bureau of Statistics

Map 1.1
Israel and the Surrounding Region



Source: iStockphoto. Processing by logo Design Studio

Chapter 2

Demographic Characteristics

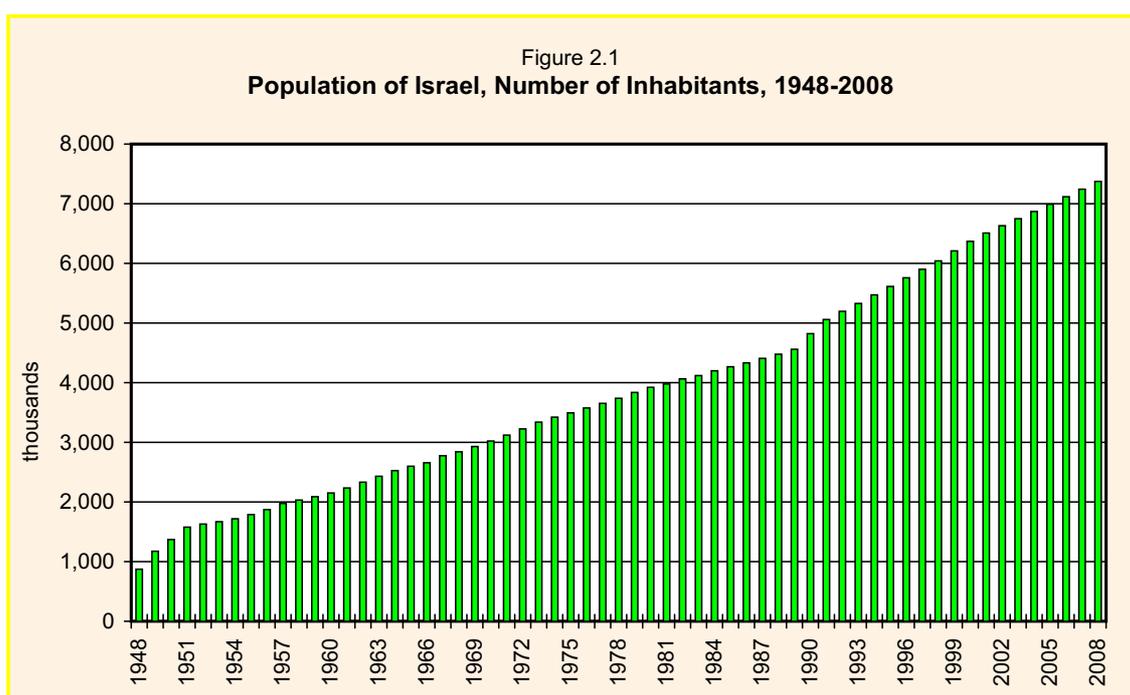
Interactions between the human population and the physical environment affect the carrying capacity of the environment as a life supporting system. Environmental carrying capacity reflects the potential of the environment to provide basic life needs, such as food and physical living space, and its ability to absorb products and wastes generated by human activity. Changes in population size, population growth rate, population dispersion and population density affect the carrying capacity of the environment and, consequently, the quality of life and the environment in Israel.

Israel is one of the most densely populated countries in the world, with the highest density in the center of the country. Most of the country's population resides in urban areas, and a significant portion resides along the coastal plain, exerting major pressure on the environment in the coastal area. On the assumption that these trends continue, it will be necessary to take steps to reduce the pressure, especially in the densely populated regions, in order to protect open spaces and provide for ecological corridors between remaining open spaces such as river strips.

Indicator 2.1
Population Size and Population Growth in Israel
1948-2008

Why is this indicator important?

Population size and population density exert major pressure on the environment due to the reduction in open, undisturbed spaces, the increase in consumption of natural resources (e.g., land and water) and the rise in the quantity of waste which is disposed to the environment.

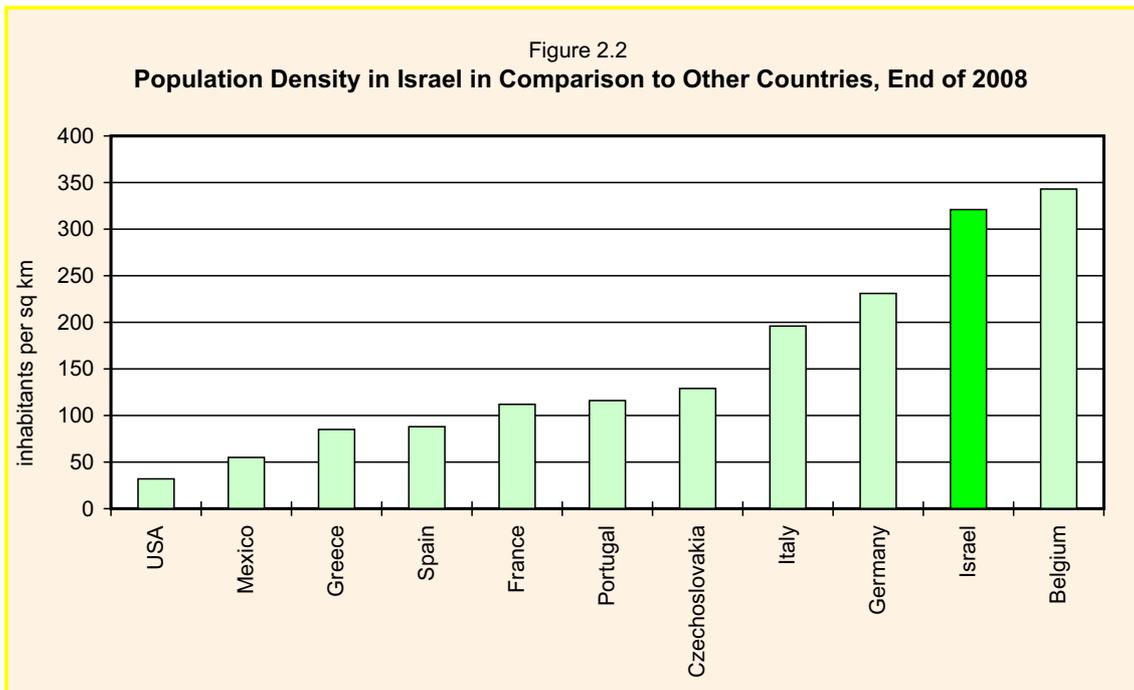


Source: Central Bureau of Statistics

What do the data show?

The rate of population growth in Israel was highest in the years following the establishment of the state in 1948, and declined later, with the exception of a major growth in population in the 1990s in the wake of a massive wave of immigration from the former Soviet Union. Israel's population reached 7,374,000 in 2008.

Indicator 2.2
**Population Density in Israel
in Comparison to Other Countries**
End of 2008



Source: Central Bureau of Statistics

What do the data show?

Israel is one of the most densely populated countries in the world.

Chapter 3

Economic Characteristics

Economic activity has a significant impact on the environment, whether in terms of energy and industrial production or consumption patterns of households and businesses. On the one hand, environmental degradation has been linked to unsustainable production and consumption patterns. On the other hand, economic development and quality of life are dependent on the quality of the environment.

This chapter presents the main indicators associated with the economy: Gross Domestic Product per capita, one of the main indicators used to assess the economic strength of a country in comparison to other countries, and energy indicators, which are often associated with economic growth and development since energy is a driving force of the economy.

Growth in population and production is often accompanied by growth in energy consumption, which, when not based on renewable energy, leads to a further decrease in already limited energy sources and to environmental degradation and pollution. These problems may be addressed through greater energy use efficiency and through the use of alternative energy sources which are both renewable and non-polluting, such as wind or solar energy.

Since most of Israel's energy consumption is based on non-renewable sources, economic development and growth have been accompanied by environmental degradation, including damage to natural resources, air pollution and greenhouse gas emissions. The challenge is to decouple the link between economic growth and environmental degradation.

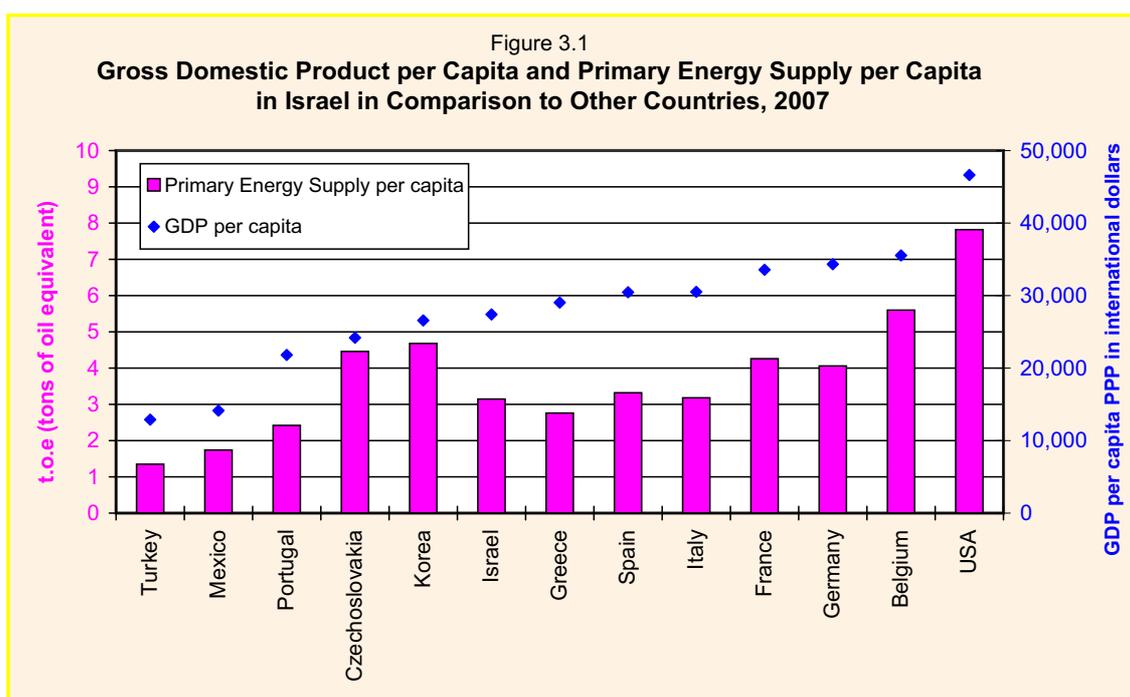
Indicator 3.1

Primary Supply of Energy per Capita and Gross Domestic Product per Capita in Israel in Comparison to Other Countries

2007

Why is this indicator important?

GDP per capita and energy supply per capita help indicate the economic strength of a country and its energy use efficiency. Both have a significant impact on the environment since economic strength is often accompanied by increased use of environmental resources while higher energy use efficiency is an indicator of resource use savings. A comparison of indicators between Israel and other countries provides a background to the state of environmental resources and the state of environmental pollution – indicators which are discussed in further detail later in this publication.



Source: Primary Energy Supply: Israel – Central Bureau of Statistics; Other countries – OECD Factbook 2009 Economic, Environmental and Social Statistics; GDP: International Monetary Fund

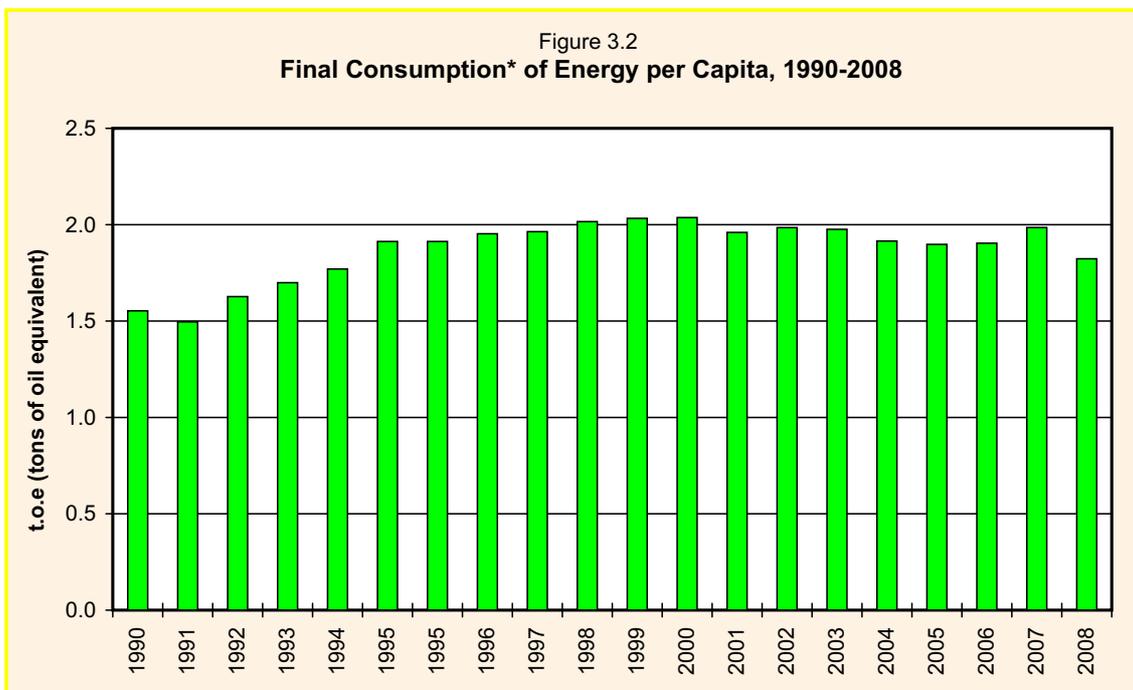
What do the data show?

The supply of primary energy per capita in Israel is similar to that of European Mediterranean countries, such as Spain, Greece and Italy. Similarly, the GDP per capita in these countries is similar to that of Israel.

Indicator 3.2
Energy Consumption per Capita
 1990-2008

Why is this indicator important?

This indicator, in conjunction with additional indicators such as GDP per capita, is a component in assessing the capacity of the economy to develop while using its energy systems more efficiency as well as in assessing the capacity to decouple the link between energy consumption, which is largely based on degradable resources, and the required economic development.



* **Final consumption:** Energy use in the economy, excluding use by energy suppliers.

Source: Central Bureau of Statistics

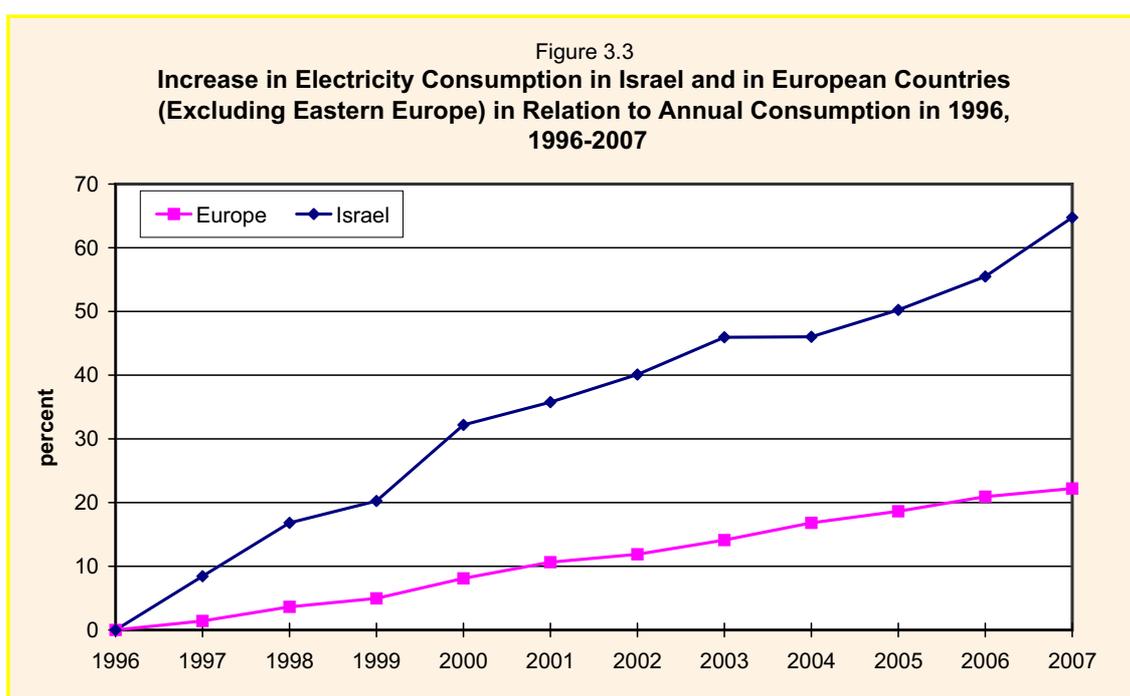
What do the data show?

Energy consumption per capita increased in 1991-2000, and stabilized in 2000. A decrease relative to 2007 was noted in 2008, which may reflect an improvement in energy use efficiency in Israel.

Indicator 3.3
Electricity Consumption in Israel and Europe
1996-2007

Why is this indicator important?

Electricity consumption is a significant component of energy consumption. An increase in peak demand for electricity may indicate the need to expand the electricity production system, or alternately, to increase energy use efficiency and to switch to the production of clean energy, such as solar energy.



Source: U.S. Energy Information Administration (EIA)

What do the data show?

A trend of fast growth in electricity consumption, at a relatively steady pace, is evident in Israel. Electricity consumption has doubled itself within less than ten years. Furthermore, the rate of growth of Israel's electricity sector is much higher than that of the European electricity sector, due to Israel's higher rate of population growth and consistent growth in quality of life. At the same time, the data may also indicate a trend of energy use efficiency in Europe which is not yet the case in Israel.



PART II

ENVIRONMENTAL RESOURCES QUALITY AND USE



Chapter 4

Land

Land Cover in Israel

Land cover relates to the totality of uses which cover the ground, including existing land uses, such as cities, villages, industrial areas, quarries, forests, and more. Land uses impact on the landscape, society, economy, environment, natural assets and ecological processes everywhere.

Open spaces, including natural scrublands and garigues, planted forests, agricultural areas, and rocky grounds and desert have environmental, landscape, ecological, cultural and social value. They provide a diversity of ecosystem services and constitute land reserves for future generations. Any decrease in open spaces is significant since it is irreversible.

Built areas in this chapter include residential, industrial and commercial areas as well as other areas, such as quarries and cemeteries.

Israel's land area is small while its population relative to its size is large. Population density grows concomitantly with population growth. The challenge facing Israel is to continue to supply its residents with the necessary space for residential, industrial and transportation development while protecting the country's open spaces.

Planning in Israel is based on rational and careful use of open space for building purposes, increased density of built areas and contiguous development.

Indicator 4.1

Main Land Uses

2007

Why is this indicator important?

Open space which is continuous and undisturbed is characterized by high ecological, landscape and environmental values. Built areas have a significant impact on open spaces, beyond their absolute size, due to their dispersion and the multiplicity of infrastructures which fragment and bisect open spaces and ecosystems. Land use information provides basic data to the planning system and reflects the level of open space protection which is the basis for ecosystem functioning.

Table 4.1
Main Land Uses, 2007

	sq km
Built areas:	
Residential (including tourism)	878.5
Industrial and commercial	214
Disturbed (quarries, cemeteries)	55
Total	1,147.5
Open spaces:	
Mediterranean natural vegetation	3,300
Desert natural vegetation	12,000
Forest	950
Agriculture	4,200
Total	20,450
Total	About 21,600

Source: Moti Kaplan, 2007 construction data: from data processing for the National Master Plan for Building, Development and Conservation (TAMA 35); Moti Kaplan, Patterns in the Utilization of Constructed Land in Israel, Ministry of Environmental Protection, Jerusalem Institute for Israel Studies, 2007; Central Bureau of Statistics; Open Space and Biodiversity Division, Ministry of Environmental Protection

What do the data show?

Built space in Israel totaled 1,147.5 sq km in 2007, which are 5.3% of the land area of the country. This figure does not include the following areas, which should be added:

- Defense system areas;
- Interurban highway areas.

Chapter 5

Air

Air Quality

The main sources of air pollution are human activity and dust storms. Anthropogenic sources include emissions from power plants, industry, vehicles and household heating and cooling.

Monitoring stations have been established throughout Israel to measure pollution: general stations are located in population centers which are not adjacent to emission sources, transportation stations are located near primary traffic junctions, and secondary pollutant stations are located downwind at relatively far distances from the emission sources.

The following air pollutants are continuously measured in these monitoring stations: respirable particles, sulfur dioxide, ozone, nitrogen oxides and carbon monoxide.

Respirable Particles

Monitoring stations measure both fine respirable particles which are smaller than 2.5 microns ($PM_{2.5}$) and respirable particles which are smaller than 10 microns (PM_{10}). Sources of respirable particulates include anthropogenic sources and natural sources. Particulates are emitted during combustion processes in power plants, industry, transportation and home heating. They are also produced by photochemical oxidation of sulfur dioxide, nitrogen oxides and volatile organic compounds. Since small particles have a long duration in the atmosphere, they may reach areas far away from emission sources. Dust storms which originate in the deserts of North Africa and Saudi Arabia constitute a major natural source of fine respirable particles in Israel. Air pollutants may also reach Israel from Western Europe.

Indicator 5.1

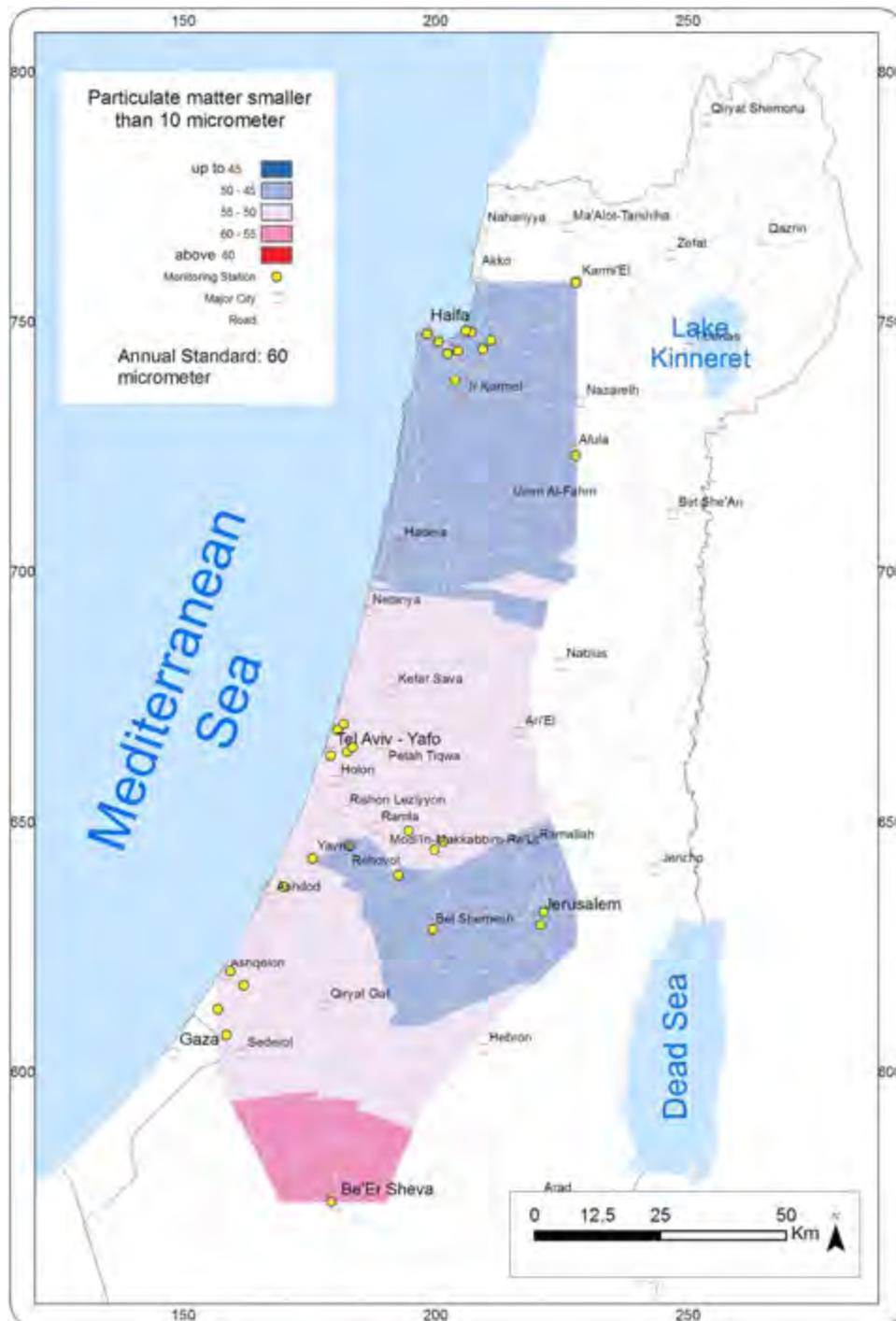
Concentration of Respirable Particles (PM_{10}) in the Air

Spatial Distribution, 2008

Why is this indicator important?

Assessment of the extent of air pollution is designated to facilitate policy making on pollution abatement and air quality improvement, evaluate the effectiveness of actions taken, determine high air pollution areas for priority treatment, estimate the scope of the population's respiratory exposure, establish air quality standards and check compliance with these standards, and serve as a database for research on health and the environment.

Map 5.1
Concentration of Particles Smaller than 10 Micrometers in the Air, microgram per cubic meter, 2008



Source: National Monitoring Network, Air Quality and Climate Change Division, Ministry of Environmental Protection

What do the data show?

The concentration of respirable particles in Israel is high, stemming, to a large degree, from high background concentrations resulting from dust storms which reach Israel due to its geographic proximity to the Arabian deserts. The annual concentration of particles ranges between 50-55 micrograms per cubic meter. In the Beersheba region in the south of the country, particle concentrations range between 55-60 micrograms per cubic meter.

Ozone

Tropospheric ozone is an indicator of photochemical air pollution. Ozone is a secondary pollutant formed when nitrogen oxides and volatile organic compounds combine chemically in the presence of sunlight, especially during the spring, summer and fall seasons. Although most of the pollutants that form ozone (ozone precursors) are emitted in urban areas, concentrations of tropospheric ozone are often high in Israel's inland areas which are distant from emission sources.

Indicator 5.2

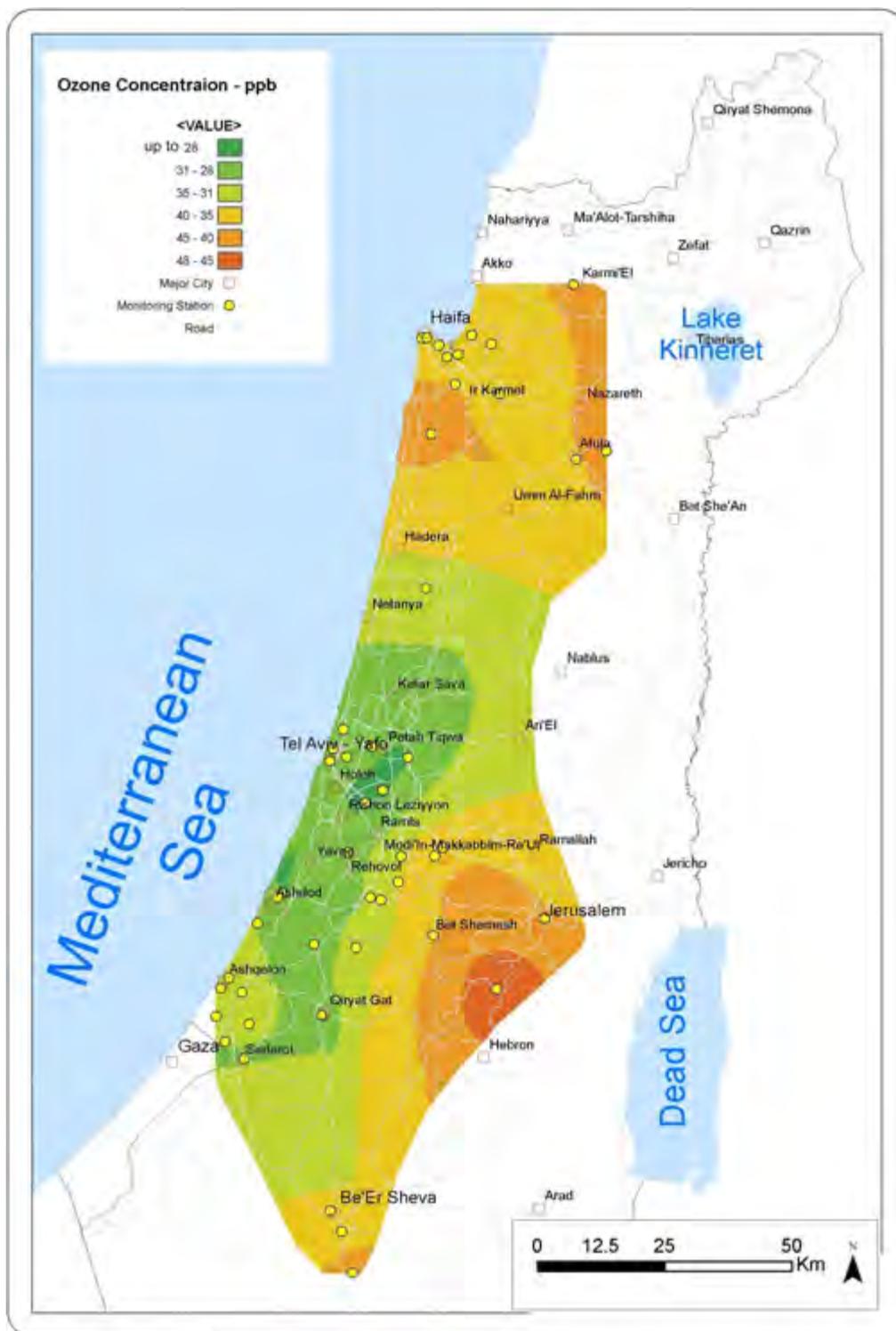
Concentration of Ozone in the Air

Spatial Distribution, 2008

Why is this indicator important?

See Indicator 5.1.

Map 5.2
Concentration of Ozone in the Air, parts per billion, 2008



Source: National Monitoring Network, Air Quality and Climate Change Division, Ministry of Environmental Protection

What do the data show?

High annual concentrations of ozone were measured in areas distant from Israel's main sources of emission, including the Western Galilee, the northern valleys, the plains and the mountain area, the Negev and Eilat. In inland regions of the country, dozens to hundreds of exceedances of the eight-hour recommendations of the World Health Organization (51 parts per billion or 100 micrograms per cubic meter) were measured.

Nitrogen Oxides

Nitrogen oxides are produced from the reaction of nitrogen and oxygen in the atmosphere during combustion at high temperatures. Nitrogen oxides are emitted by power plants, industrial boilers and furnaces, and motor vehicles.

Nitrogen oxides which are monitored in transportation stations indicate the presence of other vehicular air pollutants which are not monitored continuously in monitoring stations, such as volatile organic compounds.

Indicator 5.3

Concentration of Nitrogen Oxides in the Air

Half-Hour Averages. General Stations

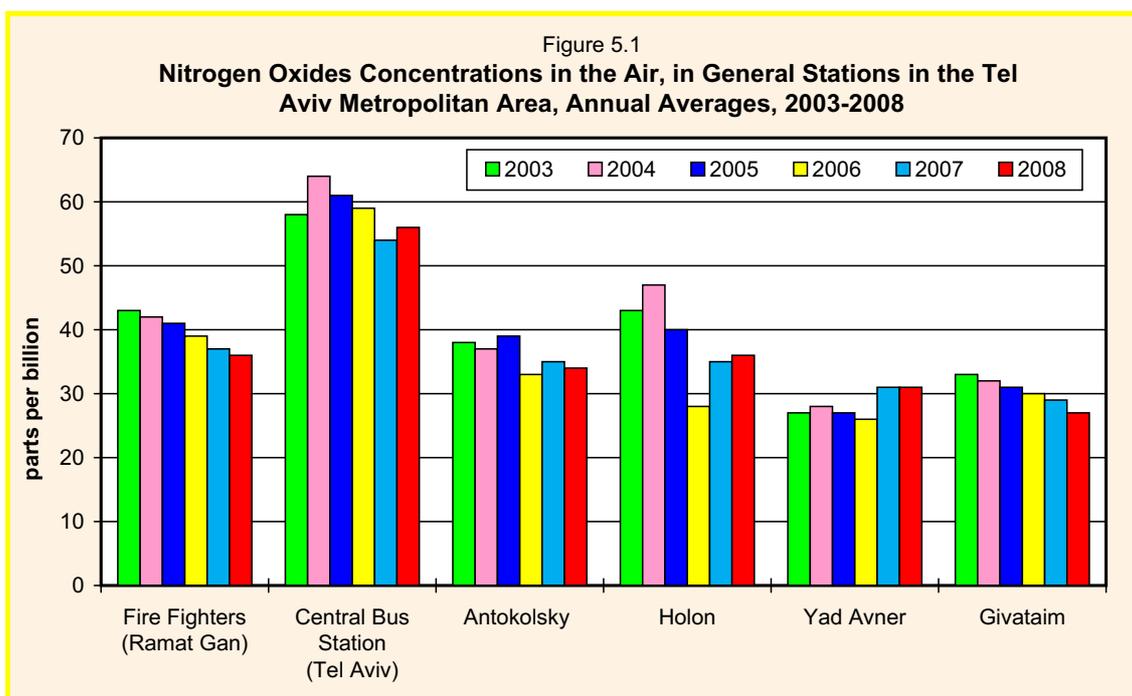
(Tel Aviv Metropolitan Area, 2003-2008; Jerusalem, 2000-2008);

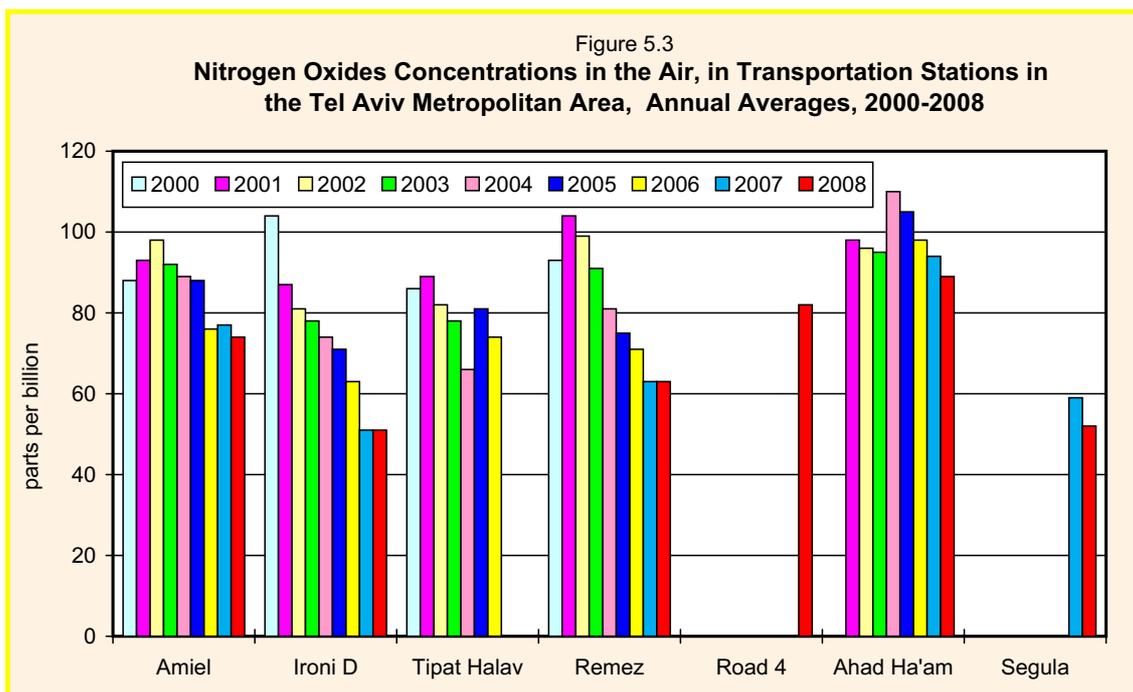
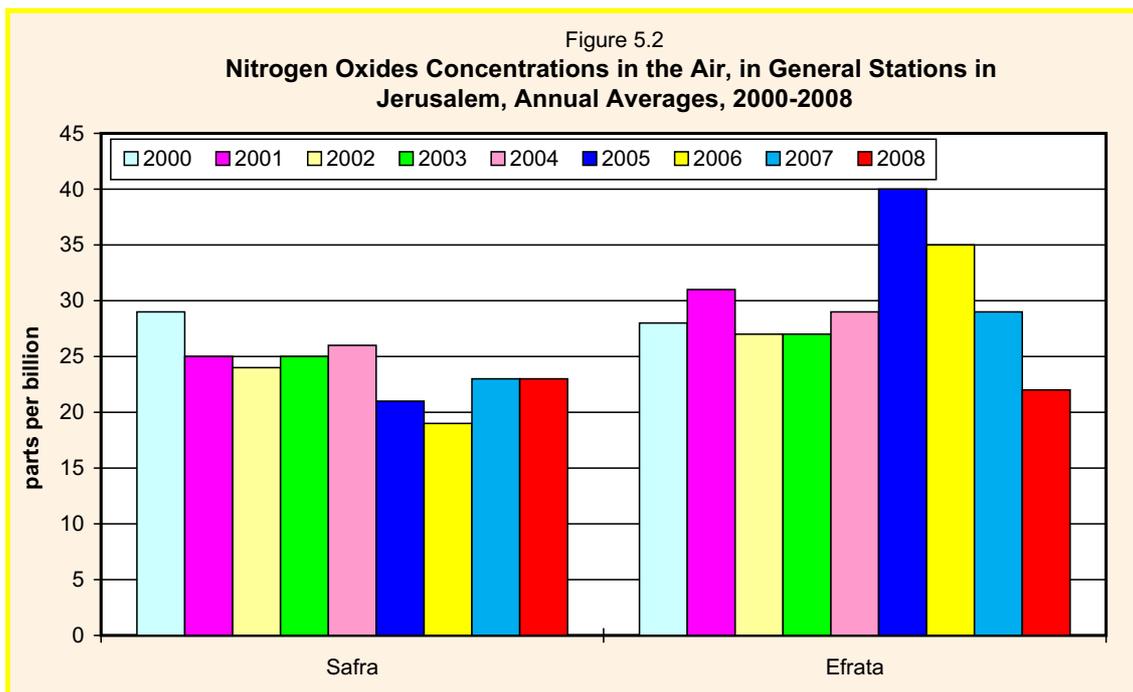
Transportation Stations

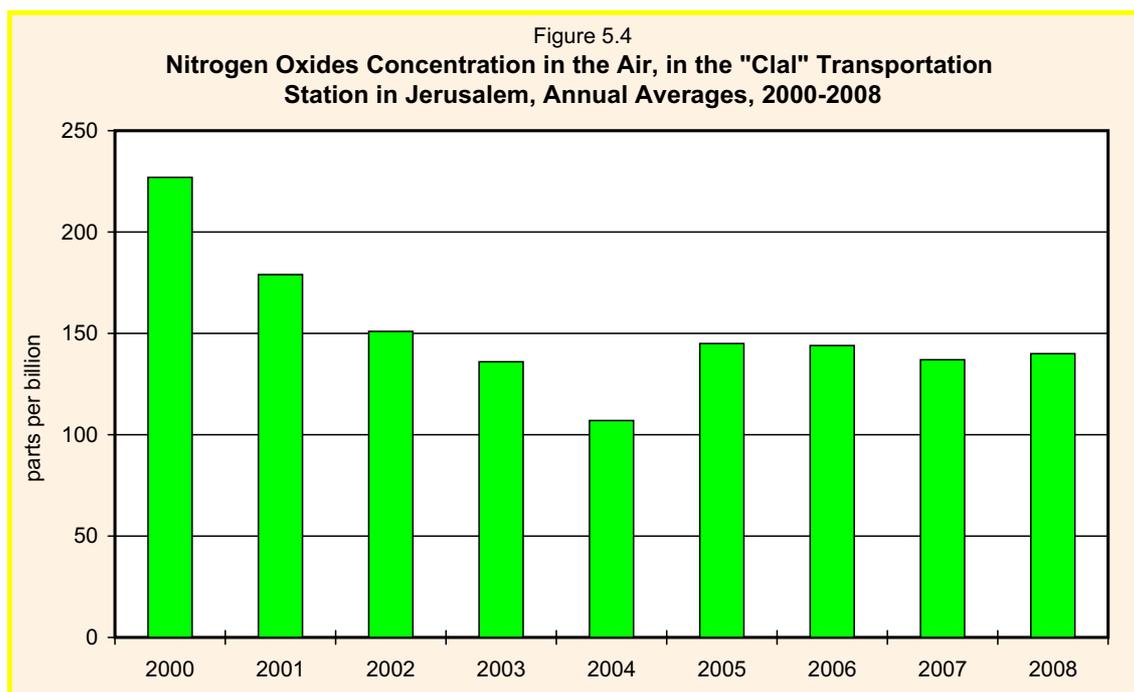
(Tel Aviv Metropolitan Area and Jerusalem, 2000-2008)

Why is this indicator important?

See Indicator 5.1.







Source: National Monitoring Network, Air Quality and Climate Change Division, Ministry of Environmental Protection

What do the data show?

Figure 5.1 shows a 2.7% to 6.9%, decrease in nitrogen oxides concentrations, with the exception of stations in Holon and the Central Bus Station in Southern Tel Aviv, which are adjacent to road paving and building projects.

A 24% reduction was measured in the “Efrata” general station in the Jerusalem neighborhood of Baka, while concentrations remained unchanged in the “Safra” station in the center of the city (Figure 5.2).

Nitrogen oxides concentrations in transportation stations (situated adjacent to busy traffic junctions at pavement height) throughout the country show a downward trend beginning in 2000 (Figure 5.3). A 4%-12% reduction was noted in 2008 in comparison to 2007, which is largely attributed to pollutant emission reductions and favorable atmospheric dispersion conditions.

In the “Clal” monitoring station in the center of Jerusalem high concentrations of nitrogen oxides were recorded, which are attributed to high emissions of nitrogen oxides from vehicles and to poor pollutant dispersion in this area.

Chapter 6

Water

Water scarcity has always been a major concern in Israel, and increasing population, industrial and agricultural growth have exerted additional pressures on the country's limited water resources, in terms of both quantity and quality.

Israel's main water resources include the Sea of Galilee (Lake Kinneret), the country's only source of surface freshwater, the coastal aquifer which spans from Binyamina in the north to the Gaza Strip in the south, and the mountain aquifer which underlies the Judea and Samaria mountains. The country is transversed by dozens of rivers, most of them seasonal, whose waters flow to the Mediterranean, the Kinneret and the Dead Sea.

Increasing demand for water as a result of a growing population beginning in the 20th century led to over-pumping to provide for agricultural, domestic and industrial use. At the same time, pollutants were released to the environment, including municipal, industrial and agricultural wastewater, solid waste, fertilizers and pesticides, hazardous material residues from the industrial sector, and more. This led to the depletion of water sources and to deterioration in their quality. In addition, consecutive and frequent drought years have taken a heavy toll on the country's water resources.

A. Sea of Galilee (Lake Kinneret)

The Sea of Galilee (Lake Kinneret in Hebrew) is the only surface water source in Israel. The lake is 21 km long and 12 km wide. Its coasts stretch 57 km and its total area is 167 sq km. Its maximum depth is 44 meters and its mean depth is 25 meters. The Kinneret watershed spans an area of 2,730 sq km.

The Kinneret is fed by the Upper Jordan River and its watershed as well as by Hermon and Golan rivers, by groundwater springs, and by precipitation in the region. It has traditionally provided about a third of the country's water requirements.

Kinneret Water Level

Indicator 6.1

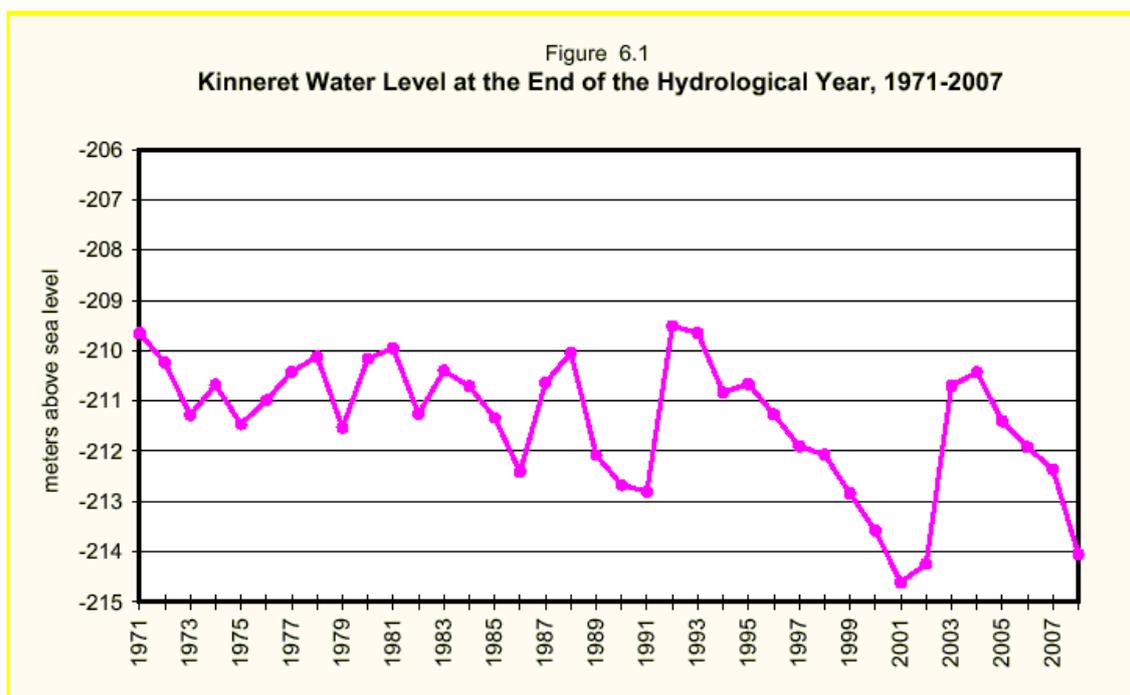
Kinneret Water Level

1971-2007

Why is this indicator important?

The Kinneret water level reflects the stored capacity of the lake which is available for human use. Water level also affects water quality in the lake and its suitability for different uses.

An upper red line is 208.80 meters below sea level (has been used for the Kinneret water level, which is not to be exceeded in order to avoid coastal flooding, and a lower red line is 213 meters below sea level (has been used to avoid harm to the ecology and quality of water in the lake). In recent years a "black line" reflecting the absolute minimum level which cannot be exceeded was established (214.87 meters below sea level), reflecting the lowest ever level of the Kinneret waters which was reached in November 2001.



Source: Israel Hydrological Service, Water Authority

What do the data show?

Major fluctuations characterize the Kinneret's water level, which are attributed to changes in recharge (annual rainfall in the Kinneret watershed and surface runoff and

underground flow into the lake). In addition, changes in water use upstream in the water shed for such uses as agriculture affect the Kinneret's water level.

During drought years, pumping from the lake to the National Water Carrier, which transfers water from the Kinneret in the north of the country to the center and south, is increased, thus further exacerbating the problem.

The increase in freshwater consumption in Israel over the past decade, on the one hand, and the frequency of series of drought years, on the other hand, have led to overdependence on the Kinneret water storage as a primary source of water, and to a further lowering of its water levels. These changes may have negative implications on the ecology and on the quality of water in the lake.

Kinneret Water Quality

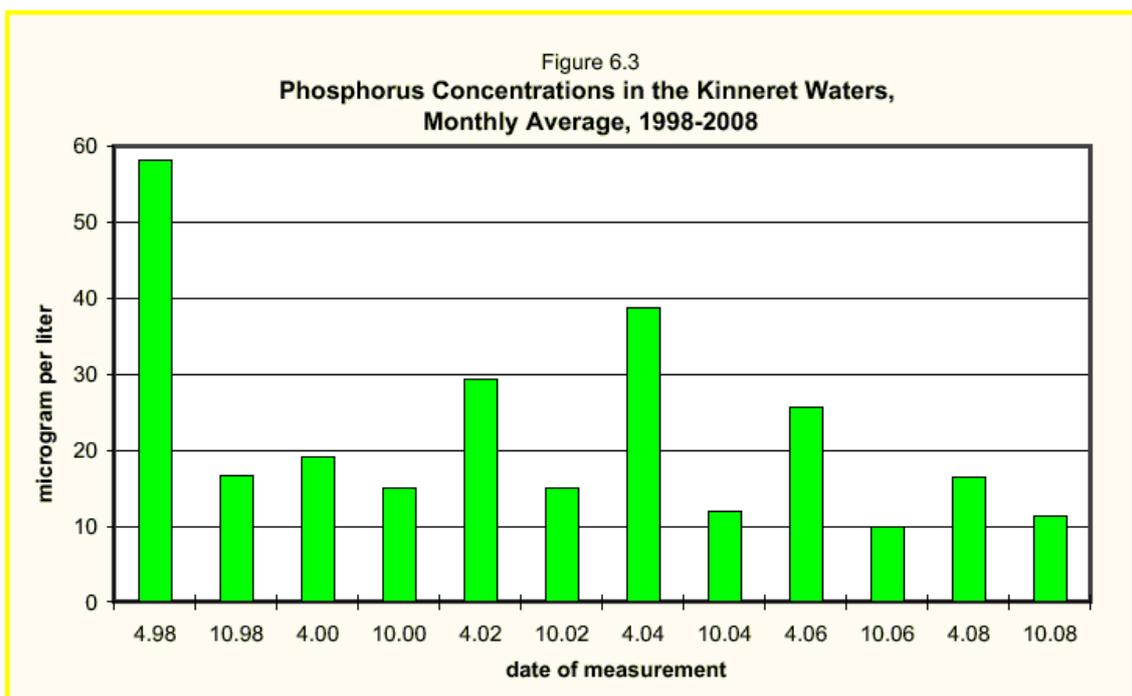
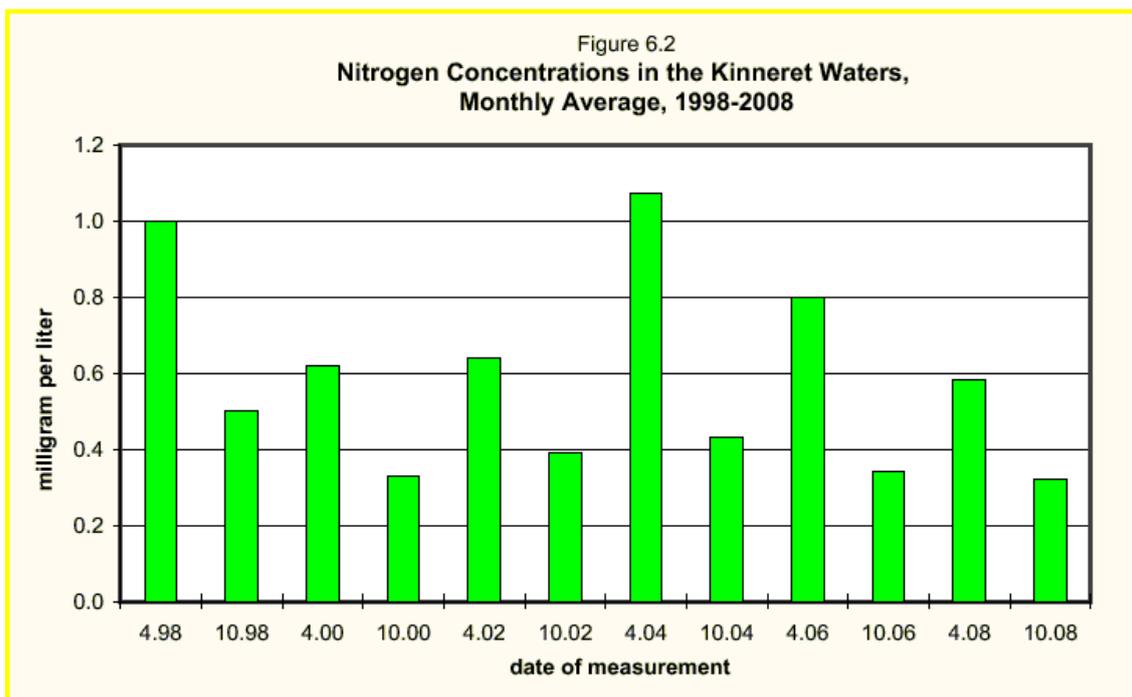
Indicator 6.2

Nitrogen and Phosphorus Concentrations in the Kinneret Waters

1998-2008

Why is this indicator important?

Nitrogen and phosphorus are fertilizers (nutrients) which are critical to algal growth in the Kinneret. Algae concentrations, on their own, are indicators of water quality and are important food sources for fish and invertebrates in the lake.



Source: Kinneret Limnological Laboratory, Israel Oceanographic and Limnological Research

What do the data show?

Nitrogen and phosphorus concentrations are higher in the spring than in the autumn due to the entry of floodwater into the lake during the winter. The Kinneret watershed is

characterized by agricultural areas and cattle farms (open pasture and cowsheds), and manure and fertilizers contribute nutrients to the rainwater which reaches the lake as surface runoff through the rivers. During the summer, nitrogen and phosphorus in the lake are used by algae, some of which settle to the lake bed and some of which serve as food for animals, thereby reducing the concentration of nutrients dissolved in water. In addition to the floodwater, mixing of the water column and the bed occurs in winter, which once again increases nutrient concentrations in the lake waters.

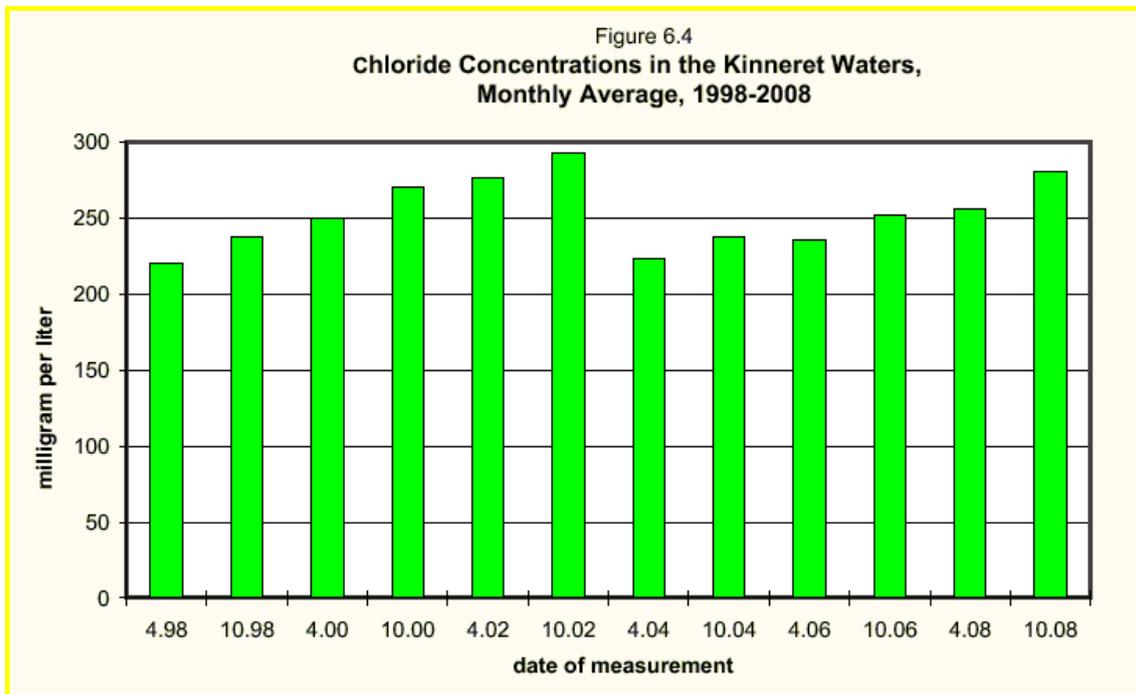
Indicator 6.3

Chloride Concentrations in the Kinneret Waters

1998-2008

Why is this indicator important?

Chloride is an indicator of total salt in the Kinneret waters. The use of Kinneret waters for drinking, agriculture and industry is largely dependent on the water's salt concentration. Biodiversity, too, may be affected by fluctuations in salt concentrations.



Source: Kinneret Limnological Laboratory, Israel Oceanographic and Limnological Research

What do the data show?

The concentration of salts in the water of the Kinneret has increased steadily between 1998 and 2002, decreased in 2004 (in the wake of a rainy year in the winter of 2002/3 and the entry of large quantities of freshwater to the lake), and has continued its increase until 2008.

Chloride concentration is impacted by the flow of water low in salts to the lake (from the rivers which feed the Kinneret), by flows of saline springs within the lake and in its environs, by evaporation, and by water pumping from the lake, especially to the National Water Carrier.

In drought years the quantity of low salt water which reaches the lake decreases while saline water flows are more stable. In addition, in drought years, pumping from the lake increases and evaporation from the lake (which is relatively stable) has a greater impact on the concentration of salts in the remaining water. Therefore, in drought years (and even in average years), water salinity in the lake increases significantly. This constrains the use of the water for irrigation of agricultural crops which are salt sensitive. However, in rainy years when the lake is enriched by freshwater, average chloride concentrations in the water decrease.

Water Inflows to the Kinneret

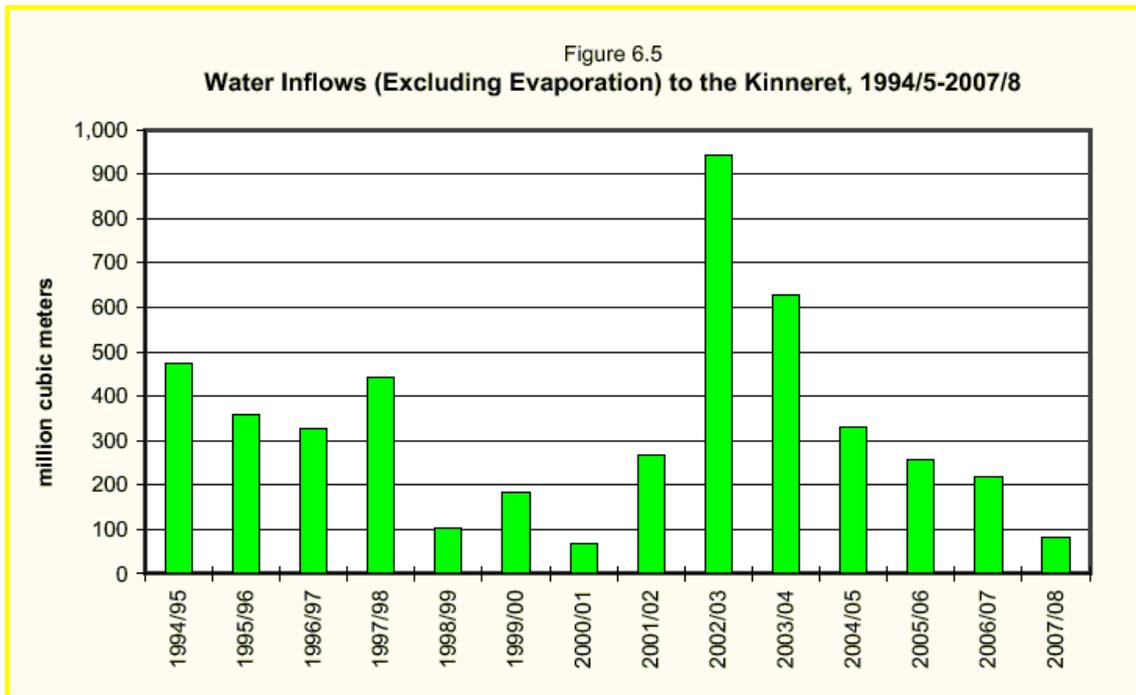
Indicator 6.4

Annual Water Inflows to the Kinneret

1994-2008

Why is this indicator important?

Lake Kinneret supplies approximately 30% of Israel's water from freshwater sources, but this supply is dependent on the quantity of water that reaches the lake every year from rainfall and, especially, from river flow. Water quality in the lake, which is of major importance to habitat quality, is also dependent on the quantity of water flowing to it every year. Therefore it is important to estimate the inflow of water into the lake on an annual basis over time. These data may explain, even if only partially, annual changes in water quality and even in fish catch.



Source: Water Authority

What do the data show?

The Kinneret is subject to major changes in its flow regime. Series of rainy years are followed by series of drought years.

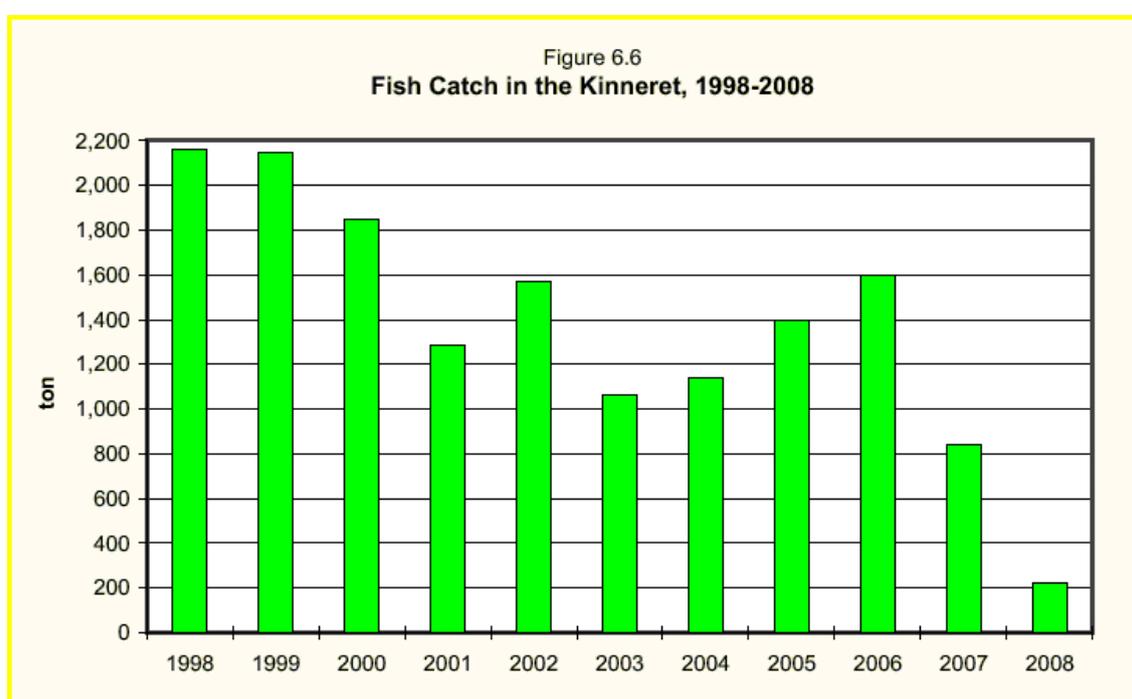
Fishing in the Kinneret

The Kinneret is a rich habitat for a wide diversity of life: phytoplankton (microscopic algae which undergo photosynthesis) are at the first level of the food web, followed by zooplankton (small animals which float in the water and feed on the phytoplankton), and higher on the food web – fish. The Kinneret serves as a source of fish to both professional and amateur fishermen. Protection of the aquatic environment and the ecological balance enables the wise use of this resource for fishing purposes. However, diminished precipitation, resource overexploitation and pollution have changed the character of the Kinneret and have harmed the fishing resource.

Indicator 6.5
Fish Catch in the Kinneret
1998-2008

Why is this indicator important?

The quantity of fish in the Kinneret is impacted by water quality, water levels, competition between fish species, predation by birds, and fishing pressure. Annual fish catch is one of the indicators for ecological stability in the Kinneret, and is used to set fishing policy in the lake.



Source: Fishing and Water Agriculture Division, Ministry of Agriculture and Rural Development

What do the data show?

Over the past decade a dramatic decrease in fish catch in the Kinneret has occurred. While some recovery was noted in 2002 and in 2005-2006, the fish catch in 2007-2008 declined to an all time low, with the lowest catch in 2008.

The main reasons for the drastic reduction in fish catch in the Kinneret appear to be overfishing and fishing with illegal nets. In addition, the fish catch is mostly composed of small fish which comply with the minimal size permitted for fishing, but this hinders the recovery of the fish population in the lake. Other factors may include poisoning by pesticides, predation by cormorants and changes in food types available to the fish. The

critical state of the fishing resource in the Kinneret endangers the lake's ecological balance.

B. Aquifers

The coastal aquifer is a phreatic sandstone aquifer which extends along Israel's Mediterranean coastline and allows for the storage of rainfall falling over the coastal plain and for relatively shallow groundwater pumping.

With the beginning of widescale settlement, intensive agricultural cultivation and modern industrialization in the 20th century along the coastal plain, which were unaccompanied by waste and wastewater treatment or pollution prevention activities until the 1980s, water quality in the aquifer deteriorated. Wastewater, fertilizers and pesticides, fuel, hazardous materials and dairy farm leachate infiltrated groundwater. Water quality in the coastal aquifer is steadily declining, and some 200 out of 700 drinking water wells have been shut down due to non-compliance with drinking water standards.

The mountain aquifer lies to the east of the coastal aquifer, and Israel largely uses the western part of this aquifer, known as the Yarkon-Taninim aquifer. Rainfall mostly penetrates to the Yarkon-Taninim aquifer through the ridges of the Judea and Samaria mountains, and pumping takes place along the foothills of the mountains for technical reasons. Water quality is for the most part high, with the exception of specific areas polluted by wastewater or industrial effluents.

The coastal and mountain aquifers supply most of the groundwater for drinking, agriculture and industry in Israel.

Additional aquifers of lesser national importance are found in the Eastern Galilee, Western Galilee, Eastern Mountain, Negev and Arava.

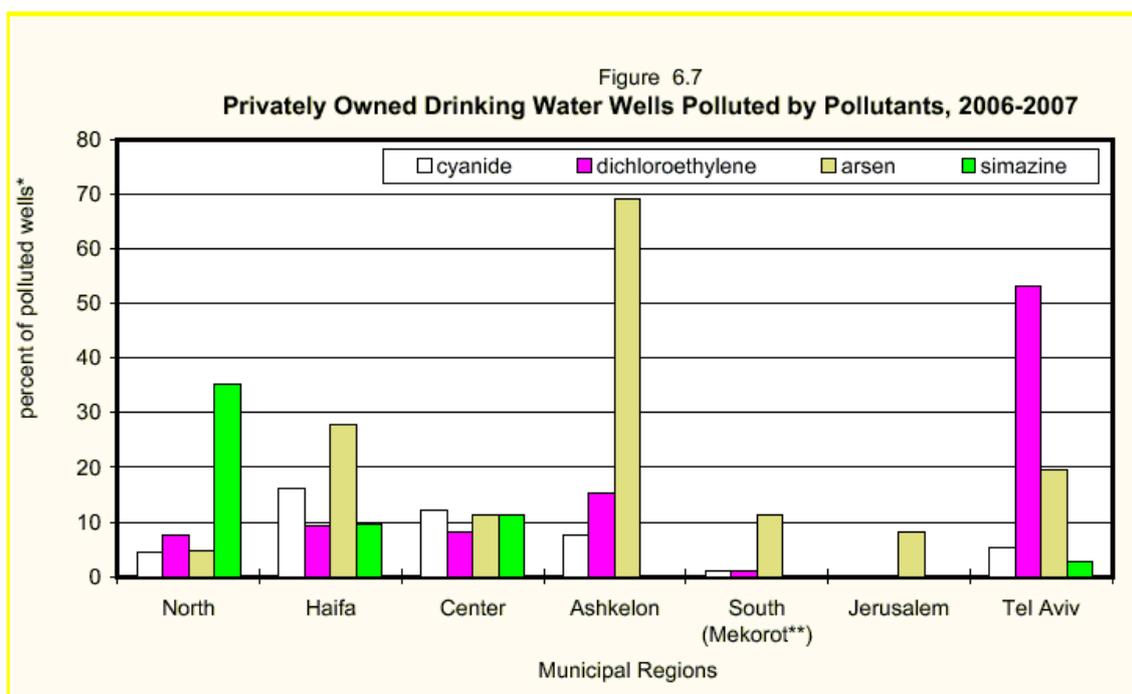
Indicator 6.6

Privately Owned Drinking Water Wells (Mostly in Local Authorities) Polluted by Industrial Pollutants and Pesticides, by Region

2006-2007

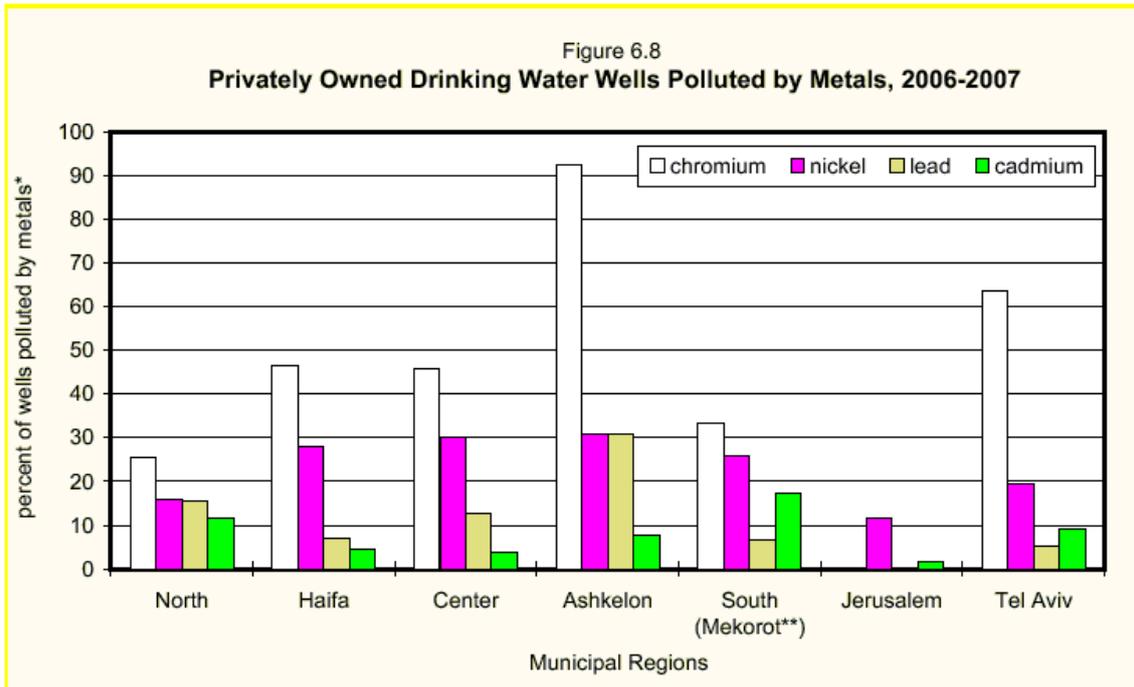
Why is this indicator important?

The extent of groundwater deterioration is expressed in the percent of water sources which are polluted and indicates the scope of industrial activity and the efforts made to prevent pollution in the years preceding the detection of the pollution.



* Data refer to wells in which pollutants were detected out of the total number of wells which comply with the required drinking water quality.

** In the southern region, data relate to Mekorot (Israel National Water Company) wells, since there are very few privately-owned wells and they cannot be statistically analyzed.



* Data refer to wells in which pollutants were detected out of the total number of wells which comply with the required drinking water quality.

** In the southern region, data relate to Mekorot (Israel National Water Company) wells, since there are very few privately-owned wells and they cannot be statistically analyzed.

Source: Public Health Department, Public Health Services, Ministry of Health

What do the data show?

The extent of pollution in different parts of Israel is impacted by the level of industrialization and urbanization and, to a lesser extent, by agricultural development. The prevalence of drinking water wells with traces of pollutants in the center of the country is relatively high and is lower in the north. In the sparsely populated southern part of the country, the percent of polluted wells is very low.

It should be noted that the data only relate to wells which comply with the required quality of drinking water, in which low concentrations of pollution have been detected. Wells in which the concentration of pollutants exceeds the required quality are shut down and are not included in this analysis.

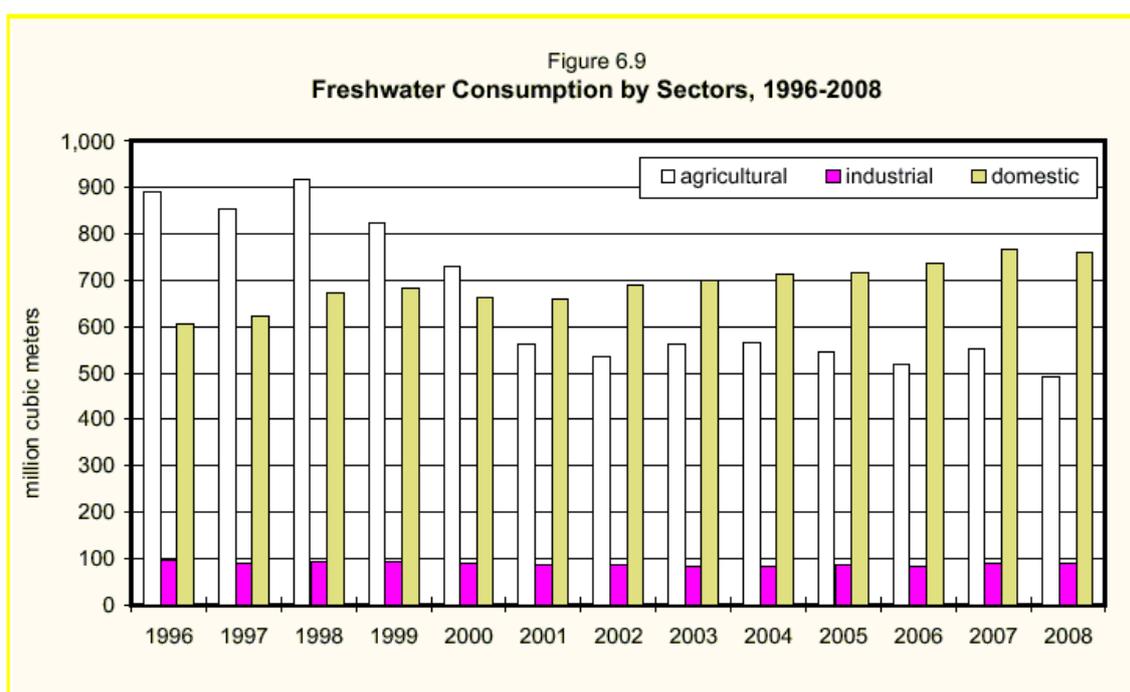
C. Water Consumption

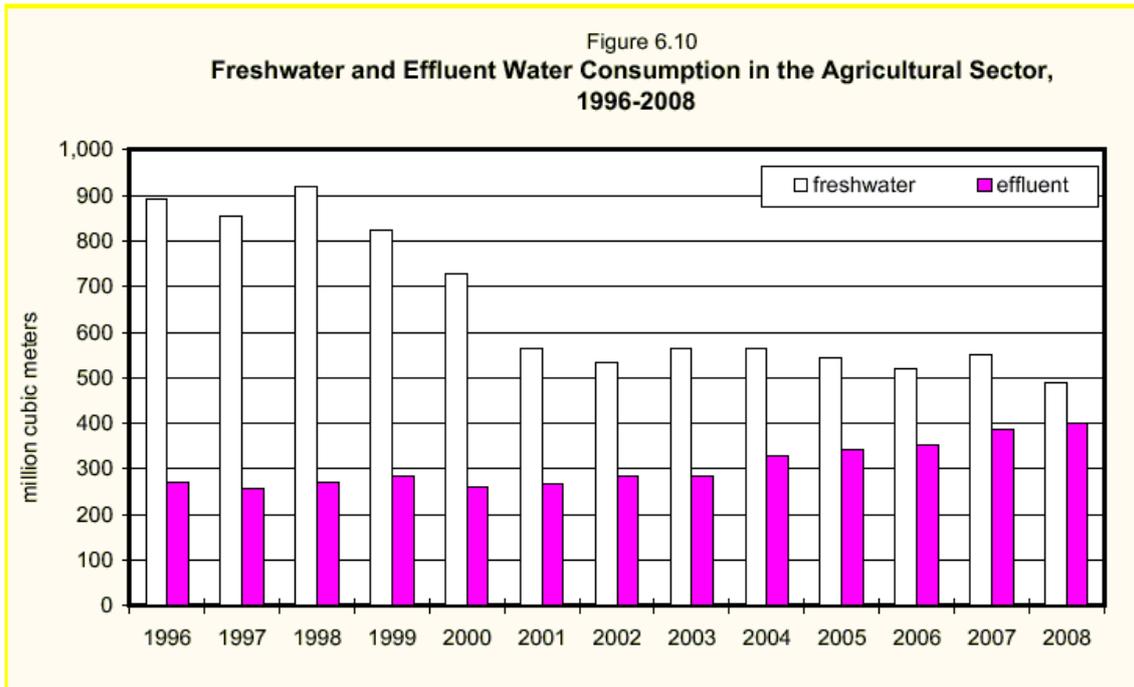
Israel is situated in a semi-arid region, where available water sources constitute a major constraint which impacts on the development of ecosystems, the growth of the population and the development of agriculture and industry.

Indicator 6.7 Water Consumption by Sectors 1996-2008

Why is this indicator important?

Information about general water consumption facilitates the calculation of the pressure on available water sources (see Indicator 6.4) and the measurement of available water source distribution between the different sectors.





Source: Water Authority

What do the data show?

Freshwater consumption decreased from 1,591 million cubic meters (MCM) in 1996 to 1,309 MCM in 2002 and increased somewhat to 1,337 MCM in 2008.

Over the past decade, the share of agriculture in the total consumption of freshwater sources decreased from 43% in 2001 to 36% in 2008, while the share of the domestic sector increased from 37% in 1996 to 57% in 2008. The share of industrial consumption remained consistent throughout this period, ranging between 6%-8%.

The agricultural sector supplemented its water requirements by increasing its effluent reuse rate. While effluents constituted 21% of the total water directed for agricultural irrigation in 1996, they increased to 36% in 2008.

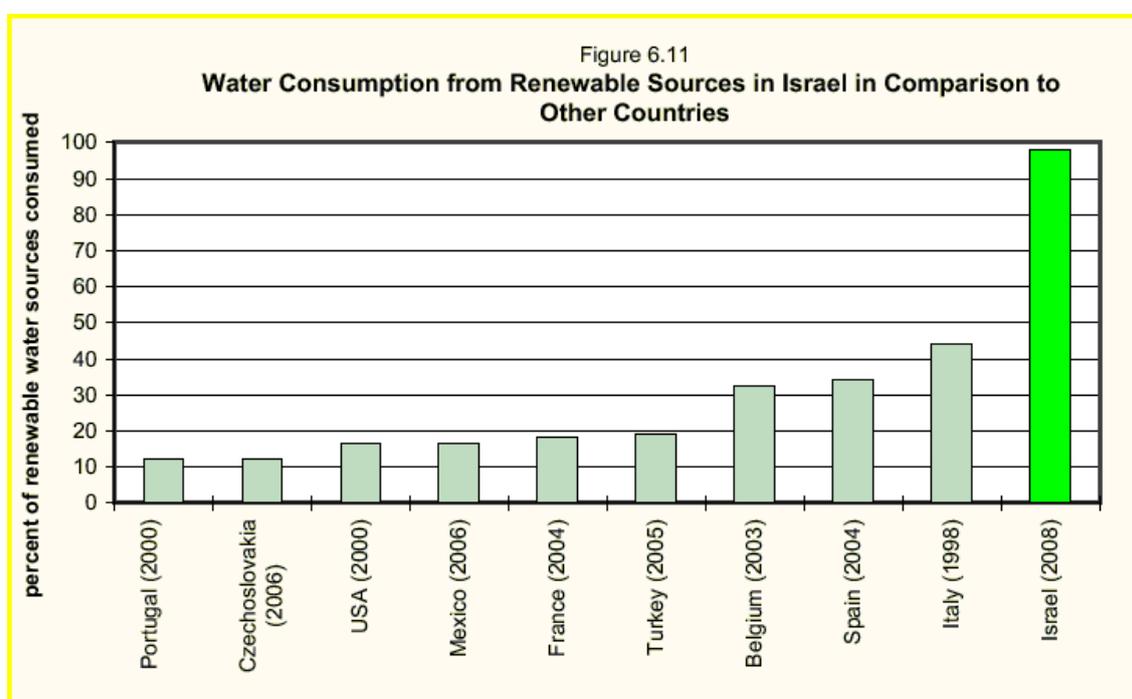
International Comparison

Indicator 6.8

Water Consumption from Renewable Sources in Israel in Comparison to Other Countries

Why is this indicator important?

The utilization of water sources, which are renewed by precipitation and river flow, for domestic, agricultural and industrial consumption diminishes the quantity of water available for nature (springs, rivers and wetlands) and prevents the flushing of salts and other pollutants from groundwater to sea. The percent of renewable water use for consumption indicates the pressure on natural water sources.



Source: Israel – Water Authority; Other countries - OECD Environmental Data Compendium 2006-2008

What do the data show?

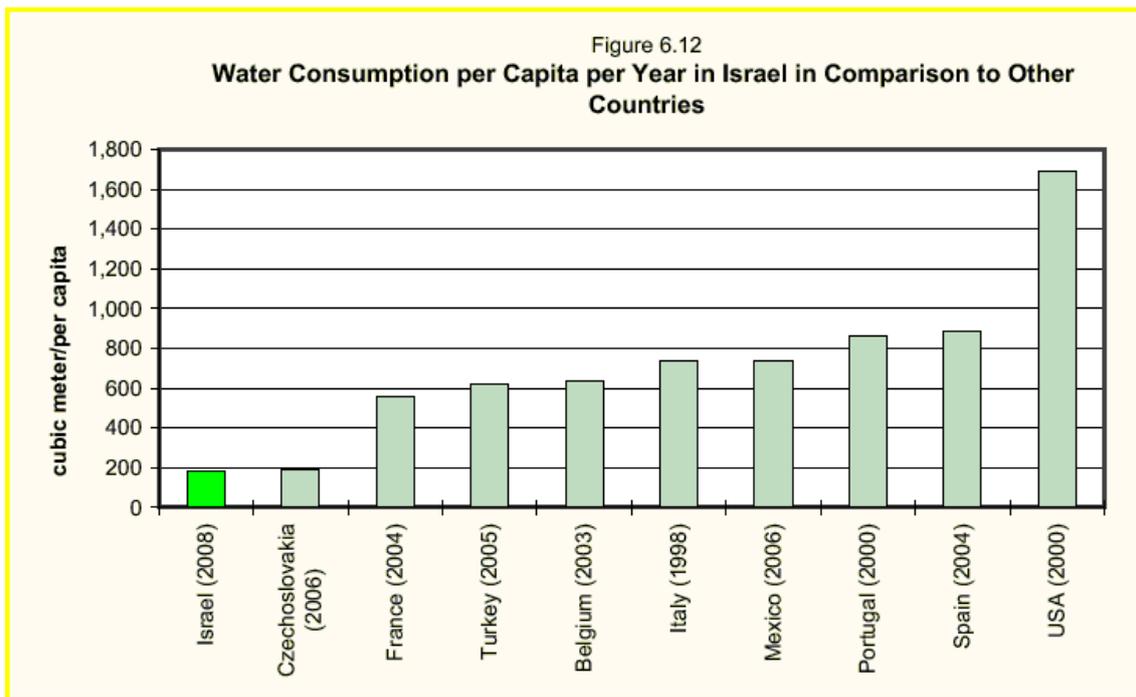
Relative to other developed or industrialized countries, Israel makes use of nearly all of its water sources for domestic, agricultural and industrial consumption. This adversely impacts on natural water bodies and wetlands and on the flora and fauna which live in them.

Indicator 6.9

Water Consumption per Capita per Year in Israel in Comparison to Other Countries

Why is this indicator important?

The quantity of water available per capita reflects the well-being and economic services which are provided by natural resources.



Source: Israel – Water Authority; Other countries - OECD Environmental Data Compendium 2006-2008

What do the data show?

The quantity of water per capita which is produced in Israel is very low relative to most developed countries worldwide, because Israel is a semi-arid country which does not benefit from significant sources of water which originate outside of its area. The low availability of water makes efficient use of water in different sectors imperative.

Chapter 7

Sea

The sea is a habitat for a wide diversity of plants and animals, a source of water, a resource for leisure and recreation, a channel for marine transportation, a source of oil production, and most importantly, a climate moderator in coastal regions. In recent years, Israel has begun to construct seawater desalination facilities, among the largest in the world, for the production of large quantities of potable water.

A. The Mediterranean Sea

Israel is located on the eastern Mediterranean Sea and its coastal strip spans 194 km.

Coastal Water Quality in the Mediterranean Sea

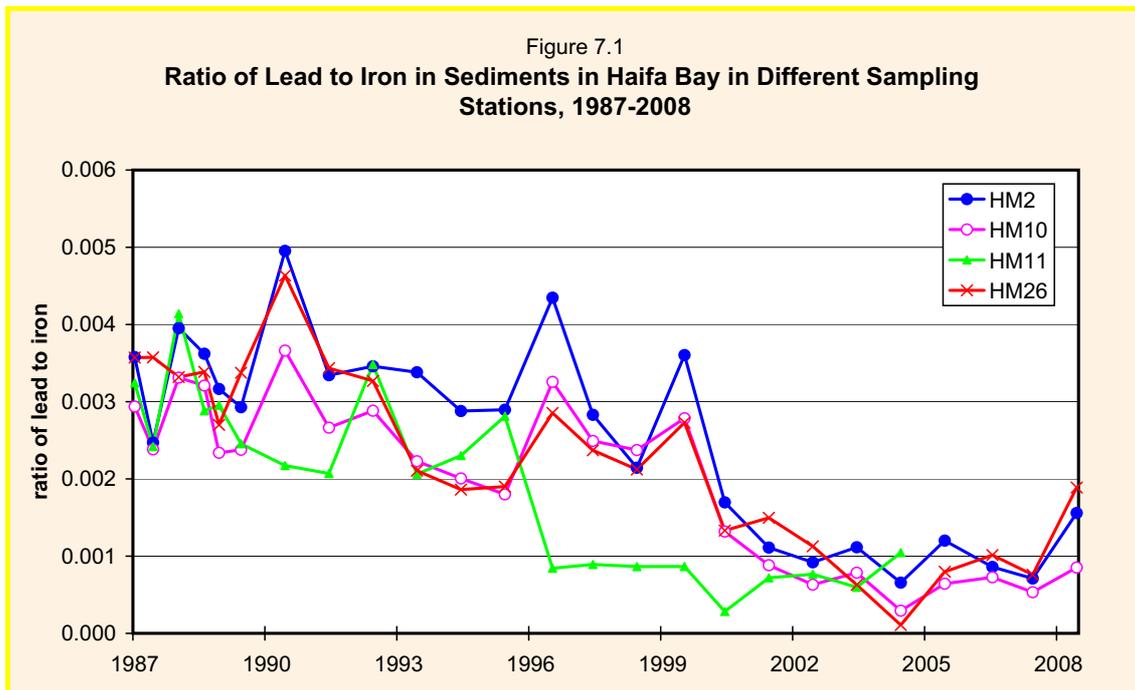
This chapter presents selected indicators used within the framework of Israel's National Monitoring Program for the Mediterranean Sea, which includes the following eight components:

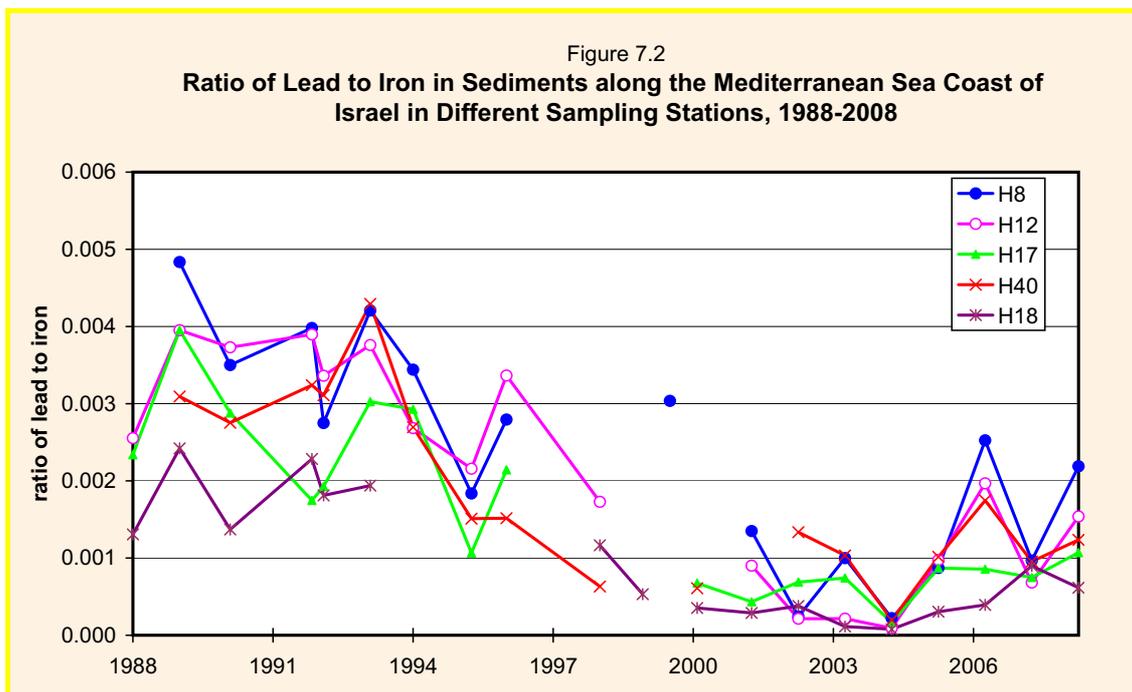
- Monitoring of heavy metals in coastal waters
- Monitoring of the introduction of nutrients (fertilizers) and particulate matter into coastal waters through coastal rivers
- Monitoring of atmospheric fluxes of nutrients and heavy metals into coastal waters
- Monitoring of nutrient levels and algal populations in the shallow area (up to a depth of 30 meters) of the coastal waters
- Environmental mapping of the coastal waters area based on satellite data
- Monitoring of benthic communities along the coastline
- Monitoring of the biological effects of pollution on the sea (biomarkers)
- Estimation of the overall pollution load introduced into the coastal waters derived from a database on point sources of pollution

Indicator 7.1
**Lead Concentrations in Sediments
along the Mediterranean Sea Coast**
1987-2008

Why is this indicator important?

The distribution of lead levels in sediments along the coast reflects the impact of land-based pollution.





Source: Herut B., Shefer E., Gordon N., Galil B., Tibor G. and Tom M. (2009), *Environmental Quality of Israel's Mediterranean Coastal Waters in 2008, IOLR Report H77/2009*

What do the data show?

Trends relating to the ratio of lead to iron in sediments in the years 1988-2008 show that beginning in 1996 lead levels in sediments along the coast diminished. This multi-annual trend appears to reflect the reduction in lead emissions as a result of the switch to low-lead fuels in Europe at the end of the 1980s, in Israel in the mid-1990s and in Egypt at the end of the 1990s.

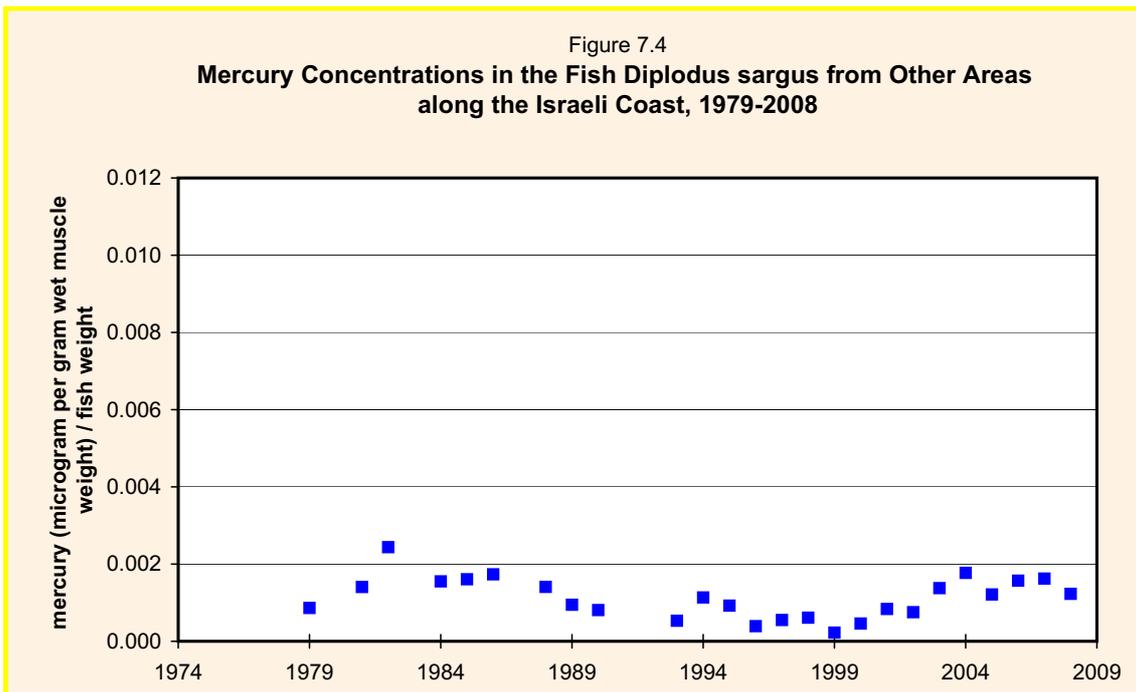
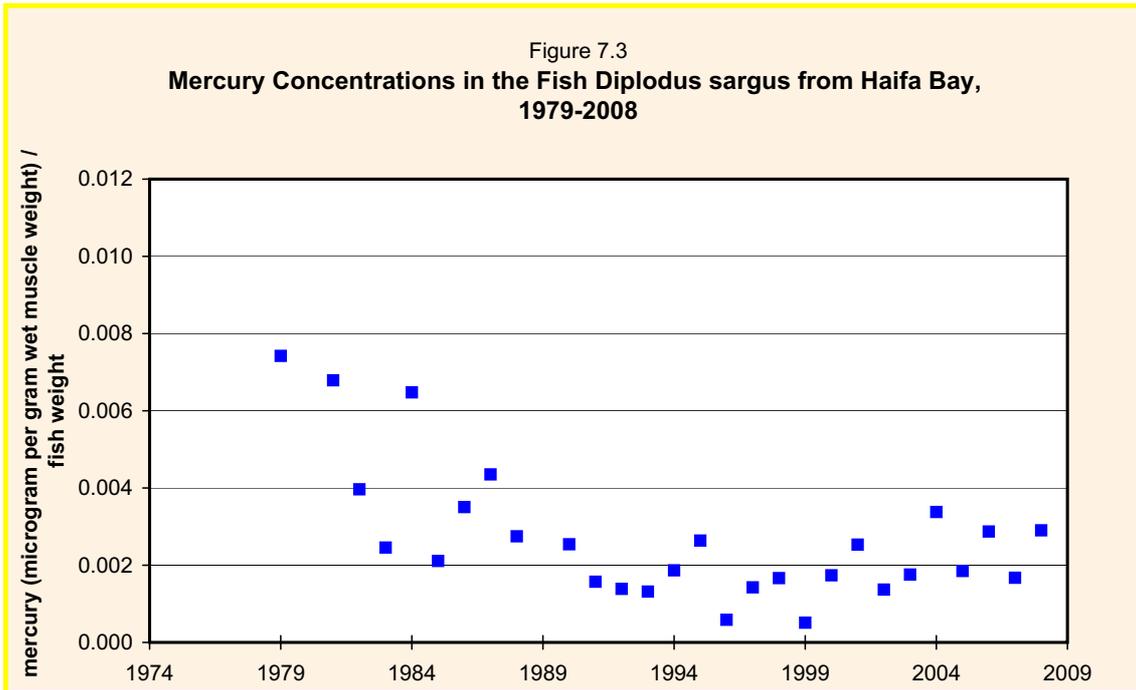
Indicator 7.2

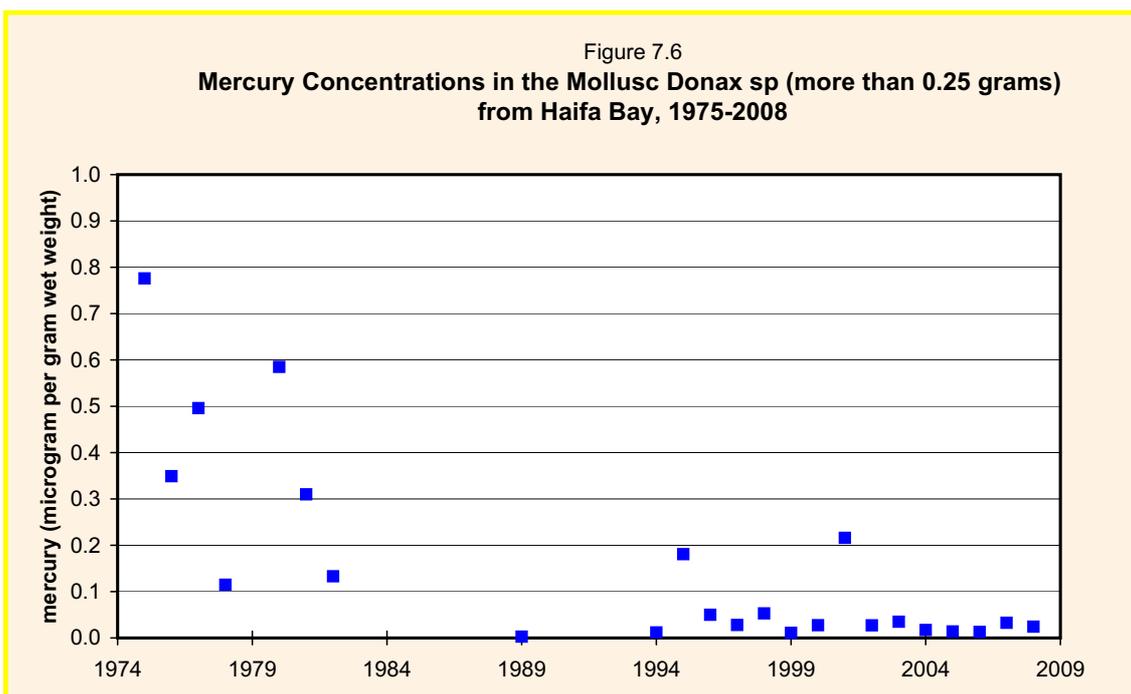
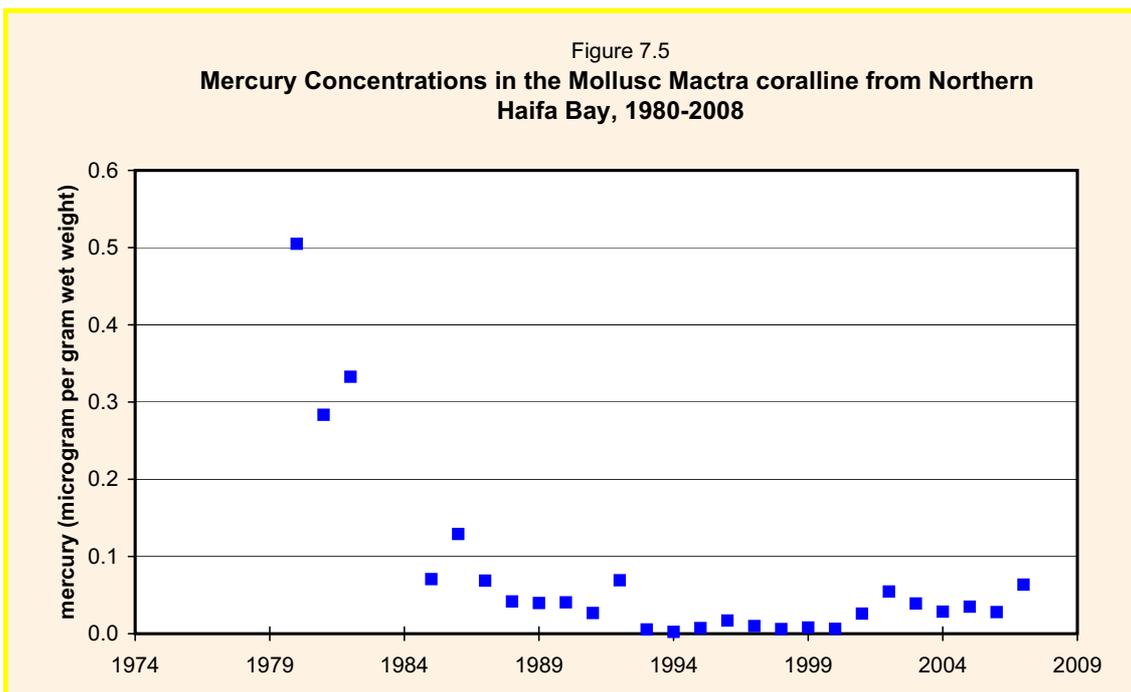
Concentrations of Mercury in Fish and Molluscs in Haifa Bay

Fish: 1979-2008, Molluscs: 1975-2008

Why is this indicator important?

Water and sediment pollution in Haifa Bay has affected, among others, pollutant concentrations in the tissue of organisms residing in these waters. These organisms may accumulate pollutants in their tissues, which intensifies the pollution level in their body. The consumption of large quantities of polluted animals by predators or by humans may cause poisoning.





Source: Herut B., Shefer E., Gordon N., Galil B., Tibor G. and Tom M. (2009), *Environmental Quality of Israel's Mediterranean Coastal Waters in 2008, IOLR Report H77/2009*

What do the data show?

Mercury enrichment trends in fish (ratio of mercury to weight) and in molluscs (mercury concentrations) show that since the beginning of the 1980s, mercury levels in fish and molluscs in Haifa Bay have significantly decreased, stabilizing at much lower levels, although the levels are still high in comparison to individuals of the same species outside the Bay. In some species in some sites in northern Haifa Bay a trend of increase was noted in recent years.

Mediterranean Coast

Israel's coastal strip spans 194 km along the Mediterranean Sea, from the cliffs of Rosh Hanikra in the north to the Gaza Strip in the south. The coastal strip is characterized by a variety of landscapes and historical sites and by a rich biodiversity.

Most of the Israeli coast from the Gaza Strip until Haifa Bay is part of the Nile littoral cell, and its morphology is largely based on sand transport from the Nile delta.

A kurkar (calcareous sandstone) cliff extends along some 60 km of the coast. Cliff erosion, a natural phenomenon which is accelerated by coastal and marine construction, has impacted on the landscape and on human activity.

Coastal uses include, among others, infrastructures such as ports, water-cooled power plants, army facilities, buoys for the supply of fuel, gas and chemicals, and seawater desalination plants. In addition, the coast is a major source for leisure and tourism and national parks and nature reserves abound alongside it. Efforts are currently being made to declare nature reserves in areas more distant from the coast and in the deep water.

Indicator 7.3

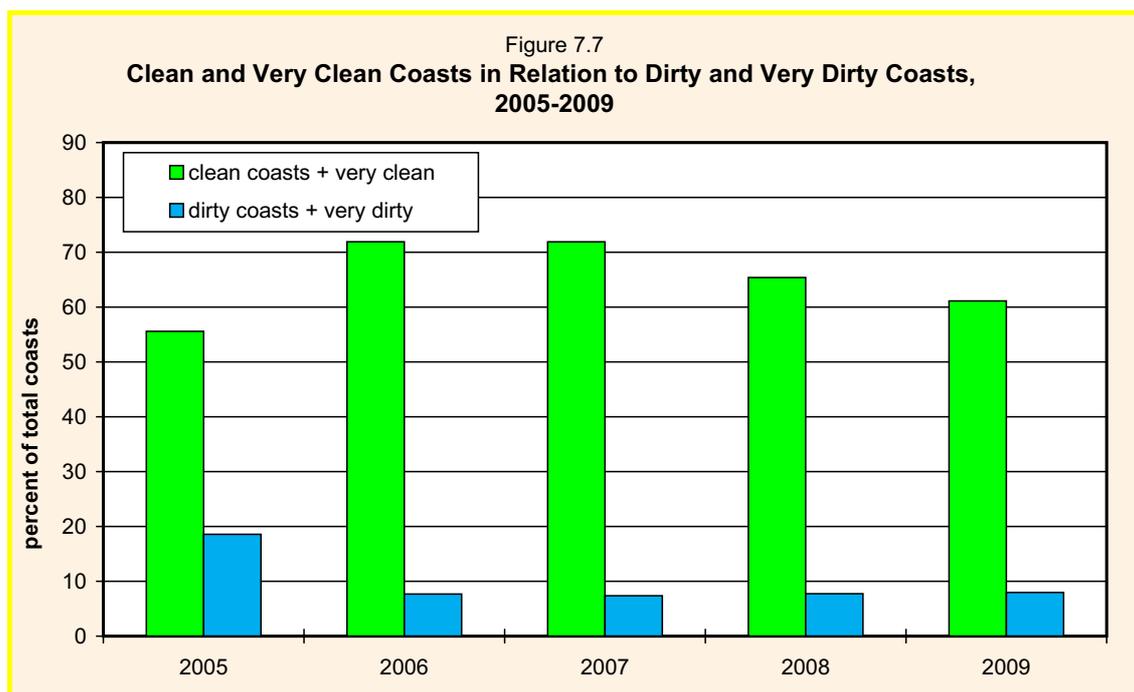
Cleanliness Level of the Mediterranean Coasts on the Basis of Number of Plastic Pieces in a Unit of Land

2005-2009

Why is this indicator important?

Since plastic is the main component of waste on the coast, constituting at least 80% of all waste on the shoreline, plastic is used as a cleanliness indicator.

Israel's Clean Coast Index is a tool used to assess the cleanliness level of the coast and to assess the effectiveness of education, information and enforcement activities.



Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

What do the data show?

Coastal cleanliness has improved in relation to 2005, especially in the years 2006-2007. Due to financial constraints and limited accompanying activities, the Clean Coast Program did not operate at full capacity in 2008. In 2009, plastic bags reached Israel's coastlines from the sea (from an unknown source) and adversely affected coastal cleanliness.

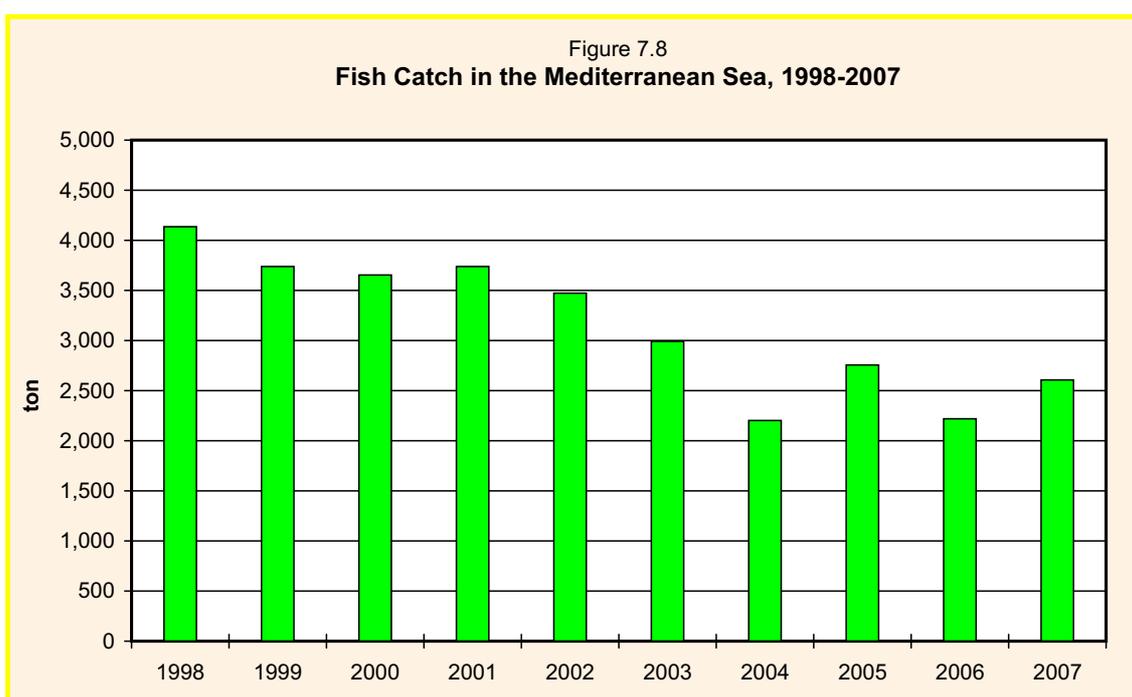
Fishing in the Mediterranean Sea

The Mediterranean Sea is a rich habitat for a wide variety of fish and other vertebrates and invertebrates. Protection of the marine environment enables wise use of this resource for fishing. Marine pollution, invasive species and climate change are responsible for changes in the marine environment which, in turn, adversely impact on the fishing sector and require the adoption of a sustainable development approach.

Indicator 7.4
Fish Catch in the Mediterranean Sea
1998-2007

Why is this indicator important?

Fish catch in the Mediterranean Sea is an indicator of marine water quality, fishing pressure on the marine resource and marine resource management.



Source: *Fishing and Aquaculture in Israel in 2007*, Fishing and Aquaculture Division, Ministry of Agriculture and Rural Development

What do the data show?

A clear trend of decrease in fish catch is noted, which began in 2001 and continued until 2004. The years 2005, 2006 and 2007 show both increases and decreases. Therefore, a clear trend over the past decade cannot be discerned. This instability may be a natural phenomenon or a result of marine pollution prevention actions, on the one hand, and climate change and the entry of invasive species, on the other hand.

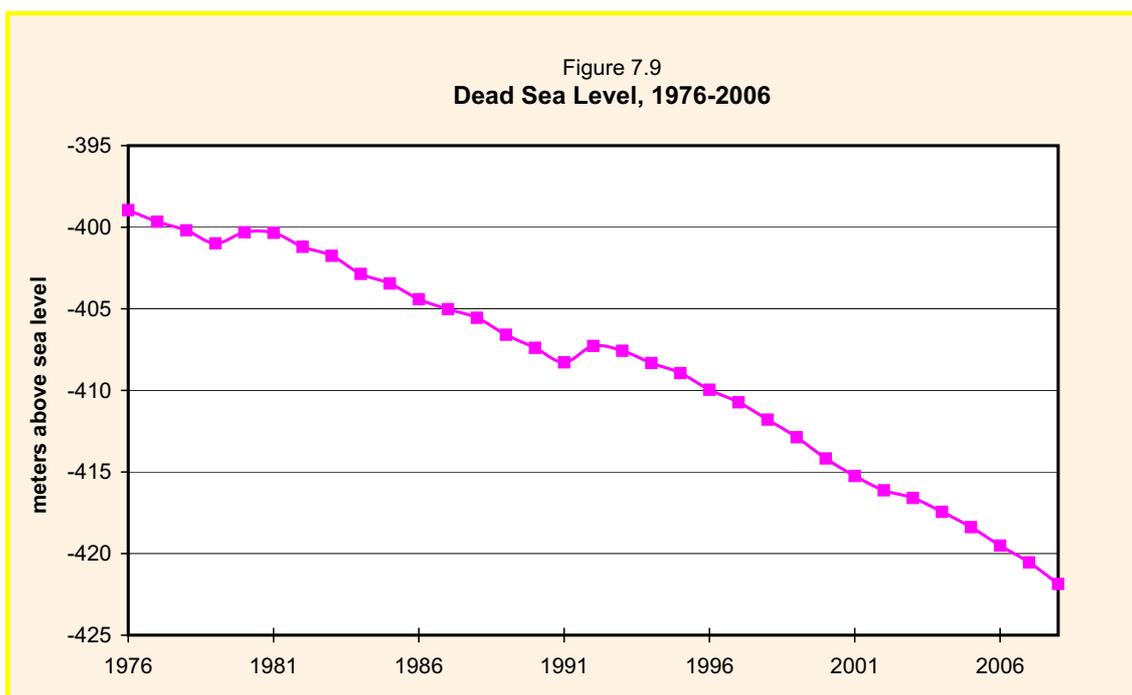
B. Dead Sea

The Dead Sea, situated some 400 meters below sea level, is the lowest point on earth and the saltiest large water body. It drains the Jordan River and to a lesser degree spring and river water and is a drainage basin without an outlet. The dissolved salts and minerals in its waters serve the chemical industry in Israel and in the Kingdom of Jordan for the production of potassium, bromine and magnesium. The Dead Sea is a unique environmental resource and serves as an important tourism site. Its chemical characteristics have transformed it into an economic resource for industry as well.

Indicator 7.5
Dead Sea Level
 1976-2006

Why is this indicator important?

The decline in the Dead Sea water level has led to the creation of hundreds of sinkholes, to changes in the water regime which feeds nature reserves on the Dead Sea shores, to shoreline retreat, and to changes in access to the water line.



Source: Hydrological Service, Water Authority; *The Dead Sea Basin: Assessment of Current Situation and Prospects for the Future Under Continued Dead Sea Water Level Decline*, Ministry of Environmental Protection, Ministry of National Infrastructure and Jerusalem Institute for Israel Studies

What do the data show?

Over the past fifty years, the water level of the Dead Sea has declined by more than 30 meters and reached 421.86 meters below sea level as of October 2008.

Pumping of water from the Kinneret and the Yarmuk River to meet the water needs of Israel, Jordan and Syria and water pumping from the Dead Sea to meet the industrial needs of Jordan and Israel have led to a deficit in the water balance of the Dead Sea, which has reached some 800 MCM per year. This deficit continues to grow due to the capture of river water in all three countries and the establishment of new reservoirs. The rate of water level decline is more than a meter a year.

Chapter 8

Biological Diversity

Israel has a rich biodiversity which includes hundreds of thousands of species of plants, animals and small organisms. This wealth is attributed to Israel's unique setting at the meeting point of three continents, the meeting of different climatic zones, the center of global migratory bird routes, and location along the Mediterranean coast and the Red Sea.

Israel's species diversity comprises about 3% of the globally known species. This diversity is attributed to the contact between different terrestrial climate regions and to the location of Israel on the coastal extensions of two different oceans – the Mediterranean is an extension of the Atlantic Ocean and the Red Sea is an extension of the Indian Ocean.

The main threats to Israel's biodiversity are related to the development pressures on its open spaces. These lead to the loss of ecosystems which supply essential services, to fragmentation and disruption of ecosystem continuity, to habitat pollution, and to overexploitation of the natural resources provided by ecosystems. Second in importance is the threat posed by the introduction and establishment of alien species – either accidentally or intentionally. Some of these species have succeeded in proliferating and expanding their distribution limits by pushing out local species by means of competition for resources, predation, and spread of disease. In addition, climate change is expected to harm ecosystems and thereby adversely impact ecosystem services.

Destruction of inland water sources, especially due to overpumping and overexploitation of water sources, is a major threat to fish, amphibians and thousands of invertebrate species. Similarly, coastal habitats are endangered by accelerated development of the coastal environment.

At the same time, the number of species known to be in danger of extinction remains small. Nature reserves have been declared and hundreds of species were declared protected natural assets. At the end of 2009, declared nature reserves and national parks in Israel spanned an area of 4,647 sq kms, some 20% of the area of the country, with most of these protected areas concentrated in the desert region.

Table 8.1
Number of Wild Species of Flora and Fauna Known in Israel, 2007

Taxonic Group	Estimated number of defined species in Israel
Prokaryota (bacteria and cyanobacteria)	5,100
Protoctista (especially single celled)	1,800
Algae	2,000
Fungi and Lichen	830
Kingdom Plantae	
Bryophytes	248
Spermatophyta (wild only)	2,388
Total Plants	2,636
Kingdom Animalia	
Invertebrates	
Invertebrates (excluding Insecta)	8,160
Insecta	20,500
Total Invertebrates	28,660
Vertebrates	
Tunicata & Hemichordata	130
Inland Water Fish	32
Mediterranean Sea fish (near Israel's coasts)	342
Amphibians	7
Reptiles	103
Birds	511
Mammals	104
Total Vertebrates	1,229
Total Fauna	29,889
Total Species	About 42,255

Source:

Avi Shmida and Gadi Pollack (2007). *Red Data Book, Endangered Plants of Israel, Volume A*;
 Amit Dolev and Avi Perevolotzky (2002). *Red Book: Vertebrates in Israel*;
 Reuven Ortal (1997). *Science Division, Nature and Parks Authority*;
 Prof. Bella Galil, personal communication;
 Open Space and Biodiversity Division, Ministry of Environmental Protection.

Indicator 8.1
Species in Danger of Extinction
2008

Why is this indicator important?

The danger of extinction of flora and fauna species indicates the state of habitats, including their pollution, the reduction in their size, their fragmentation and their exposure to chemical pollution and other human disturbances such collection, hunting, poisoning and others.

Table 8.2
Number of Extinct Wild Plants and Wild Plants in Danger of Extinction, 2007

In Danger of Extinction		Already Extinct		Total Wild Plants
Total	Percent	Total	Percent	
413	17.3	36	1.5	2,388

Source: Avi Shmida and Gadi Pollack (2007). Red Data Book, Endangered Plants of Israel, Volume A

Table 8.3
Number of Extinct Terrestrial Vertebrates and Terrestrial Vertebrates in Danger of Extinction, 2008

Class	Total Species	Globally Extinct	Regionally Extinct	Critically endangered	Endangered	Vulnerable	Near threatened	Least concern	Missing Data or Undefined
Inland water fish	32	5	1	6	0	0	0	18	2
Amphibians	7	1	-	2	2	1	1	0	-
Reptiles	103	-	3	13	7	15	9	44	12
Nesting birds	207	-	4 + 11 (extinct as nesting)	18	19	13	49	80	13
Mammals	104	-	5 + 4 (in reintroduction process)	12	25	20	6	30	2
Total	453	6	28	51	53	49	65	172	29

Source: Amit Dolev and Avi Perevolotzky (2002). Red Book: Vertebrates in Israel; Dan Alon, Yoav Perlman (May 2008), Birds in Danger of Extinction. Current Status

What do the data show?

About 1.5% of Israel's wild plants and about 8% of the total number of vertebrates have become extinct. The greatest harm was caused to inland fish species (19%), followed by amphibians (14%) and lastly mammals (9%).

Some 17% of the species of wild plants are in danger of extinction. The greatest danger of extinction among vertebrates is to amphibians followed by mammals.

Indicator 8.2

Number of Invasive Species

2009

Why is this indicator important?

Invasive species may totally change the ecosystem that they invade, whether natural or human managed. They may harm local biodiversity, thereby affecting the supply of ecosystem services.

Table 8.4

Number of Invasive Species, 2009

Kingdom	No. of Invasive Species
Flora	45-50
Fauna	
Invertebrates	
Snails	9
Insects	124
Vertebrates	
Mammals	2
Birds	10
Reptiles	2
Inland Water Fish	6
Mediterranean Fish (near Israel's coasts)	35

Comment: Data on arachnids, fungi, bacteria and other microorganisms is missing.

Source:

Jean-Marc Dufour-Dror (2009). Invasive plant species in Israel's natural areas: Distribution, stages of invasion, degrees of ecological threat and a tool for prioritizing control of invasive

plant populations. The Center for Environmental Policy in the Jerusalem Institute for Israel Studies in cooperation with the Nature and Parks Authority;

Amit Dolev and Avi Perevolotzky (2002). Red Book: Vertebrates in Israel;

Ohad Hatzofe and Simon Nemtsov (2004). Invasive Terrestrial Vertebrate Species that Have Established Wild Populations in Israel, Nature and Parks Authority;

Prof Bella Galil, personal communication;

Open Space and Biodiversity Division, Ministry of Environmental Protection;

B.S. Galil (2009). Taking stock; inventory of alien species in the Mediterranean Sea. Biol. Invasions 11 (2); 359-372;

U. Roll et al. (2007). Non-indigenous insect species in Israel and adjacent areas. Biol. Invasions 9: 629-643;

U. Roll et al. (2007). Characteristics of the introduced fish fauna of Israel. Biol. Invasions 9:813-824;

U. Roll et al. (2009). Non-indigenous land and freshwater gastropods in Israel. Biol. Invasions 11:1963-1972.

What do the data show?

There are some 50 species of invasive plants in Israel. Among invertebrates, some 124 species of invasive insects are known. Among vertebrates, the highest numbers of invasive species are found among Mediterranean fish and birds.



PART III

POLLUTION AND ENVIRONMENTAL DAMAGE



Chapter 9

Air Pollution

Air pollution is a result of natural or anthropogenic activity during which gases or particles are emitted to the air in concentrations which adversely affect human health. Natural sources of air pollution include dust storms while anthropogenic sources include electricity generating power plants, transportation, industry, agricultural activity, and waste treatment. Industrial activity and population growth have a major impact on air quality. Israel's unique conditions, including population density, steady rise in quality of life and meteorological conditions, exacerbate the problem of air pollution.

This chapter surveys air pollutant emissions and their emission sources. Details concerning the pollutants are presented in Chapter 5 (Air Quality).

A. Pollutant Emissions by Source

Electricity Production

Electricity production from fossil fuels is accompanied by the emission of pollutants, including nitrogen oxides, sulfur oxides (especially sulfur dioxide), particulates, carbon monoxide, hydrocarbons and other pollutants, as well as carbon dioxide. The specific emission of air pollutants (i.e., emission per weight unit which accompanies the production of a unit of electrical energy, such as grams per kilowatt hour) is dependent on the type of production unit and the type of fuel used.

In recent years, pollutant emissions from power plants in Israel decreased, with an even steeper decrease in the specific emission of different pollutants. This is attributed to the imposition of stringent requirements by the Ministry of Environmental Protection which call for upgrading existing power units, introducing pollutant reduction technologies, and switching to cleaner fuels with lower emission factors. It is expected that this trend will continue with the increase in natural gas use in Israel and with the installation of sulfur dioxide and nitrogen oxides emission reduction measures in coal-fired stations.

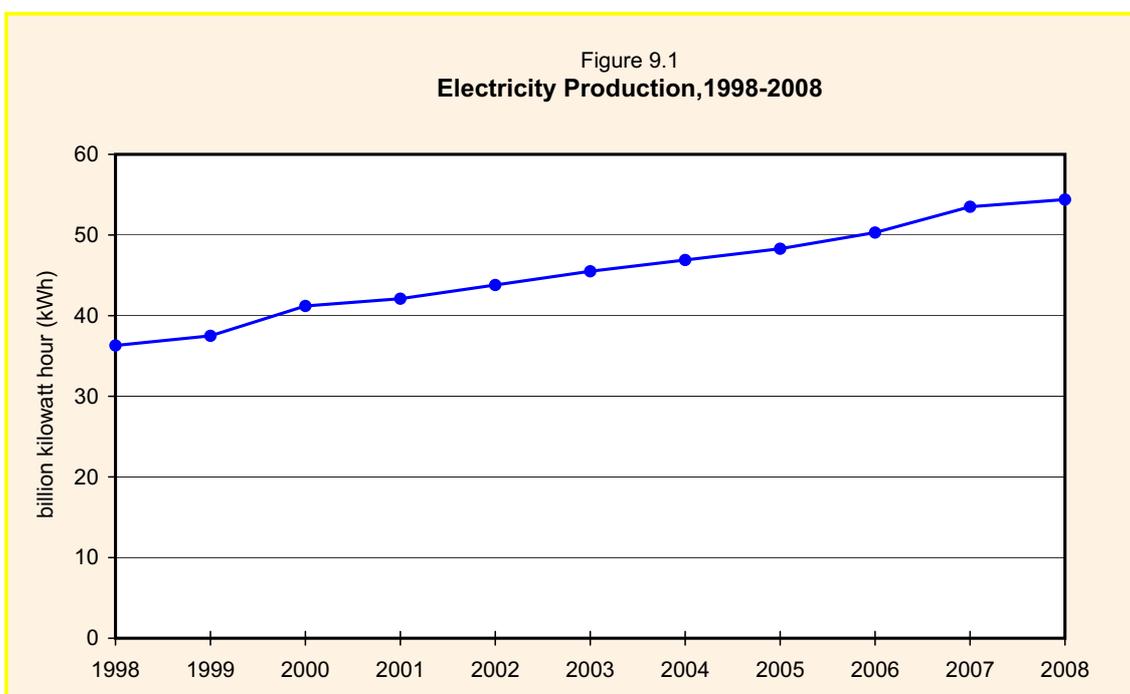
Indicator 9.1

Electricity Production, Annual Production and Specific Emission* of Sulfur Dioxide (SO₂), Nitrogen Oxides (NO_x) and Particulate Matter (PM) to the Air during Electricity Production

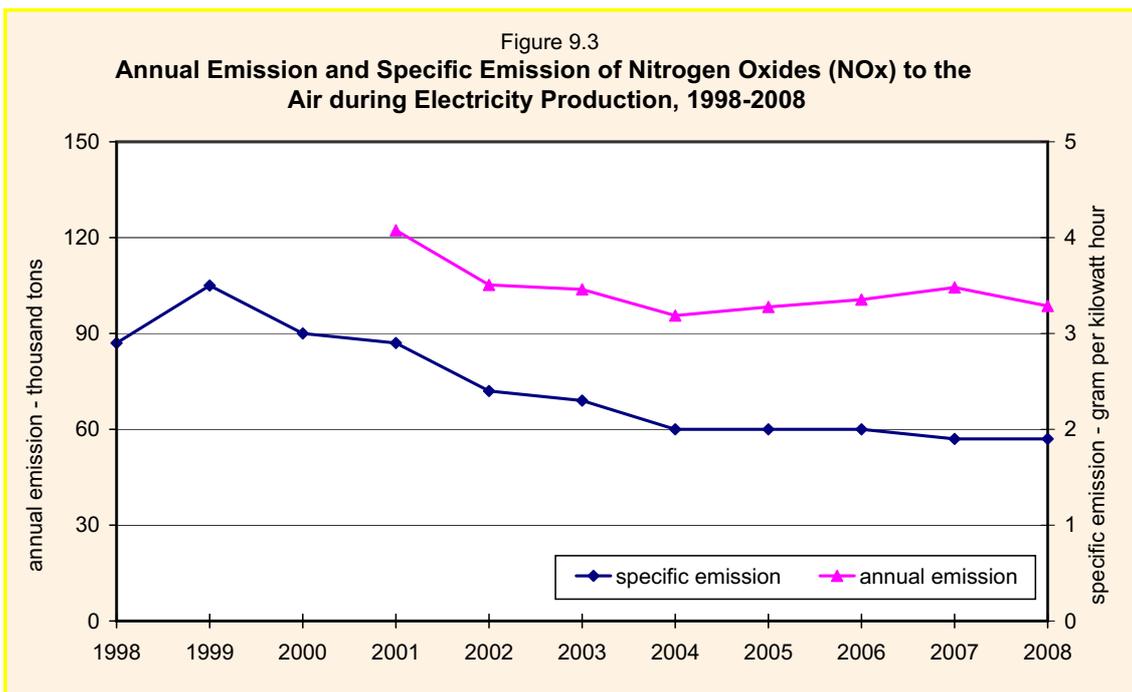
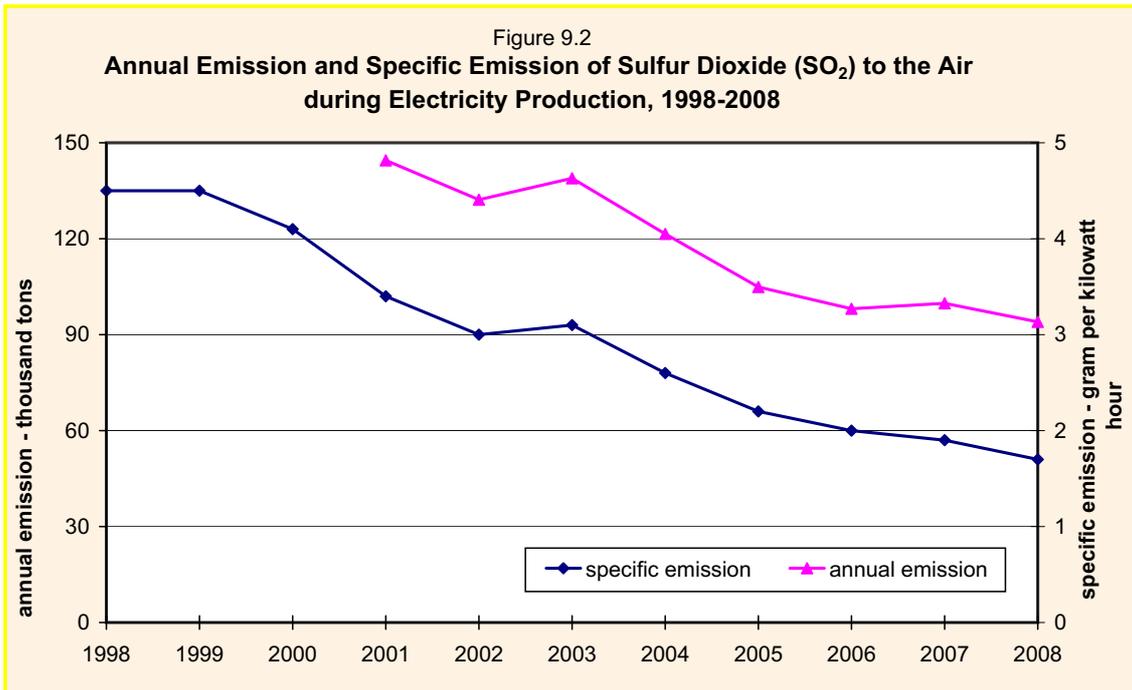
1998-2008

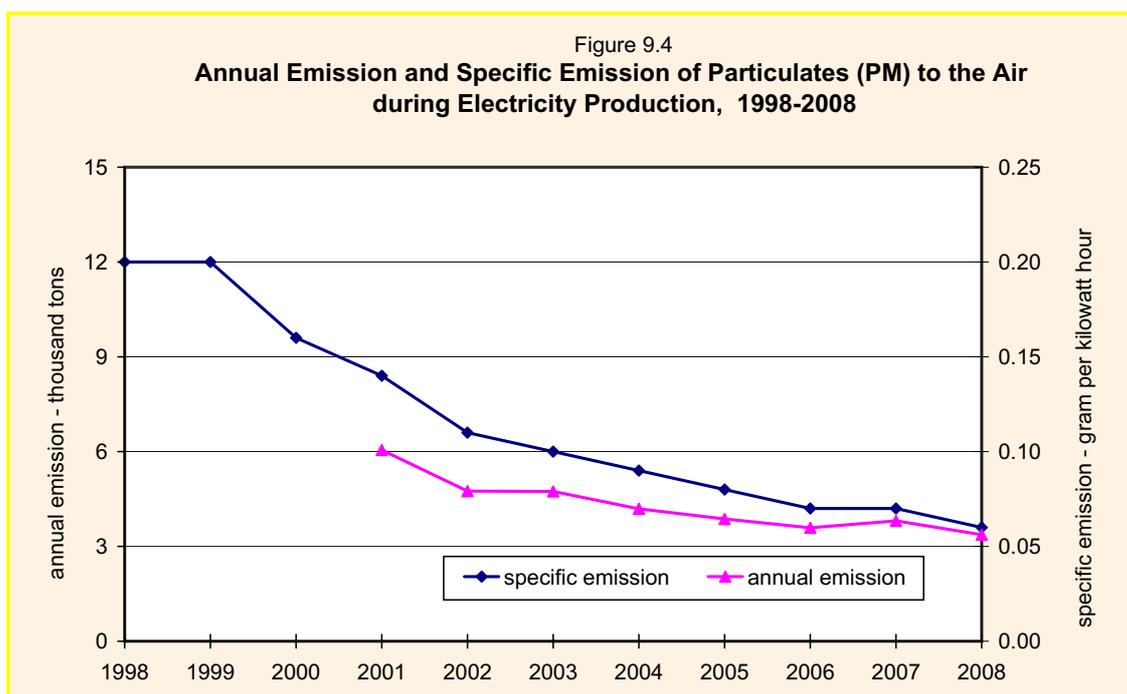
Why is this indicator important?

Assessing the extent of pollution facilitates steps to treat air pollution, set priorities and invest resources, establish standards, and ensure oversight over measures which are taken.



* Specific emission: emission per unit of energy production of a kilowatt hour.





Source: Israel Electric Corporation Ltd.

What do the data show?

Despite a 29% increase in electricity production between 2001 and 2008, a 35% decrease in annual emissions of sulfur dioxide was measured and a 50% decrease in its specific emission (emission relative to kilowatt hour production).

This reduction is attributed to improvements in fuel quality in accordance with Ministry of Environmental Protection requirements, including reduction of coal sulfur content, gradual reduction in high-sulfur fuel, and switch to low-sulfur fuel in oil-fired stations. In 2004, natural gas replaced oil in the large electricity production units in the Eshkol site in Ashdod, and beginning in the second half of 2006 natural gas was introduced into the Reading power plant in Tel Aviv. In 2009, the Hagit and Gezer power plants converted to natural gas in accordance with Ministry of Environmental Protection requirements.

In parallel, a 19% decrease in annual emissions of nitrogen oxides took place and a 34.5% decrease in their specific emissions. This reduction is attributed to the replacement of burners and improvement in combustion processes in oil-fired power plants, use of cleaner fuels, installation of advanced combustion systems characterized by low nitrogen oxides emissions in gas turbines, and introduction of natural gas.

Similarly, particulate emissions decreased by 44.3% and their specific emissions decreased by 57%. This reduction is attributed to the replacement of burners and

improvements in combustion processes in oil-fired power plants, upgrading of the fuel basket, taking of measures to improve the efficiency of electrostatic precipitators that trap suspended coal ash in coal-fired stations, and introduction of natural gas.

Transportation

Transportation is the main source of air pollution in city centers and populated areas in Israel. The steady increase in the number of vehicles and kilometers traveled exacerbates the problem.

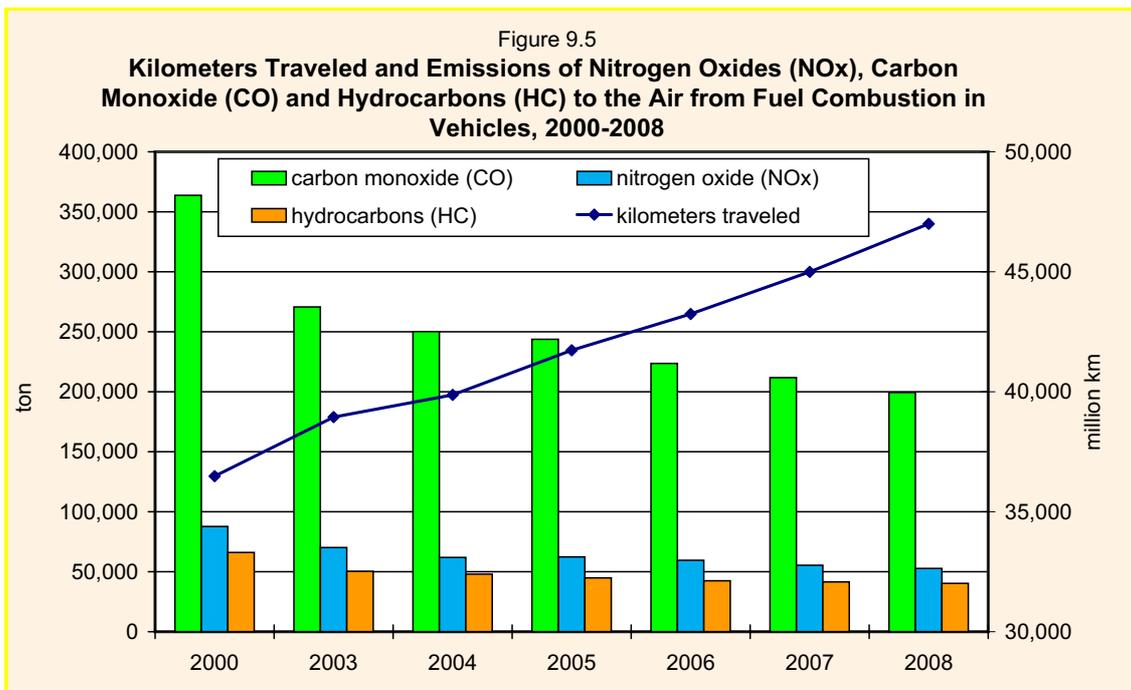
Indicator 9.2

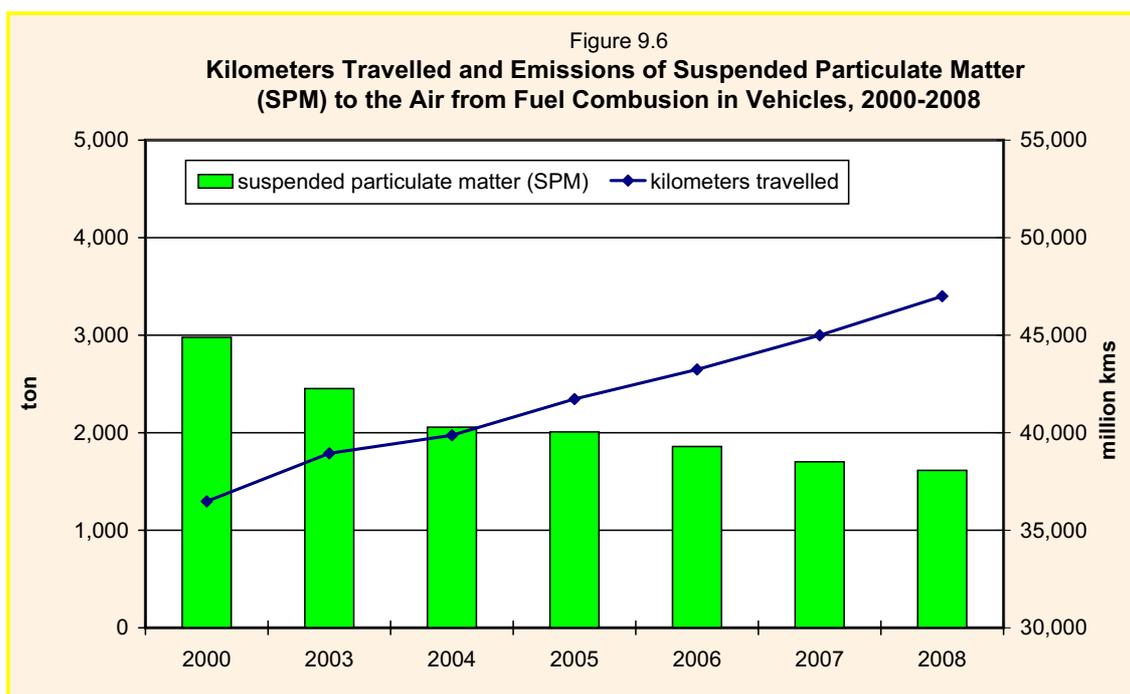
Kilometers Traveled and Emissions of Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Hydrocarbons (HC) and Suspended Particulate Matter (SPM) to the Air from Vehicles

2000-2008

Why is this indicator important?

Assessing the extent of pollution facilitates steps to treat air pollution, set priorities and invest resources, establish standards, and ensure oversight over measures which are taken.





Source: Central Bureau of Statistics; Air Quality and Climate Change Division, Ministry of Environmental Protection

What do the data show?

From 2000 to 2008 a 30% increase in kilometers traveled occurred in Israel. Nevertheless, carbon monoxide, nitrogen oxides, hydrocarbons and particulate matter emissions decreased by 40% to 45% each.

This sharp decrease in pollutant emissions is attributed to the purchase of new vehicles in parallel to the removal of older vehicles from the road. The percent of gasoline-powered vehicles equipped with a catalytic converter increased significantly during this period and more stringent emission standards were set for both diesel and gasoline-powered vehicles.

B. Greenhouse Gas Emissions

Concentrations of greenhouse gases have increased significantly since the beginning of the Industrial Revolution. The greenhouse effect has been associated with major environmental damages and is the central cause of global climate change including global warming, changes in the precipitation regime, melting of glaciers, rising sea levels and desertification.

Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfurhexafluorides.

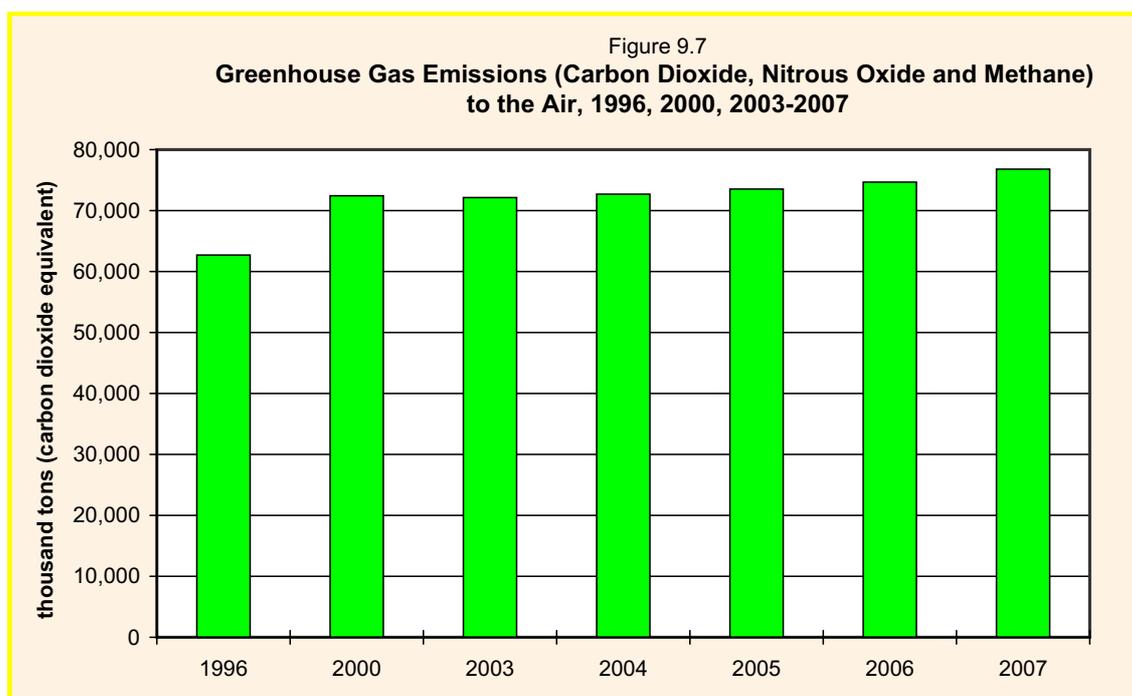
Indicator 9.3

Emissions of Greenhouse Gases (Carbon Dioxide, Nitrous Oxide and Methane) to the Air

1996, 2000, 2003-2007

Why is this indicator important?

Although Israel's share in the emissions of greenhouse gases is lower than 0.3% of the total emissions of all countries, Israel takes part in the global effort to reduce greenhouse gases.



Source: Central Bureau of Statistics

What do the data show?

Between 1996 and 2007, greenhouse gas emissions in Israel increased by 14 million tons. This reflects the increase in economic activity – energy, transportation and industrial production – as a result of growth in population (see Chapter 2, Demographic Characteristics) and in quality of life.

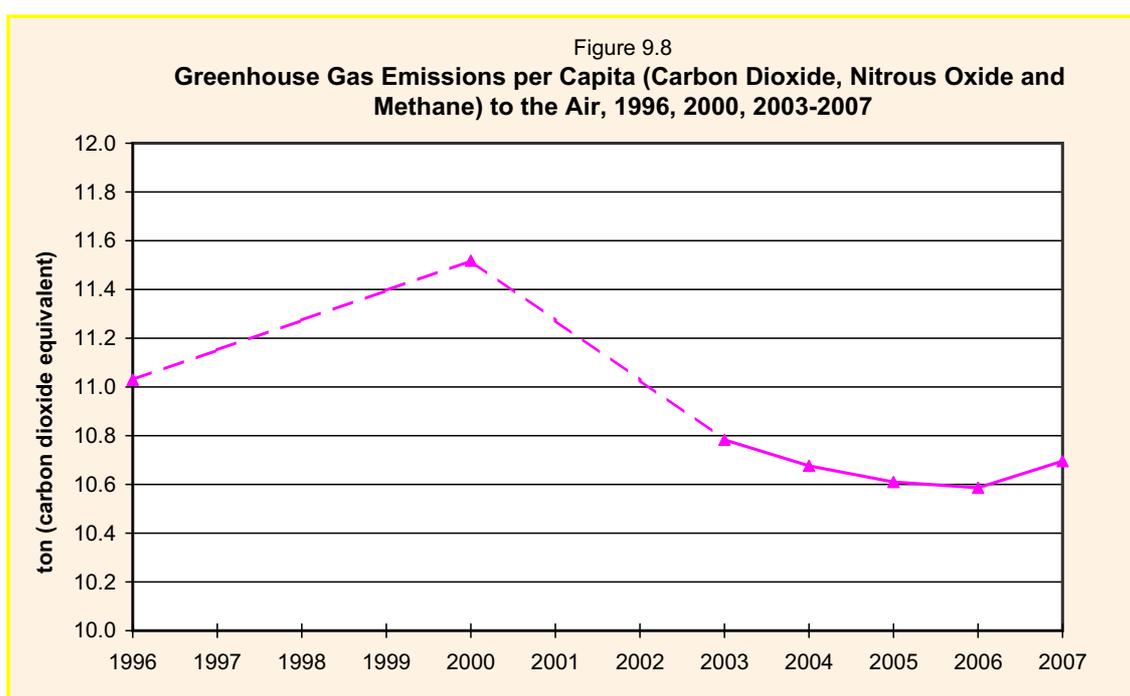
Indicator 9.4

Emissions of Greenhouse Gases per Capita

1996, 2000, 2003-2007

Why is this indicator important?

In Israel, where the population is steadily growing, measuring emissions per capita is important in order to follow up on changes which result from the per capita consumption of products and fuels. This indicator also enables a comparison of greenhouse gases emissions among different countries.



Source: Central Bureau of Statistics

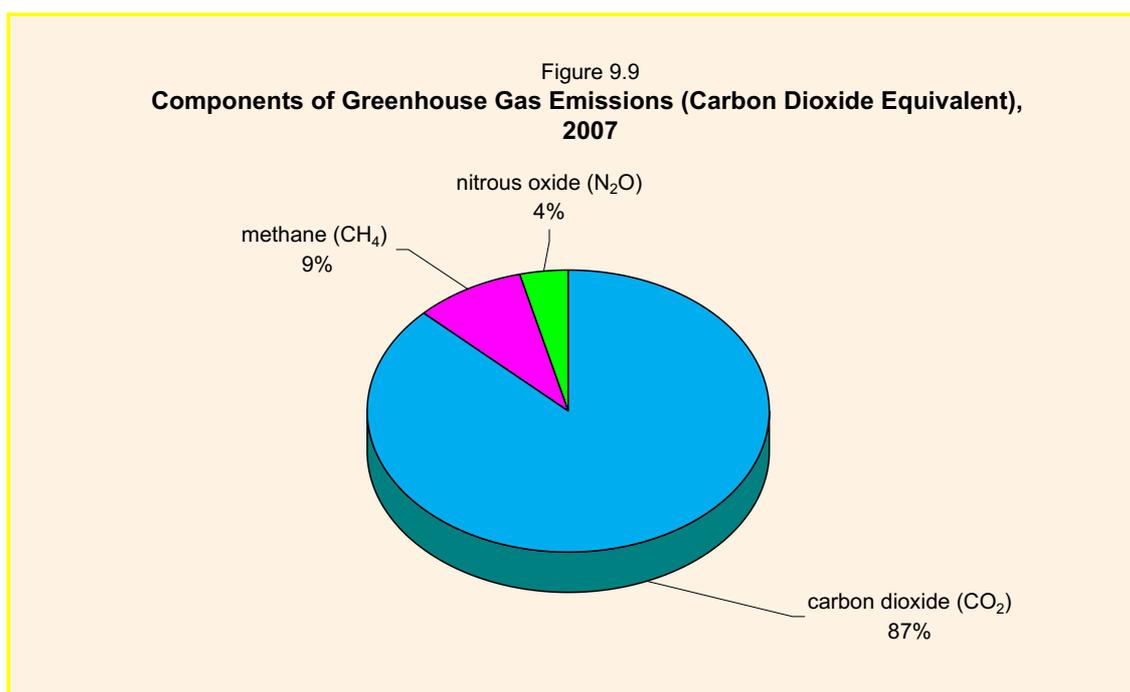
What do the data show?

Between 2000 and 2007, the specific per capita emission of greenhouse gases decreased significantly (0.82 tons). However, an increase relative to 2006 was noted in 2007 (0.11 tons). There is no direct correlation between greenhouse gas emissions and population size. These data may be attributed to the fact that alongside increased efficiency of fuel use in transportation, changes in the fuel basket of the Israel Electric Corporation and increased efficiency of industrial cement production, population size and quality of life continue to increase. Therefore, a trend of increase in total emissions is discerned along with changes in the specific emission level per capita.

Indicator 9.5
Components of Greenhouse Gas Emissions
2007

Why is this indicator important?

The measurement of the relative contribution of each gas helps focus efforts on measures to reduce greenhouse gas emissions.



Source: Central Bureau of Statistics

What do the data show?

Carbon dioxide is the main greenhouse gas emitted into the atmosphere (87%), followed by methane (9%) and lastly nitrous oxide (4%). This is attributed to the fact that greenhouse gas emissions in Israel are largely derived from the combustion of fuels for the production of electricity and for transportation. Methane is emitted from municipal waste and agricultural farms.

Carbon Dioxide

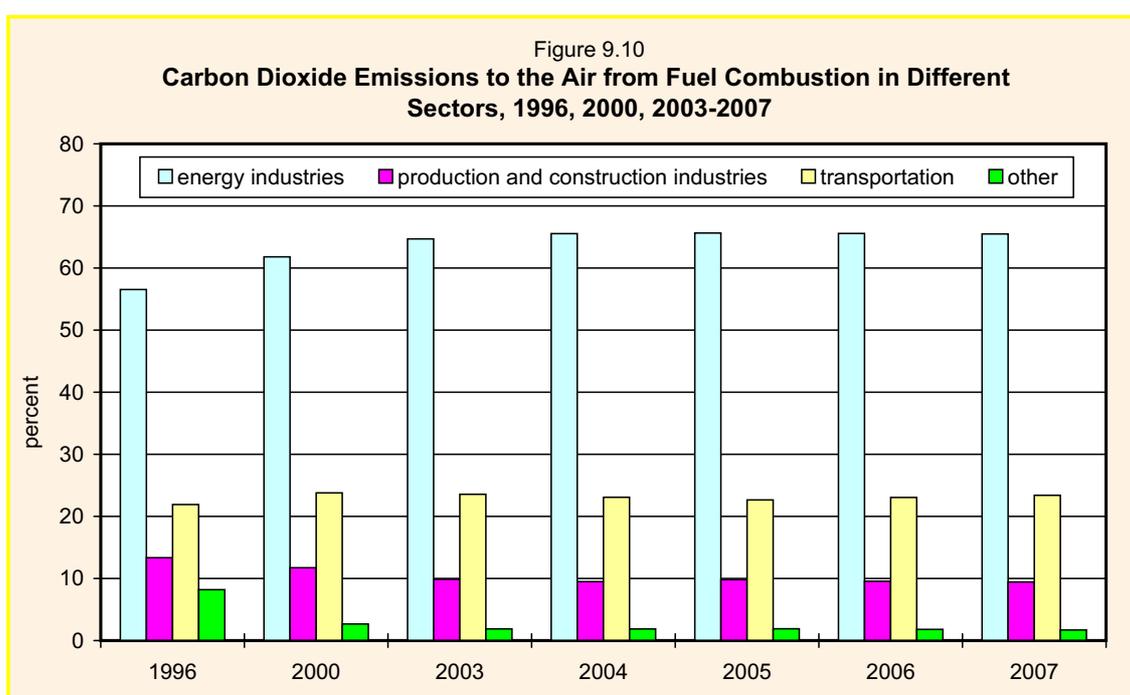
Indicator 9.6

Emissions of Carbon Dioxide to the Air from Fuel Combustion in Different Sectors

1996, 2000, 2003-2007

Why is this indicator important?

97% of the emissions of carbon dioxide originate in fuel combustion. In order to set priorities for treatment, it is important to calculate the relative contribution of each sector to fuel combustion.



Source: Central Bureau of Statistics

What do the data show?

The main source of carbon dioxide emissions is fuel combustion, especially for electricity production and fuel refining. The second source is fuel combustion for transportation and, to a lesser extent, fuel combustion for the production and construction industries. The share of the energy sector is on the increase, while the share of the transportation sector has remained stable. On the other hand, the production and construction industry has decreased its relative share. A possible explanation may be the increased demand for energy due to population growth and the rise in standard of living

in comparison to the demand for energy in the production and construction industry. Furthermore, some of the products in the production and construction industry are designated for export and are not impacted by fluctuations in the local market.

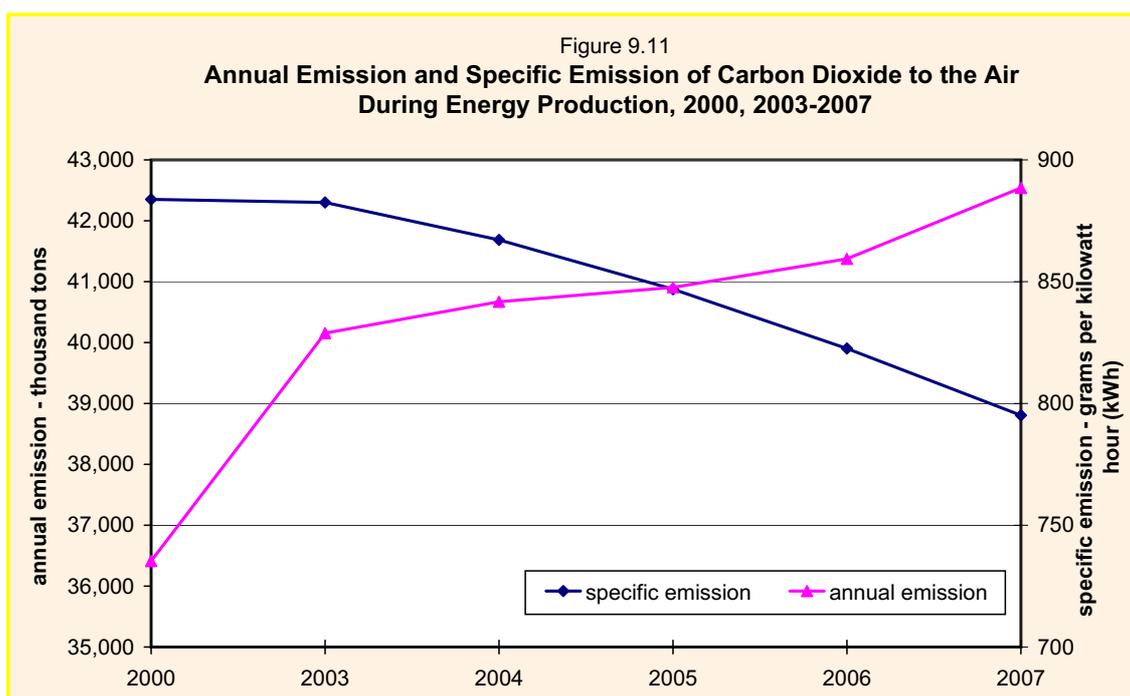
Indicator 9.7

Electricity Production, Annual Emission and Specific Emission of Carbon Dioxide to the Air in the Electricity Production Process

2000, 2003, 2004-2007

Why is this indicator important?

The main source of carbon dioxide emissions is fuel combustion in the energy industries. This indicator presents changes in emissions throughout the years which are the result of increased efficiency in the energy sector and changes in the composition of fuels used for energy production.



Source: Central Bureau of Statistics

What do the data show?

The 27% increase in electricity production between 2001 and 2007 was accompanied by a 17% increase in carbon dioxide emissions, but also by a 10% decrease in specific

emission. This may be attributed to the introduction of natural gas to the fuel basket for energy production. Gas use is associated with much lower emissions per kilowatt hour than coal.

Methane

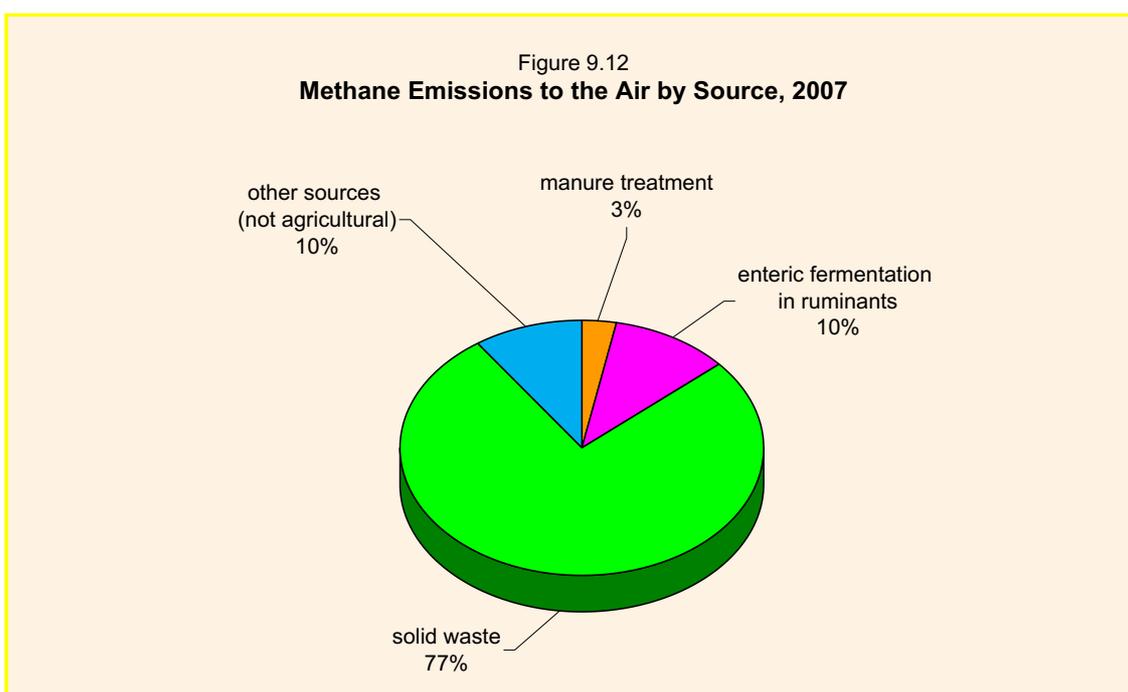
Indicator 9.8

Methane Emissions to the Air and Contribution of the Different Sectors

2007

Why is this indicator important?

Methane is the second main contributor to greenhouse gas emissions in Israel. In order to set priorities for treatment, it is important to calculate the relative contribution of each sector to the emission rate of methane.



Source: Central Bureau of Statistics

What do the data show?

Since 2003, methane emissions from the decomposition of solid waste ranged between 75% and 78% of total methane emissions. In 2007, 77% of the methane emissions

originated in the treatment of solid waste and 13% in enteric fermentation of ruminants and in manure treatment. Since 2003, methane emissions have decreased due to the collection of biogas in landfills. In recent years, methane emissions have moderately increased due to the increase in solid waste.

Chapter 10

Water Pollution

River Pollution

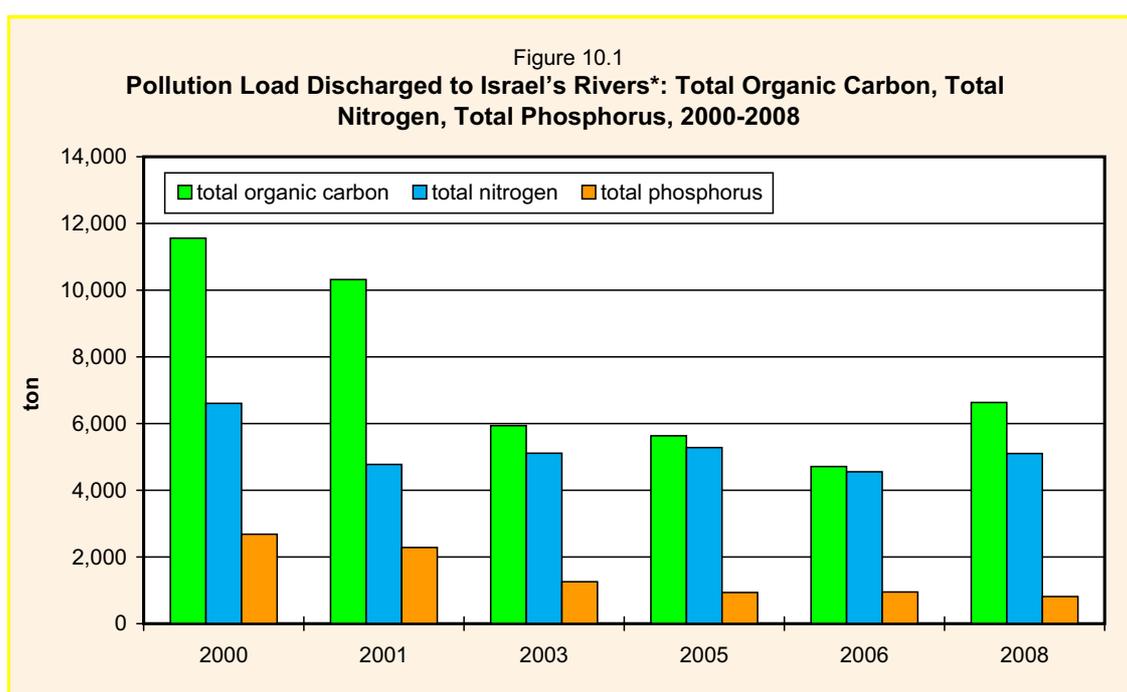
Over the past two decades dozens of facilities for the treatment of municipal wastewater, agricultural wastewater (mostly from dairy farms) and industrial wastewater were constructed in Israel. As a result the pollution load to the country's rivers decreased. The number of permanent sources of pollution to rivers has decreased from 250 sources in the mid-1990s to 100 today. Yet, paradoxically, the utilization of treated wastewater for agricultural irrigation has at times brought about a decrease in water flow in the rivers.

Indicator 10.1

Pollution Load Discharged to Israel's Rivers: Total Organic Carbon, Total Nitrogen and Total Phosphorus 2000-2008

Why is this indicator important?

The quantity of pollution discharged to rivers impacts directly on water quality and on the ecosystem and its capacity to serve as a habitat for flora and fauna species and to support fishing, sailing and bathing.



* For the Na'aman, Harod, Kishon, Taninim, Hadera, Alexander, Poleg, Yarkon, Ayalon, Soreq, Lachish, Besor Rivers.

Source: Water and Streams Division, Ministry of Environmental Protection

What do the data show?

Between 2000 and 2006, loads of organic matter (carbon) and phosphorus discharged to rivers decreased sharply while the decrease in nitrogen loads was more moderate.

Between 1994 and 2008 organic carbon decreased by 71%, nitrogen by 41% and phosphorus by 88%. The phosphorus load continued to decrease in 2008. On the other hand, organic matter loads increased due to the discharge of effluents to the Hadera River, wastewater to the Besor River, and wastewater and olive mill waste through the Nablus River to the Alexander River.

Chapter 11

Marine Pollution

The main direct contributors to marine pollution include fuel spills from vessels, dumping of waste from vessels, and discharge of municipal and industrial wastewater from land-based sources. Indirect pollution is caused by airborne pollution originating in industrial and vehicular pollution in Central and Western Europe. Thermal pollution of the sea results from the discharge of cooling water from coastal power plants. Recently, with the addition of coastal desalination plants, large quantities of brine concentrates are discharged to the sea as well. All of these processes harm marine ecosystems, flora and fauna.

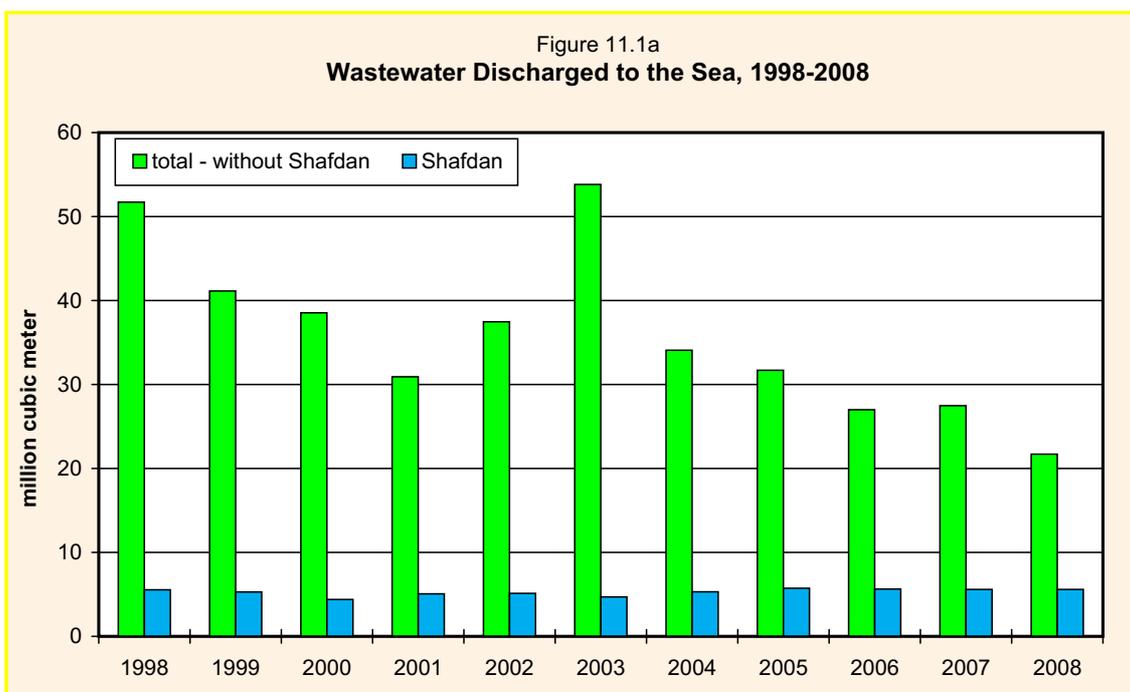
Pollution of the Mediterranean Sea

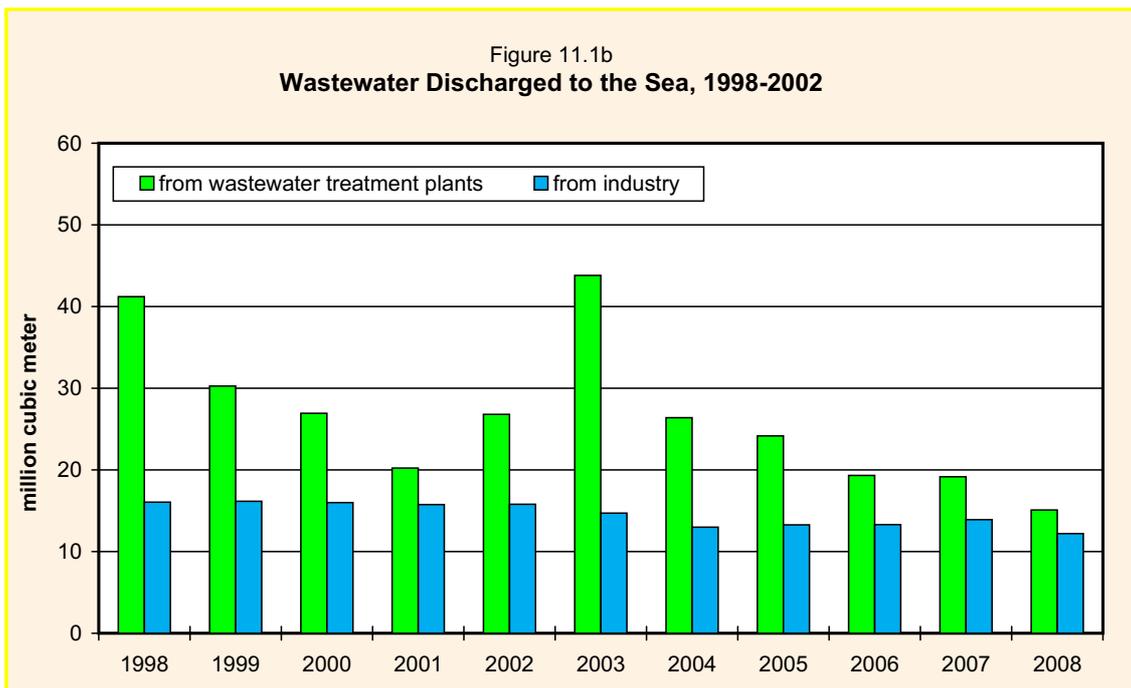
Since the Mediterranean Sea is a closed sea, it is more susceptible to pollution. Some 75% of the pollution reaching the sea originates in land-based sources (industrial waste and wastewater). Therefore, attention worldwide and in Israel is directed toward preventing land-based pollution – either from the direct discharge of wastewater to the sea or from its discharge to the sea through rivers.

Indicator 11.1
Annual Discharge of Wastewater to the Sea
1998-2008

Why is this indicator important?

The quantity of wastewater discharged to the sea affects the marine environment due to the pollutant content in the wastewater (physical, chemical and biological). Reducing the quantity of wastewater which is discharged is linked, among others, to reducing the number of wastewater outfalls and to reducing the area polluted by the discharge. Reducing wastewater discharge to the sea may at times go hand in hand with increasing the quantity of water which is recovered for agriculture.





Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

What do the data show?

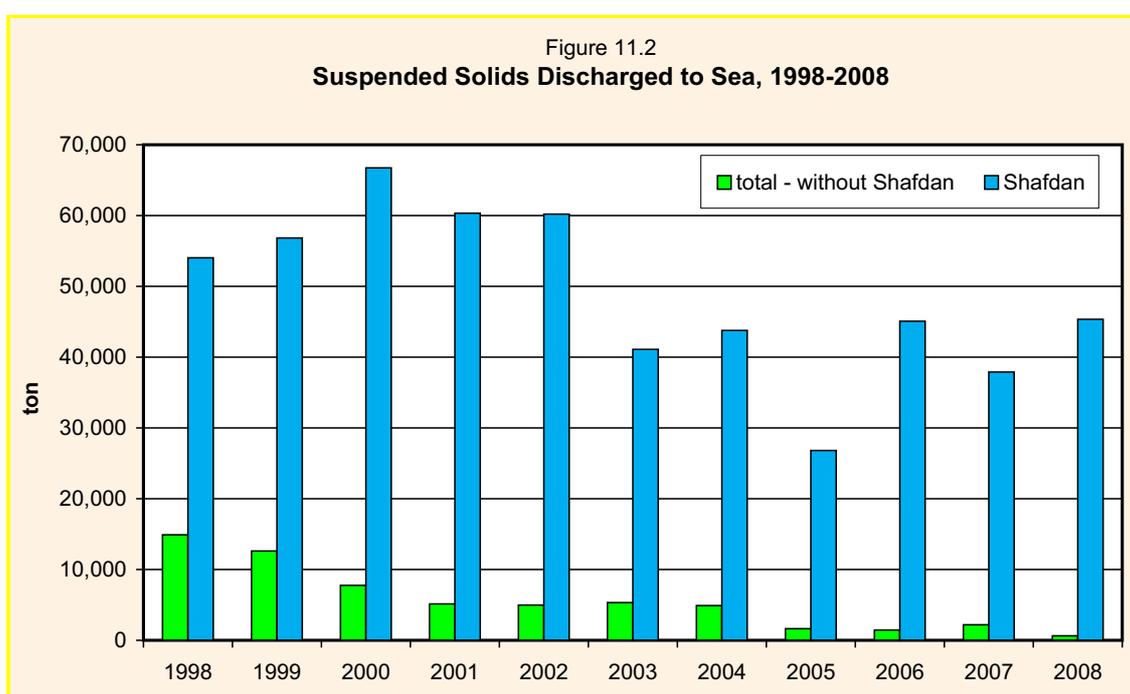
The pollution balance shows that although the Shafdan (Dan Region Wastewater Treatment Plant that serves the Tel Aviv metropolitan area) is the main source of Mediterranean Sea pollution due to the discharge of the sludge it generates to the sea, this sludge constitutes only 8% to 10% of the nationwide volume discharged directly to the sea.

The volume of industrial discharge has remained stable through the years with a moderate trend of decrease (some 15 MCM on average) while the discharge volume from wastewater treatment plants has fluctuated. It peaked in 2003 with the discharge of 43.8 MCM of wastewater to the sea, but decreased to 15 MCM in 2008 when new wastewater treatment plants in Nahariya and Acre became operational, with their effluents recovered for irrigation. In general, the greatest decrease in the volume of wastewater discharged to the sea is attributed to effluents from wastewater treatment plants.

Indicator 11.2
Load of Total Suspended Solids Discharged to Sea
 1998-2008

Why is this indicator important?

Total suspended solids may include a wide variety of pollutants (fertilizers, metals, biodegradable organic material, etc.). Total suspended solids may cause turbidity, reduce the penetration of light into the water column, and lead to sediment accumulation on the sea bed which harms marine life in the area.



Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

What do the data show?

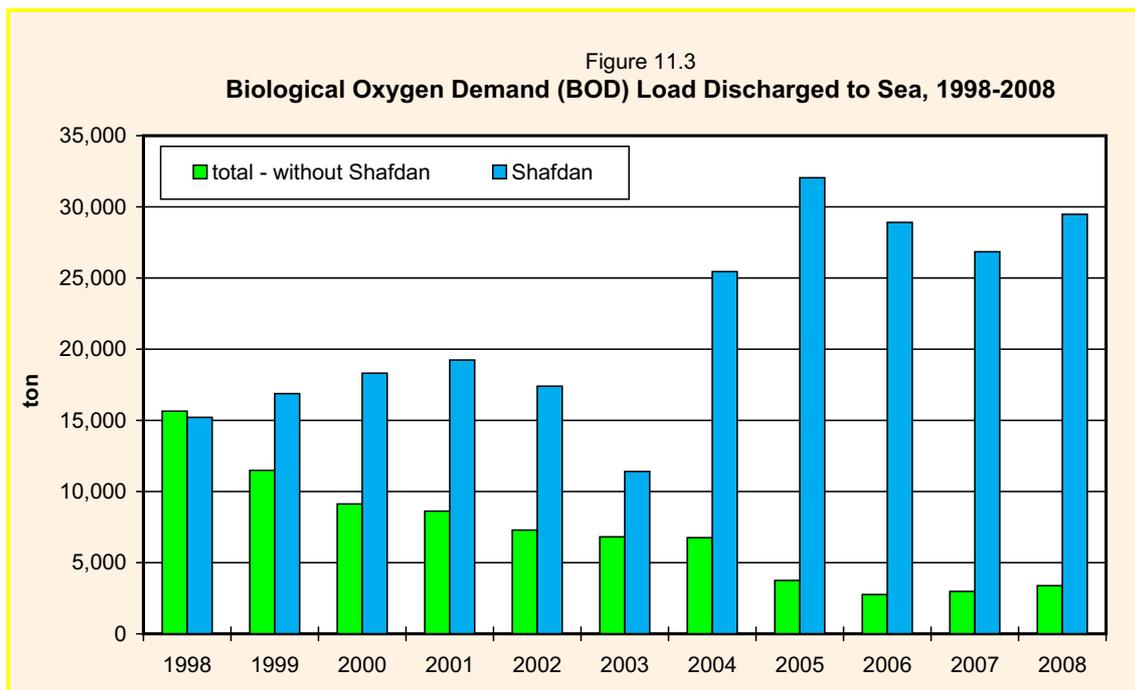
The Shafdan is the main contributor of total suspended solids, with 98.6% of the load in 2008 compared to 78% in 1998. Total load decreased by 29% from 68,935 tons in 1998 to 45,982 tons in 2008. The pollution load from all sources, excluding the Shafdan, decreased by 95.7% during this period – going down from 14,900 tons per year to 635 tons per year.

Indicator 11.3

Biological Oxygen Demand (BOD) Load Discharged to Sea 1998-2008

Why is this indicator important?

Biological oxygen demand (BOD) indicates the load of organic materials which may be decomposed by biological processes. The presence of organic material may cause a reduction in oxygen concentration in the water and in extreme cases anaerobic conditions may be created, leading to fish and animal mortality and to odors. In addition, some of the organic materials may be toxic.



Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

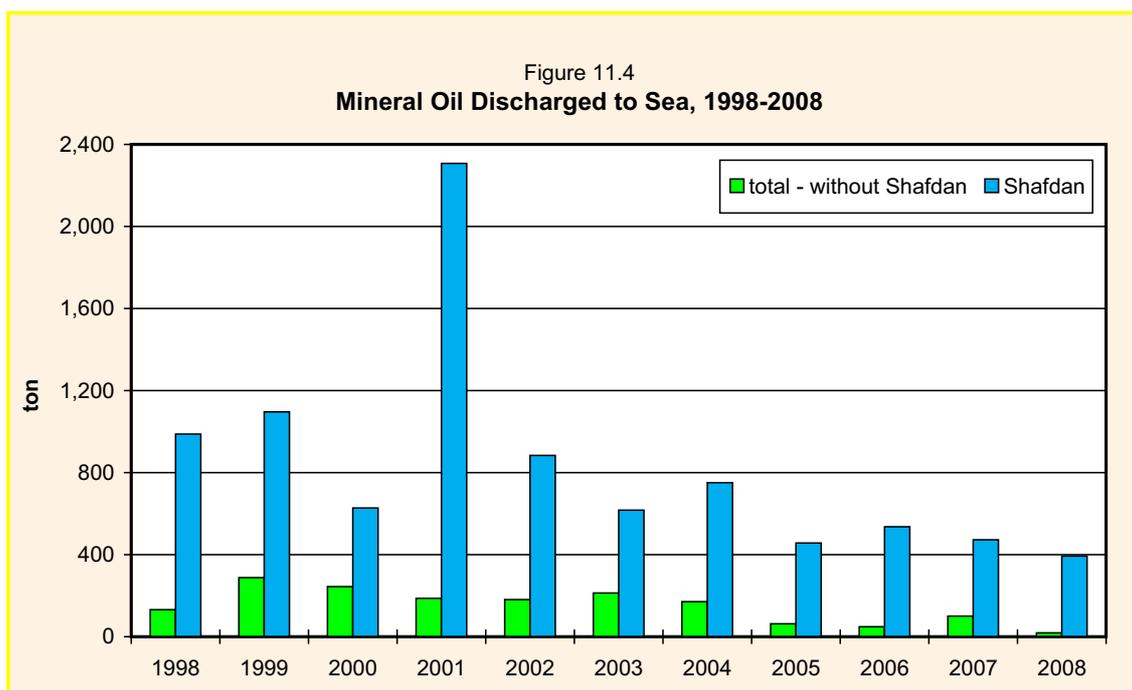
What do the data show?

The general balance shows that the BOD contribution of the Shafdan to marine pollution (89.7% in 2008, or 29,478 tons out of 32,864 tons) was significantly higher than the contribution of all other sources (3,386 tons). The contribution of all sources, excluding the Shafdan, decreased steadily through the years. Between 1998 and 2008, a decrease of 78.4% was noted, going down from 15,646 tons per year to 3,386 tons per year.

Indicator 11.4
Mineral Oil Load Discharged to Sea
 1998-2008

Why is this indicator important?

Mineral oil harms many of the creatures residing on the shallow sea bed and the coast. In small concentrations it can also harm plankton residing in the water column. It also harms sea birds.



Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

What do the data show?

The balance shows that the contribution of the Shafdan to mineral oil pollution of the sea is greater than all other sources combined, and constitutes some 95.5% of all of the mineral oil discharged to the sea in 2008.

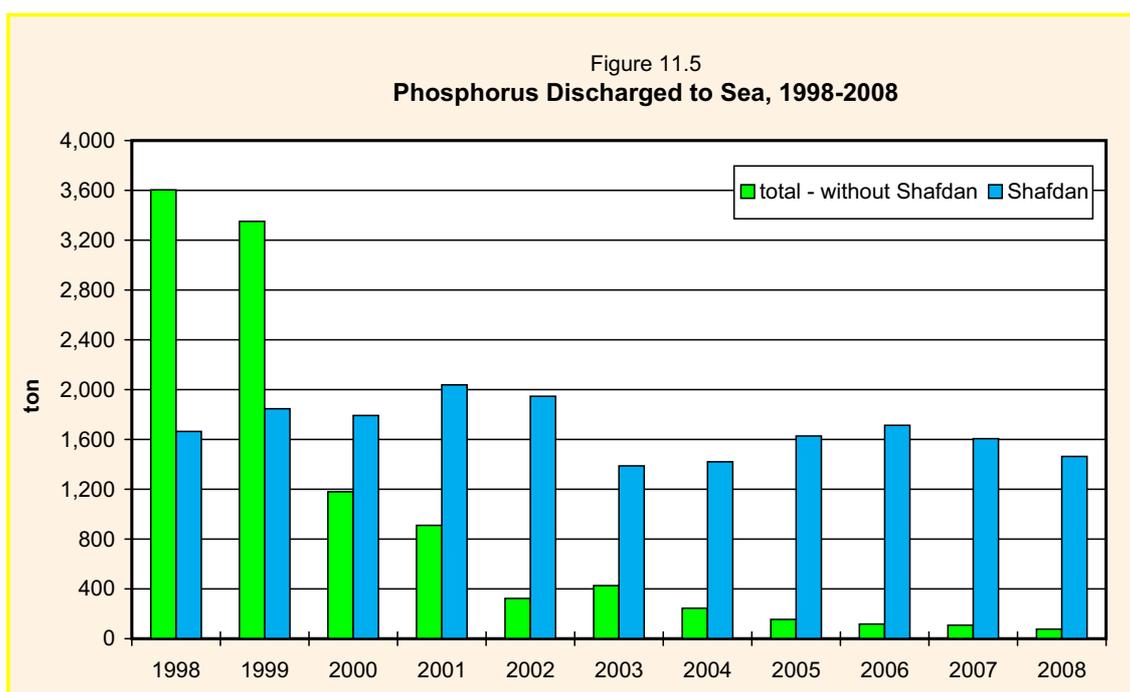
The general load, including the Shafdan, decreased from 1,120 tons in 1998 to 412 tons in 2008, a 63.2% decrease. The maximum load reached some 2,500 tons in 2001.

The load discharged by all sources, excluding the Shafdan, decreased by 85.9%, going down from 132 tons in 1998 to 19 tons in 2008.

Indicator 11.5
Phosphorus Load Discharged to Sea
 1998-2008

Why is this indicator important?

Phosphorus is a fertilizer (nutrient) and its discharge to the sea may cause accelerated development of algae, possibly including toxic species, and reduction in the oxygen concentration in the sea water due to the consumption of dissolved oxygen by algae during night hours.



Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

What do the data show?

The total phosphorus load discharge to the sea decreased by some 70.8%, going down from 5,270 tons in 1998 to 1,540 tons in 2008.

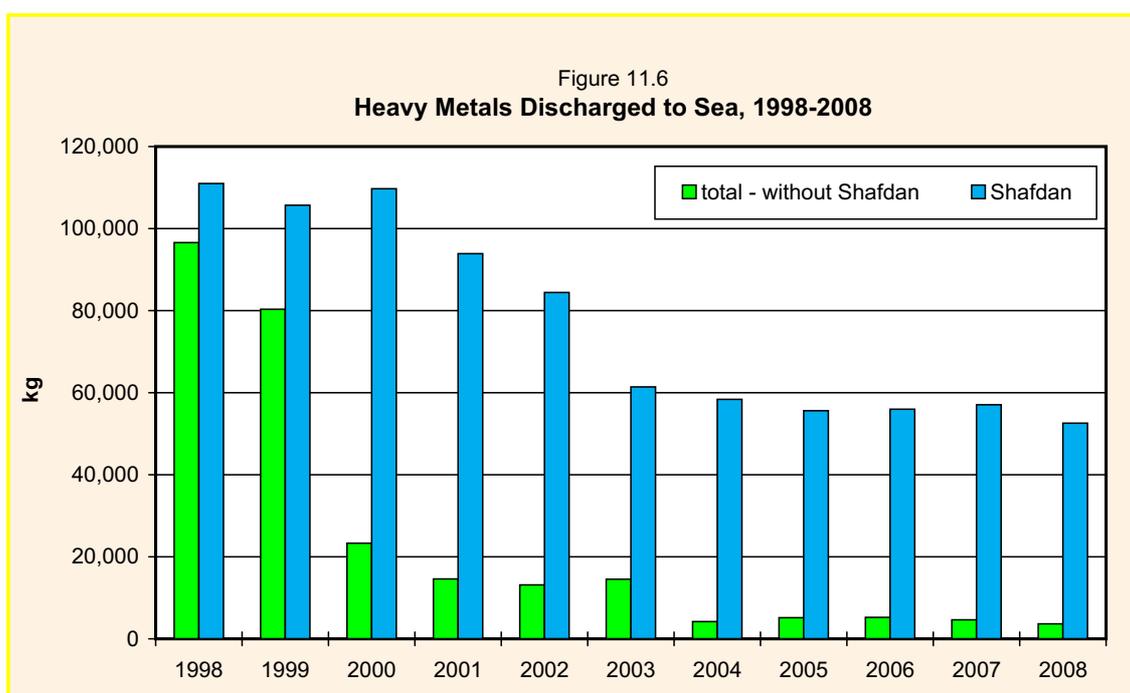
Furthermore, the contribution of the Shafdan to phosphorus pollution of the sea has increased over the years – increasing from 32% in 1998 to some 95% in 2008 of the total phosphorus that reached the sea.

The load from all sources, excluding the Shafdan, has decreased by 97.9%, going down from 3,604 tons per year to 76.6 tons per year in the same period, with most of the reduction attributed to Haifa Chemicals. The share of Haifa Chemicals, which was a major contributor to the phosphorus pollution of the sea in 1998, went down from 3,000 tons (57%) to 3.9 tons in 2008 (0.26%), a 99.9% decrease.

Indicator 11.6
Heavy Metal Load Discharged to Sea
 1998-2008

Why is this indicator important?

Heavy metals are toxic to different life systems. Mercury, the most toxic metal, harms many systems, especially the nervous system. Cadmium is harmful to animal health (damage to bones, blood pressure, kidneys and sterility). All heavy metals tend to accumulate in the food web, causing an increase in the metal concentrations in the bodies of animals.



* Mercury, cadmium, chromium, lead, copper, nickel and zinc.

Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

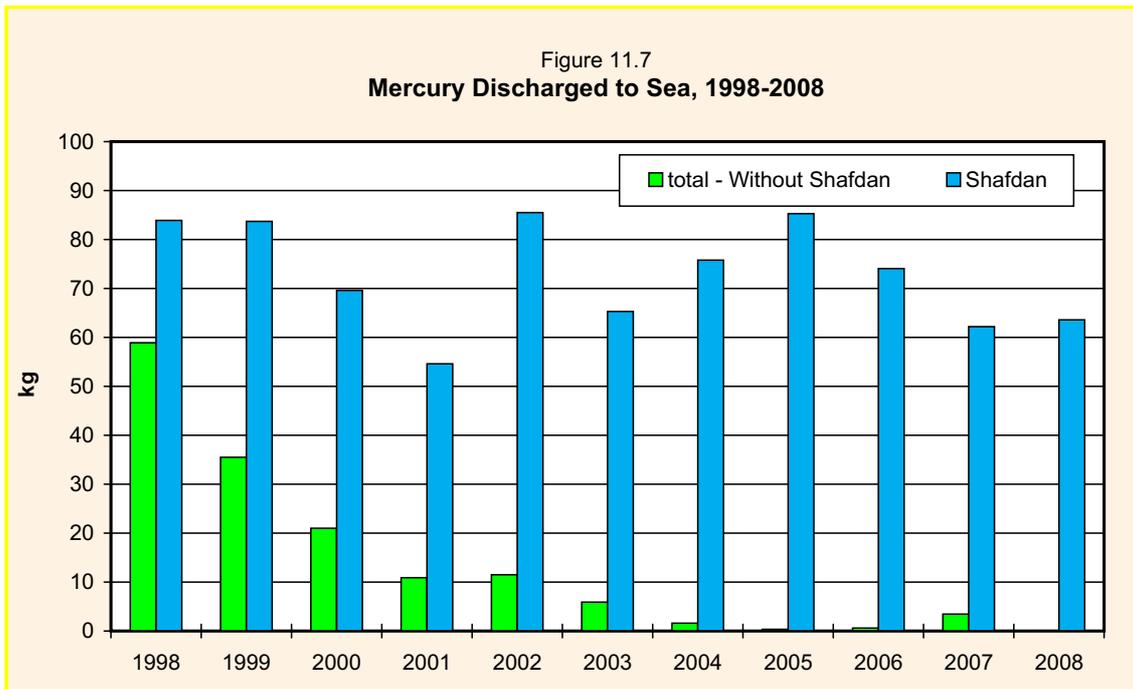
What do the data show?

The total load of pollution from all metals (mercury, chromium, cadmium, copper, nickel, lead and zinc) which are discharged to the sea has decreased by 72.9%, going down from 207.6 tons in 1998 to 52.6 tons in 2008.

Between 1998 and 2008, a significant decrease is evidenced in the quantity of metals from all sources, excluding the Shafdan: a 96.2% reduction, going down from 96.6 tons per year to 3.65 tons per year. This reduction is largely attributed to improvements in

wastewater treatment in Haifa Chemicals and to the cessation of raw wastewater discharge from the municipalities of Nahariya (2005) and Acre (2007).

In 1998, the Shafdan contributed 53.5% of the total metal pollution compared to 93.5% in 2008, due to the fact that other sources stopped the discharge of mercury or reduced their emissions. Nevertheless, pollution from the Shafdan has also decreased by 47.4%.



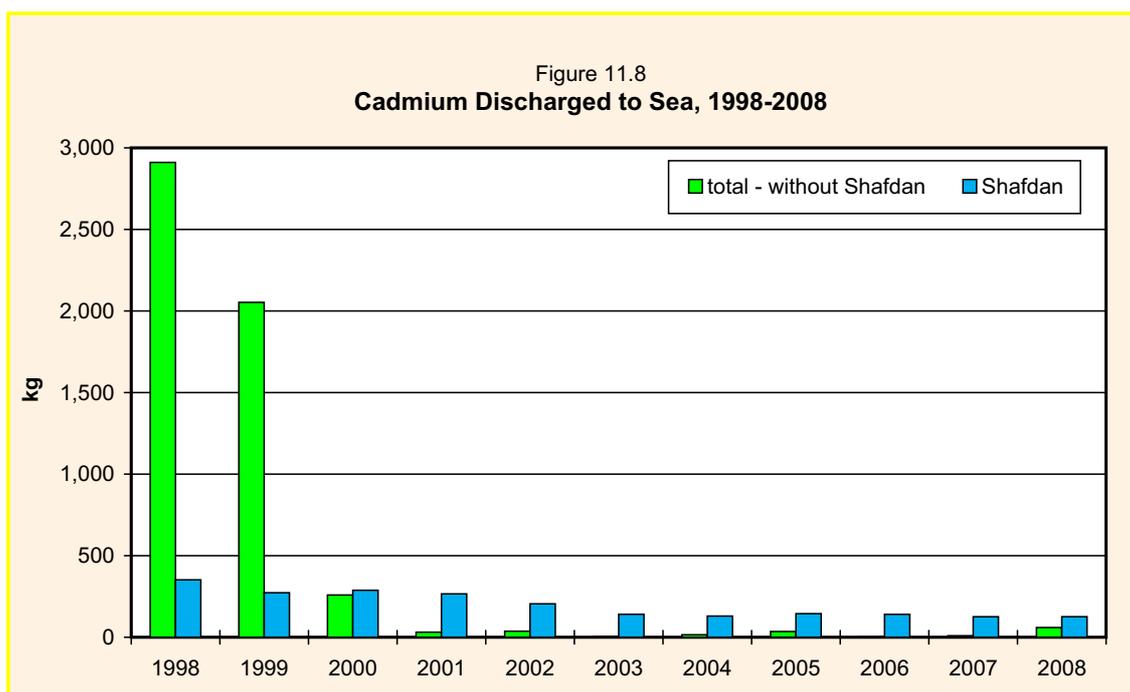
Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

What do the data show?

Although the total load of mercury pollution decreased by 55.4%, going down from 143 kg in 1998 to 63.7 kg in 2008, it remains high.

The pollution balance shows that the contribution of the Shafdan to the pollution is significantly larger than the contribution of all other sources combined – 63.6 kg compared to 0.1 kg from all other sources, or 99.86% of the total mercury pollution in 2008.

The contribution of the different sources to mercury pollution, excluding the Shafdan, decreased by 99.84%, going down from 58.9 kg per year to 0.1 kg per year in the same period. A look at the distribution of pollution among the different sources, excluding the Shafdan, shows that the main polluters in 1998 were the Electrochemical Industries (58%) and Haifa Chemicals (38%). Beginning in 2004 and onwards, emissions from all sources were very limited, with the exception of the Shafdan.



Source: Marine and Coastal Environment Division, Ministry of Environmental Protection

What do the data show?

The total load of cadmium pollution decreased by 94.3%, going down from 3,263 kg in 1998 to 186 kg in 2008.

The pollution balance shows that the relative contribution of the Shafdan to total cadmium pollution increased significantly in the reported period due to improvements in the treatment of discharges from other industrial plants, especially Haifa Chemicals. In 1998, the Shafdan contributed some 11% of the cadmium load and Haifa Chemicals contributed some 88%. However, beginning in 2001, Haifa Chemicals contributed tenths of percentages only of the cadmium pollution, while the pollution caused by the Shafdan ranged between 68% and 98% of the total quantity of cadmium.

The contribution of the different sources to the pollution of the sea by cadmium, excluding the Shafdan, decreased by 98%, going down from 2,911 kg in 1998 to 59.5 kg in 2008.

Chapter 12

Radiation Exposure

Radio Frequency Radiation

The use of radio waves (electromagnetic radiation at frequencies of between 100 kilohertz and 300 gigahertz) for communication systems such as radio and television transmitters, walkie-talkies, and cellular communication facilities has increased significantly in recent decades. In parallel, awareness of the risks associated with continuous exposure to different intensities has grown as well. It was found that radio frequency radiation can produce health effects by warming body tissues. For this reason it is important to map the sources of radiation and their contribution to total radiation.

Indicator 12.1

Exposure to Environmental Radio Radiation at Different Frequency Bands

In Areas with Different Characteristics in Terms of Proximity to Different Broadcasting Facilities, Preliminary Database, 2006

Why is this indicator important?

This indicator facilitates a review of periodic trends such as dependence on technological developments and increase in the number of radio transmitters, their intensity and their patterns of use.

Table 12.1
Average Radiation Level Measured in the Different Frequency Bands and Percent of the Total Average Level, Different Measurement Areas, 2006

Measurement Area	AM Radio 100 kHz-1.7 MHz		Short Waves 1.7-30 MHz		Cellular 800-2,200 MHz		FM Radio and TV VHF 30-400 MHz	TV UHF 400-800 MHz	Microwave – 2,200-3,000 MHz		Total average level nW/sq cm	Data range nW/sq cm	% of WHO recommendations
	nW/sq cm	%	nW/sq cm	%	nW/sq cm	%			nW/sq cm	nW/sq cm			
Near* powerful radio & TV stations	588	89	13	2	26	4	0.4	34	0.3	662	19-3,468	0.054	
Far** from powerful radio & TV stations													
Large cities	23	29	6	8	48	61	0.6	0.6	0.2	78	44-112	0.013	
Localities with cellular base stations	14	22	11	19	37	59	0.1	0.2	0.2	62	21-156	0.014	
Rural localities with cellular base stations	16	34	15	31	16	34	0.1	0.1	0.2	47	21-105	0.011	
Open areas without cellular base stations	11	53	7	46	1	7	0.1	0.6	0.2	19	13-35	0.003	
Localities without cellular base stations	9	51	7	41	1	6	0.1	0.1	0.2	17	6-34	0.004	

* Localities near powerful radio and television stations. Distance ranges between 1 and 10 km.

** Localities far from powerful radio and television stations. Distance exceeds 10 km.

Source: Amir Shachar, Ronen Hareuveny, Menachem Margaliot and Gad Shani, Radio Radiation in Israel: Environmental Levels, Spectral Composition and Sources, Summary Report, Soreq Nuclear Research Center; Noise Abatement and Radiation Division, Ministry of Environmental Protection

What do the data show?

The findings show that there are three primary areas which are significantly different from one another in terms of their exposure levels to radiation:

1. Localities near powerful broadcasting stations: the average measured levels are 650 nanowatts per square centimeter (nW/sq cm), most of them (some 90%) originating in AM radio broadcasting stations. In some of the stations, much higher values were measured.
2. Large cities and other localities with cellular base stations: average measured levels range between 60 nW/sq cm to 80 mW/sq cm. Some 60% of the exposure in these areas originates in cellular base stations and the rest in distant radio stations (AM and short wave). Levels in large cities are somewhat higher than in other localities with cellular base stations.
3. Localities without cellular base stations: the lowest levels, less than 20 nW/sq cm, were measured in these areas and in open areas in the Golan Heights. Most of the exposure in these areas (about 90%) originates in distant radio stations (AM and short wave). The low levels are attributed to the absence of cellular radiation (1-2 nW/sq cm compared to 15-55 nW/sq cm in other areas).



PART IV

WASTE TREATMENT



Chapter 13

Solid Waste

Increases in population and standard of living have been responsible for the generation of growing amounts of waste. In Israel, waste quantities have increased by 3%-5% annually over the past decade.

Hazards and nuisances which are associated with improper waste treatment include soil and groundwater contamination, air pollution and greenhouse gas emissions, proliferation of pests and spread of disease, safety problems in flight paths, visual nuisances, odors and a decline in land values.

Landfills consume precious land resources, lead to increased emissions of greenhouse gases, require long-distance transport of the waste, and carry significant external costs. Therefore, major efforts are directed toward reducing waste at source.

Types of waste:

Municipal waste – waste originating in the municipal sector, including household and commercial waste;

Industrial waste – waste originating in the industrial sector (excluding hazardous waste);

Construction and demolition waste – materials and material residues used for building, including surplus excavation material and parts of demolished buildings;

Coal ash – waste produced during coal-fired electricity generation;

Sludge – waste produced during the wastewater treatment process in a wastewater treatment plant.

Indicator 13.1

Quantity of Treated Waste by Type of Waste and Type of Waste Treatment

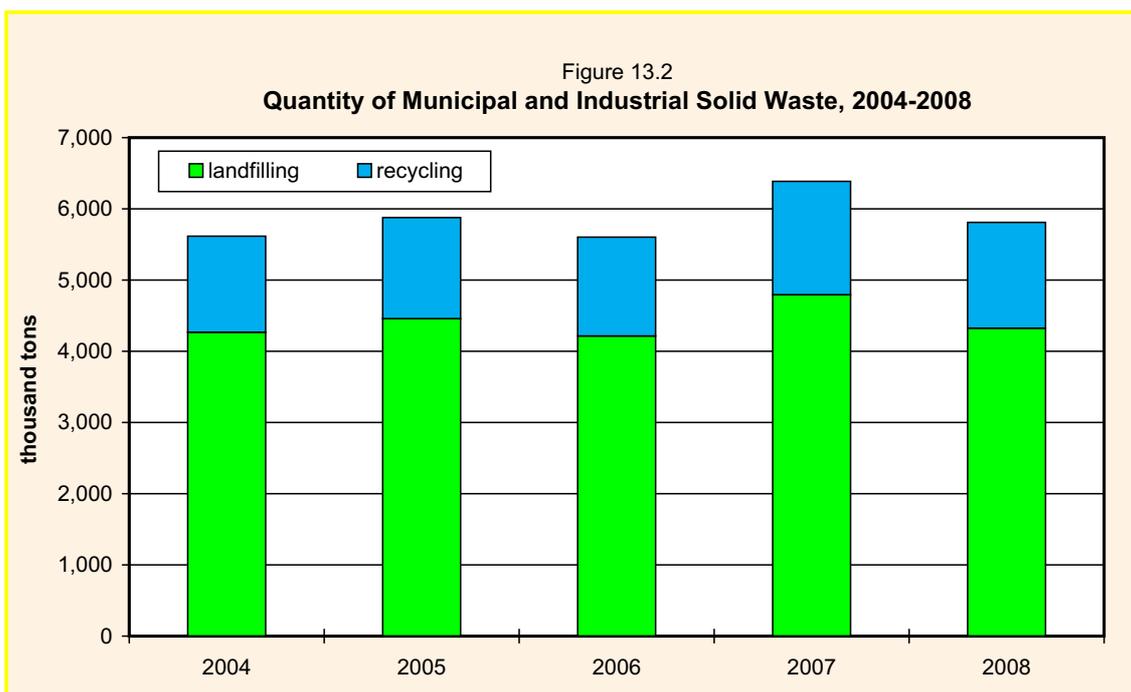
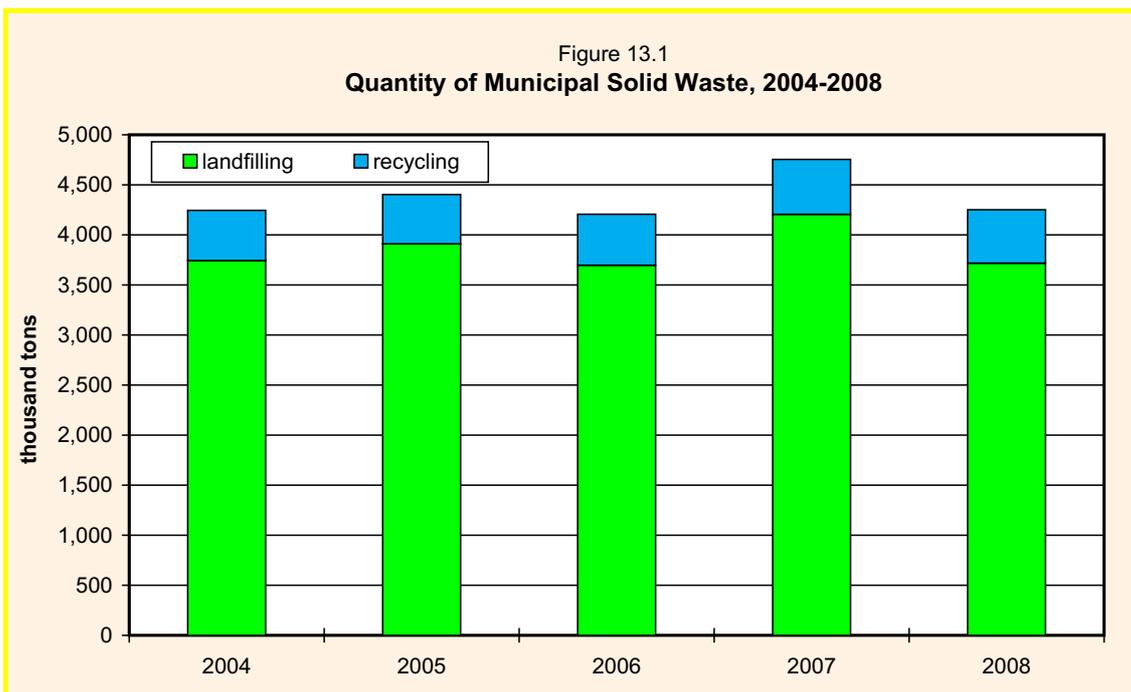
2004-2008

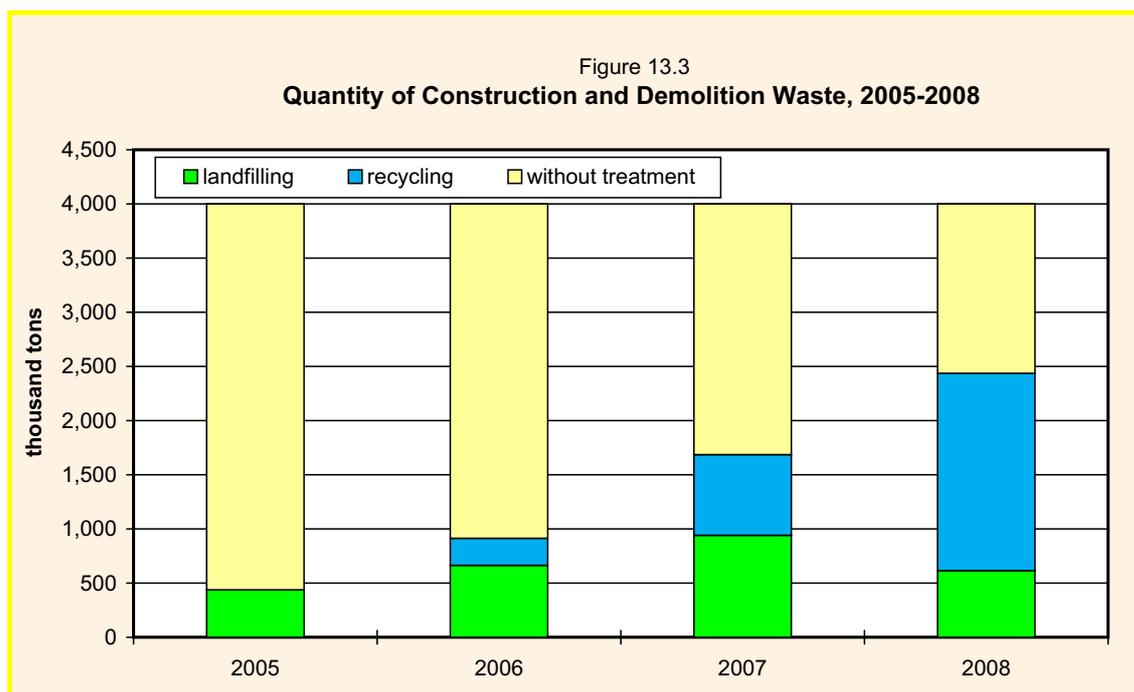
Why is this indicator important?

Follow up of changes in the quantity of solid waste which is treated in general and the quantity of waste which is recycled in particular is intended to assess the environmental pollution potential and to evaluate the success of actions to promote recycling and reduce the quantity of waste which is disposed in landfills.

Table 13.1
Quantity of Treated Waste by Type of Waste

	2004	2005	2006	2007	2008
	ton				
Municipal & Commercial Waste					
Generated	4,245,123	4,403,552	4,206,381	4,753,956	4,251,474
Landfilled	3,743,123	3,910,552	3,696,781	4,205,356	3,717,474
Recycled	502,000	493,000	509,600	548,600	534,000
Percent of Recycling	11.83	11.20	12.11	11.54	12.56
Industrial Waste					
Generated	1,371,726	1,536,599	1,491,477	1,766,712	1,647,393
Landfilled	524,037	609,977	612,342	723,141	695,393
Recycled	847,689	926,622	879,135	1,043,571	952,000
Percent of Recycling	61.80	60.30	58.94	59.07	57.79
Municipal, Commercial and Industrial Waste					
Generated	5,616,849	5,940,151	5,697,858	6,520,668	5,898,867
Landfilled	4,267,160	4,520,529	4,309,123	4,928,497	4,412,867
Recycled	1,349,689	1,419,622	1,388,735	1,592,171	1,486,000
Percent of Recycling	24.03	23.90	24.37	24.42	25.19
Construction & Demolition Waste					
Generated	Missing data	4,000,000	4,000,000	4,000,000	4,000,000
Landfilled	Missing data	437,500	663,547	940,733	615,044
Recycled	Missing data	0	250,000	745,000	1,821,276
Percent of Recycling	Missing data	0.00	6.25	18.63	45.53
Coal Ash					
Generated	1,332,000	1,170,000	1,161,000	1,205,000	1,208,000
Landfilled					
Recycled	1,332,000	1,170,000	1,127,000	1,196,000	1,188,000
Percent of Recycling	100	100	97.07	99.25	98.34
Sludge					
Generated	110,865	99,441	98,021	105,966	108,771
Landfilled	7,977	7,829	8,562	11,091	4,041
Recycled	44,488	45,812	45,843	45,025	54,463
Percent of Recycling	40.13	46.07	46.77	42.49	50.07





Source: Solid Waste Management Division, Accountant, Infrastructure Department, Ministry of Environmental Protection; Coal Ash Administration

What do the data show?

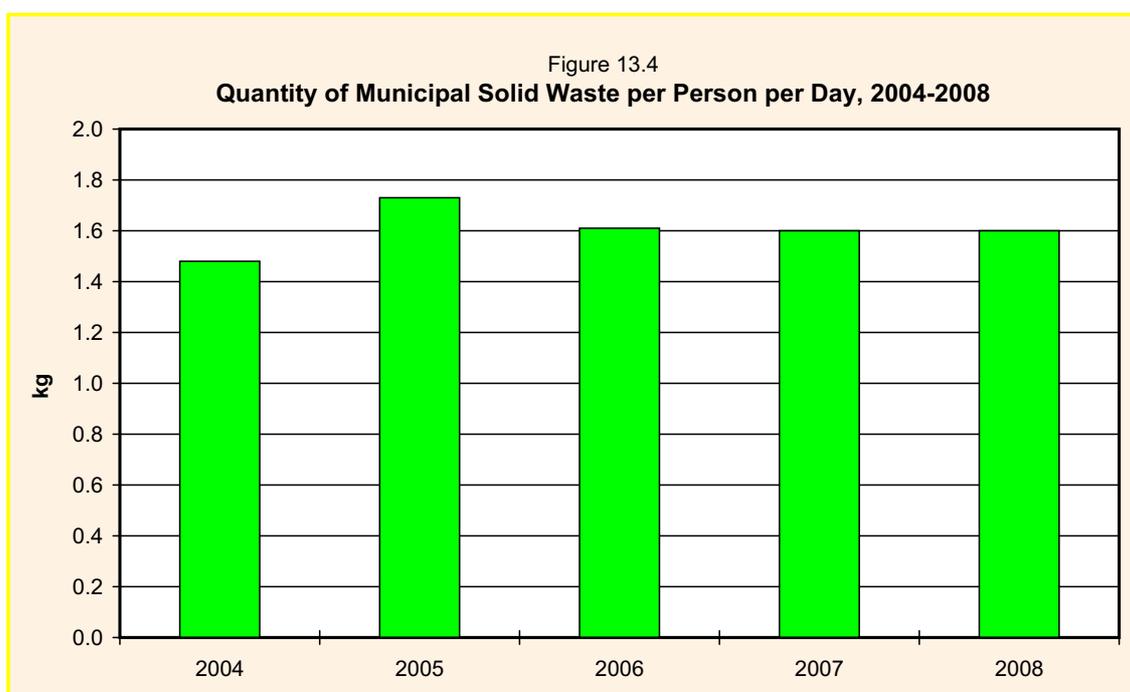
Some 11,300 thousand tons of waste are produced in Israel each year, of which some 4,400 thousand tons a year are municipal solid waste, some 1,600 thousand tons a year are industrial waste, some 4,000 thousand tons a year are construction and demolition waste, some 1,200 thousand tons a year are coal ash, and some 105 thousand tons are sludge (see Chapter 13, Wastewater, D. Sludge). No clear trend in the quantity of municipal solid waste and in the quantity of recycled municipal waste is evident, and only slight fluctuations are measured through the years. Construction and demolition waste quantities are estimated on the basis of construction starts, infrastructure work and renovation waste which is generated per person per year.

The recycling rate of municipal and industrial solid waste is about 25% and the recycling rate of municipal solid waste alone is about 12.5% a year. Until 2005, construction and demolition waste was not recycled, but recent years have seen a growth in the recycling rate of this waste, reaching 45.5% in 2008, due to the operation of dedicated recycling facilities for this waste. All of Israel's coal ash is recycled, mostly for the construction industries.

Indicator 13.2
Quantity of Municipal Solid Waste per Person per Day
2004-2008

Why is this indicator important?

In order to promote recycling and reduce landfilling, local authorities are obligated to set up a recycling infrastructure by means of dedicated receptacles for the collection of plastic waste, paper and cardboard waste, and more. Planning on the part of the authorities is based on data on the quantity of waste generated per person per day, and this indicator serves as a basis for calculating forecasted quantities. The data also reflect the culture of consumption and the level of environmental awareness.



Source: Solid Waste Management Division, Ministry of Environmental Protection

What do the data show?

The quantity of municipal solid waste per person per day ranged between 1.48 kilograms (kg) to 1.73 kg in the years 2004-2008. Between 2006 and 2008, the quantity of municipal solid waste per person per day was 1.6 kg.

Indicator 13.3

**Components of Solid Waste; Percent of Waste Weight,
Percent of Waste Volume**

1975, 1983, 1995 and 2005

Why is this indicator important?

Follow up of changes in the composition of solid waste serves as a basis for planning reduction and separation of waste at source and its recycling.

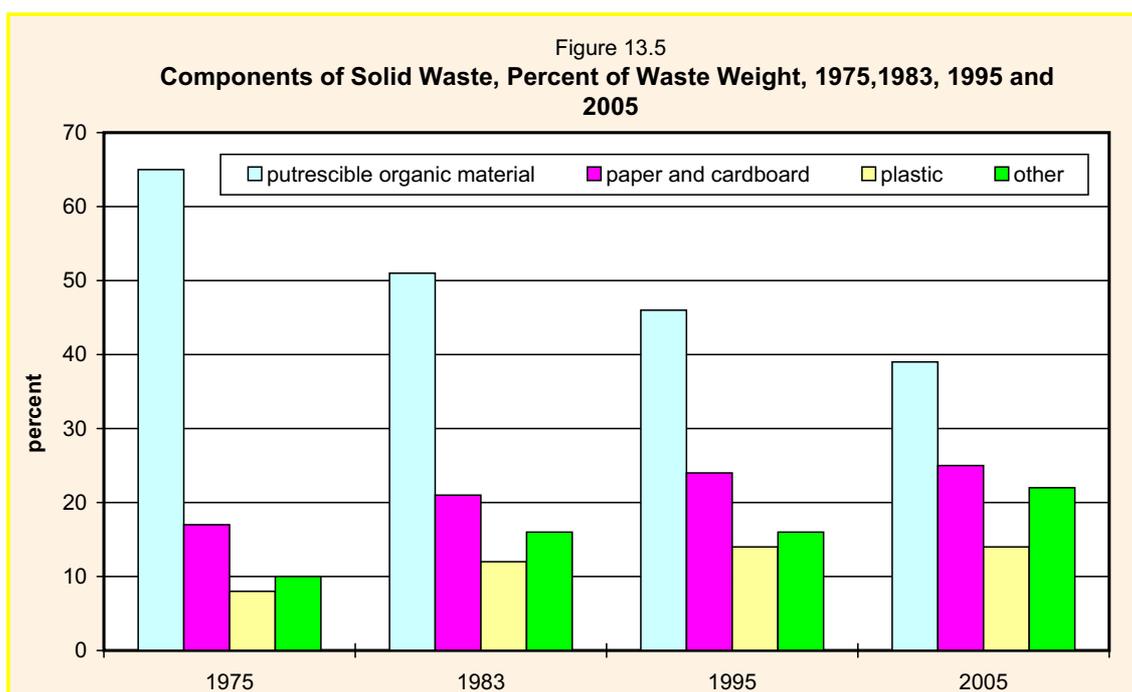


Table 13.2

**Components of Solid Waste, Volume Compared to Weight,
2005**

Material	Percent of Waste Volume	Percent of Waste Weight
Plastic	46	13
Paper	15	17
Cardboard	13	8
Organic matter	10	40
Miscellaneous	5	7
Metals	4	3
Textile	3	4
Disposable Diapers	3	5
Glass	1	3

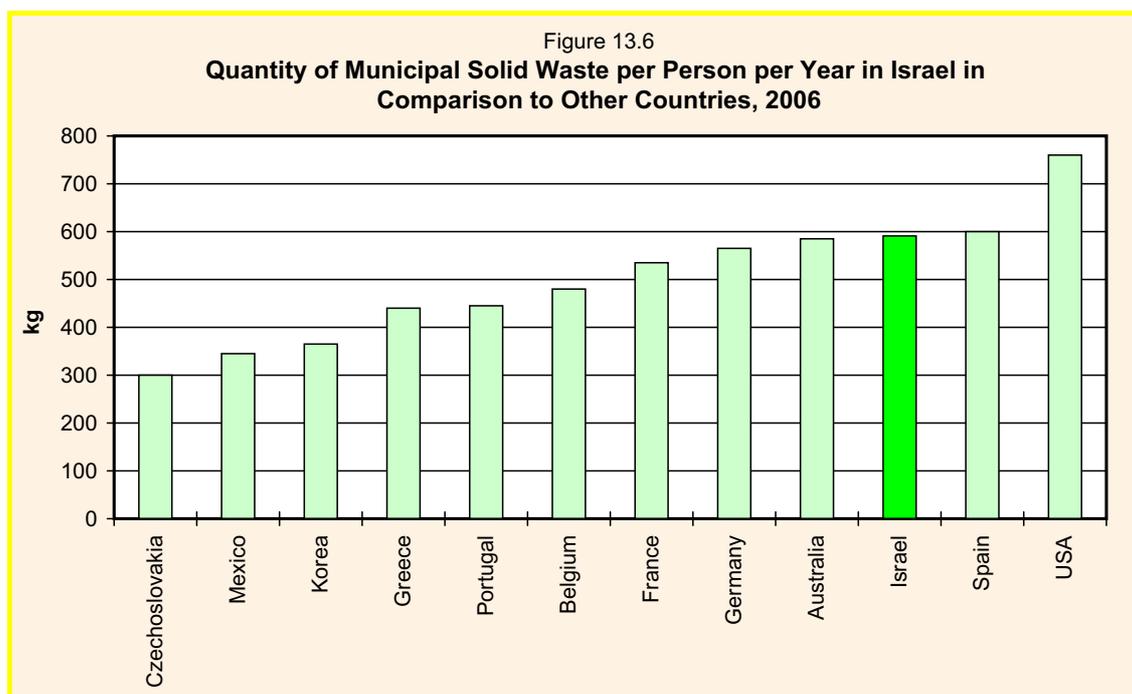
Source: *Solid Waste Management Division, Ministry of Environmental Protection; Surveys on the composition of waste were conducted by the following:*

- 1975 – *N. Baruch & Partners Consulting and Research Ltd. in cooperation with Tushia Engineering Consulting Ltd.*
- 1983 – *A. Melamed*
- 1995 – *Biotech – Environmental Co. Ltd.*
- 2005 – *Shaldag Environmental Management and Solutions Ltd.*

What do the data show?

In the period between 1975 and 2005, the paper and cardboard component and the plastic component increased while the putrescible organic matter component decreased. The increase in the quantity of paper, cardboard and plastic reflects changes in consumption and production patterns – an increase in consumption and an increase in the quantity of packaging. The components which took up most of the waste volume in 2005 (in descending order) were plastic, paper, cardboard and organic matter. The components which were the heaviest in terms of weight (in descending order) were organic matter, paper and plastic. In 2005, plastic, paper and cardboard made up 74% of the volume of the waste and 38% of its weight. Packaging made up between 15% and 20% of the weight of the municipal and industrial solid waste.

Indicator 13.4
**Quantity of Municipal Solid Waste per Person per Year in
Israel in Comparison to Other Countries**
2006



Source: Israel – Solid Waste Management Division, Ministry of Environmental Protection; Other countries – OECD Factbook 2009 Economic, Environmental and Social Statistics

What do the data show?

The quantity of municipal solid waste per person per year in Israel is similar to the quantity in developed European countries such as Spain, Germany and Austria. In 2008, every person in Israel generated an average of 585 kg of waste per year.

Chapter 14

Wastewater

A. Municipal Wastewater

Municipal wastewater is the single largest polluter of soil, water sources, rivers and the sea in Israel. Municipal wastewater includes both domestic wastewater and industrial wastewater which is discharged to municipal sewage systems (generally after treatment). It includes pathogens, organic matter, suspended solids, nitrogen compounds, phosphorus compounds, heavy metals, and more.

Wastewater is treated in wastewater treatment plants which remove suspended solids, decompose organic matter, and reduce pathogen concentrations through disinfection. Some wastewater treatment plants also remove nitrogen and phosphorus.

There are several levels of wastewater treatment. Primary treatment, which produces low quality effluents, is mechanical and includes coarse filtration, removal of sand, and preliminary sedimentation. Secondary treatment includes biological treatment, using bacteria or algae to decompose organic matter, and produces effluents with reduced risk of soil and groundwater contamination, which are suitable for agricultural irrigation, under certain restrictions. Tertiary treatment includes additional mechanical treatment to remove suspended materials and organic matter as well as biological or chemical processes to reduce the concentrations of nitrogen and phosphorus compounds.

Effluent quality is defined, among others, by biochemical oxygen demand (BOD) which, for the most part, reflects the concentration of organic matter in the effluents, and by total suspended solids (TSS). Effluents which undergo secondary treatment comply with a minimum baseline level of 20 mg per liter BOD and 30 mg per liter TSS. The quality of the effluents is also determined, among others, by concentrations of nitrogen, phosphorus, chlorides and sodium which are indicators of salinity, by concentrations of boron which is toxic to plants, and by concentrations of heavy metals which are toxic to humans and animals.

Effluents treated to secondary or tertiary level are utilized for the irrigation of different crops. Effluent recovery in agriculture thus prevents environmental pollution and adds a further water source, thereby reducing the pressure on natural water resources.

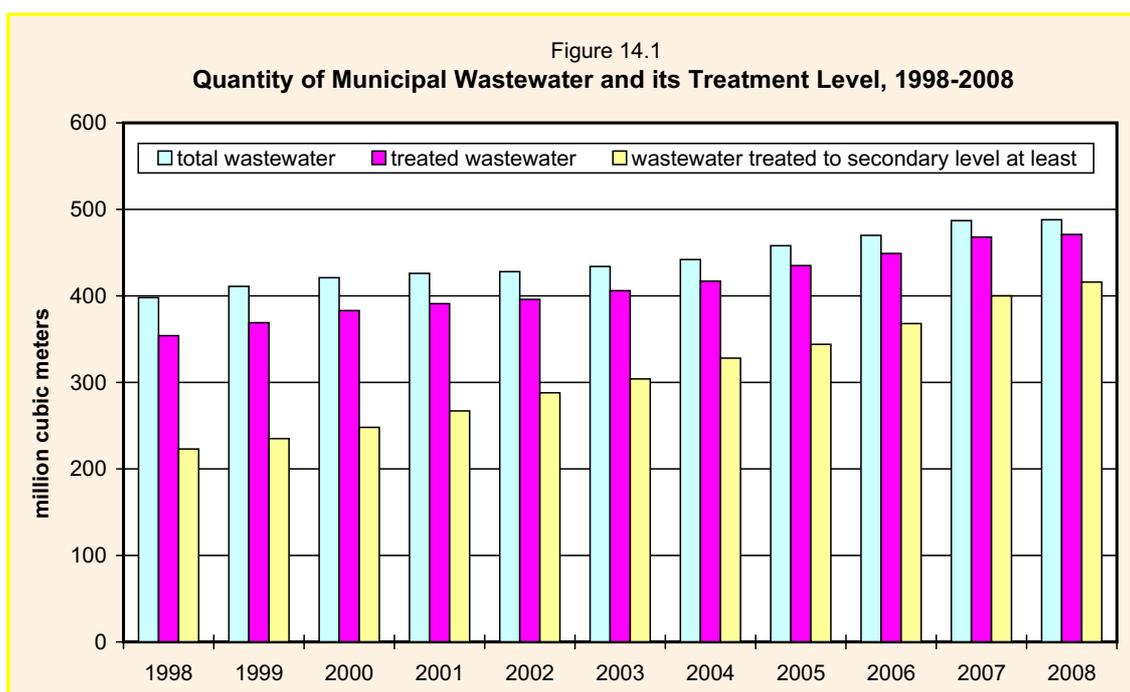
Indicator 14.1

Quantity of Municipal Wastewater and its Treatment Level

1998-2008

Why is this indicator important?

Information on the quantity of wastewater is important to assess the level of pollution caused by wastewater (in practice or in potential) and provides a basis for estimating the scope of infrastructures needed to treat wastewater as a pollutant and to subsequently use it as treated effluent which is suitable for irrigation.



Source: Water Authority; Nature and Parks Authority; Water and Streams Division, Ministry of Environmental Protection

What do the data show?

The generation of municipal wastewater in Israel has increased by 23% over the past decade: from 398 million cubic meters (MCM) in 1998 to 488 MCM in 2008.

The quantity of treated wastewater increased from 354 MCM in 1998 to 471 MCM in 2008. In this period the quantity of wastewater treated to at least secondary level increased from 223 MCM to 416 MCM, and the quantity of wastewater treated to less than a secondary level decreased from 131 MCM to 55 MCM.

In 2008, some 30% of the municipal wastewater was treated to advanced tertiary level, which includes the additional removal of organic matter, total suspended solids, nitrogen, phosphorus and pathogens. Wastewater which undergoes tertiary treatment complies with criteria of 10 mg per liter BOD and 10 mg per liter TSS and low concentrations of nitrogen, phosphorus and pathogens.

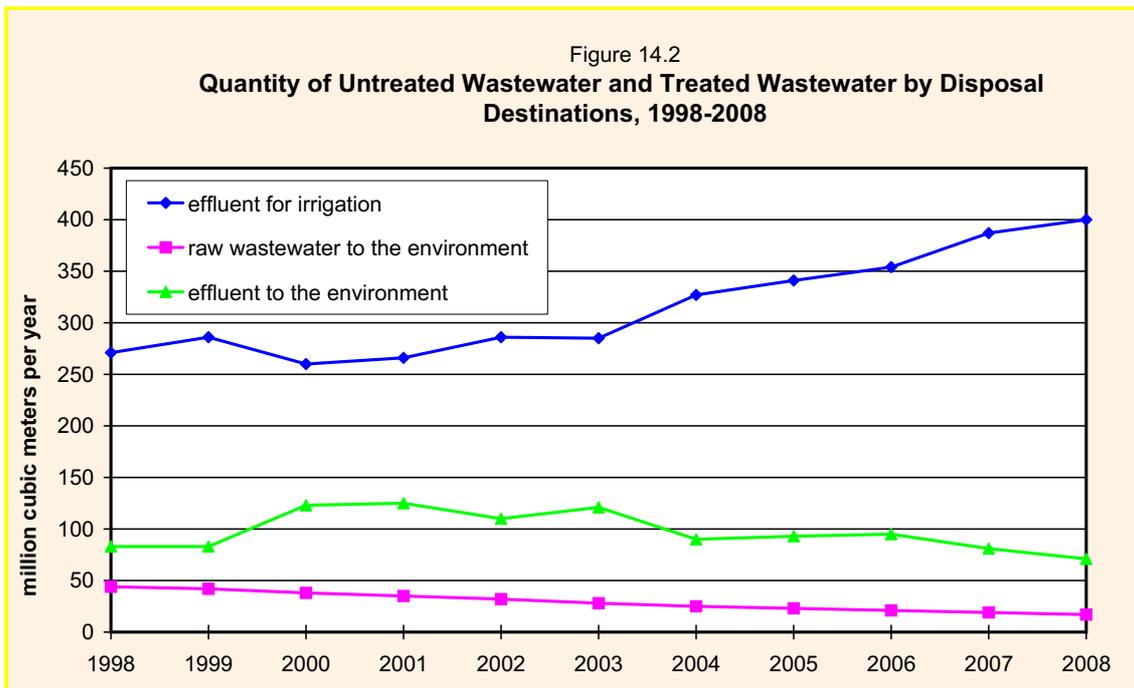
Indicator 14.2

Quantity of Untreated Wastewater and Treated Wastewater by Disposal Destinations

1998-2008

Why is this indicator important?

Untreated wastewater is responsible for environmental pollution and for pollution of the soil, surface water and groundwater. Due to the water scarcity problem in Israel, priority is given to effluent reuse for agricultural purposes. Non-compliance of effluents with water quality requirements for irrigation or inadequate infrastructure for the collection of water result in the disposal of some of the effluents to the environment.



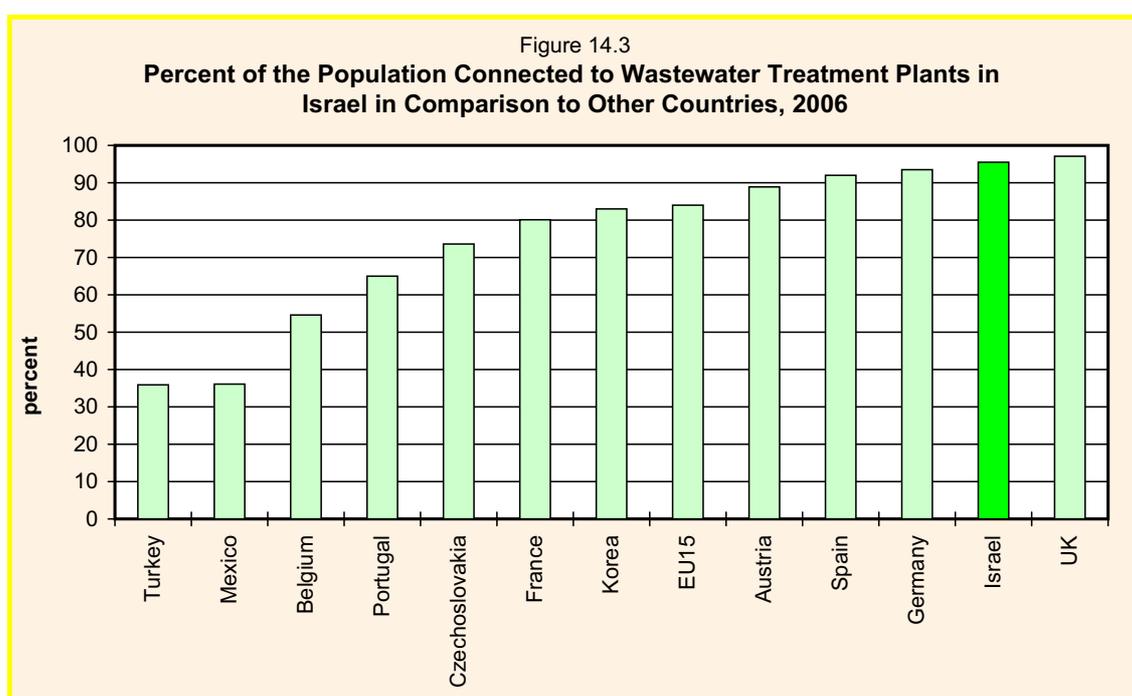
Source: Water Authority; Nature and Parks Authority; Water and Streams Division, Ministry of Environmental Protection

What do the data show?

Effluent use for agricultural irrigation increased from 271 MCM (68% of the total municipal wastewater) in 1998 to 400 MCM (82% of the total municipal wastewater) in 2008. This represents the highest effluent recovery rate worldwide. The quantity of wastewater and effluents which are discharged to the environment decreased from 127 MCM (31.9% of the total municipal wastewater) in 1988 to 88 MCM (18% of the total municipal wastewater) in 2008.

Indicator 14.3

Percent of the Population Connected to Wastewater Treatment Plants in Israel in Comparison to Other Countries 2006



Source: Israel – Central Bureau of Statistics; Water Authority; Other countries – OECD Environmental Data Compendium 2006-2008

What do the data show?

The wastewater generated by 95.5% of Israel's population is connected to central conveyance and treatment systems. This figure is high in relation to other developed countries.

B. Industrial Wastewater

Industrial consumption of water reaches some 120 MCM per year, about 5%-6% of total water consumption in Israel. The quantity of industrial wastewater reaches 16%-17% of the quantity of wastewater generated in Israel. Industrial wastewater may include different pollutants, such as heavy metals, organic load, salts and oil, and its environmental degradation potential is greater than its relative share in the municipal wastewater. Some 80% of Israel's effluents are recovered for agricultural irrigation. For this reason, it is especially important to assure the quality of industrial wastewater which is discharged to the municipal sewage system and from there to wastewater treatment plants.

Brines

The reduction of salt concentrations which are discharged to municipal sewage systems is critical to prevent wastewater salinity so as to allow for effluent recovery for agricultural irrigation and to prevent soil and groundwater salination by these effluents.

Water for industrial production is characterized by a high concentration of salts, known as brines. Industrial plants are required to separate the brine stream from the wastewater stream in the plant and to discharge the brines to the sea, while complying with the quality standards required for discharge to the sea rather than to the public sewage system.

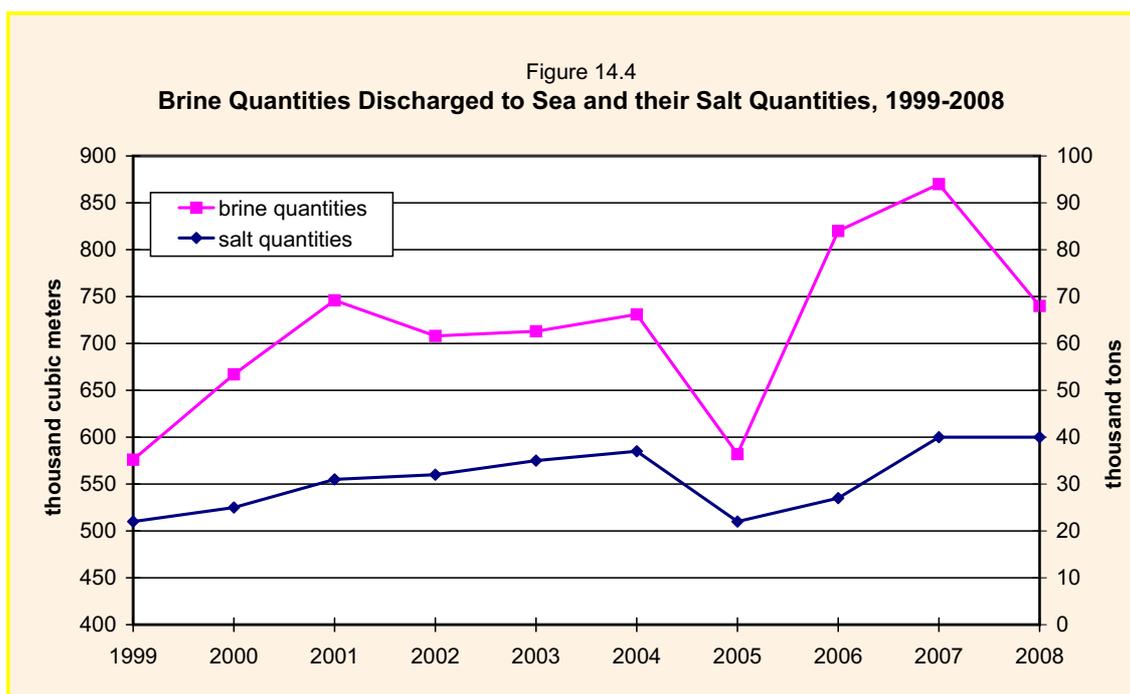
Indicator 14.4

Brine Quantities Discharged to Sea and their Salt Quantities

1999-2008

Why is this indicator important?

Due to Israel's high recovery rate of treated wastewater for agricultural irrigation, it is important to estimate the relative share of salt in industrial use which is disposed to the sea and to assess the effectiveness of oversight mechanisms for preventing the salinity of municipal effluents.



Source: Industrial Wastewater, Fuel and Contaminated Soil Division, Ministry of Environmental Protection

What do the data show?

A trend of increase in the quantity of brines discharged to sea and in the quantity of salt discharged to sea is evident between the years 1999-2008, with some fluctuations over the years. This is due to wide-scale enforcement of industry compliance, and particularly food industry compliance, with the requirement to change production processes, to separate saline streams and to dispose of them separately by means of regulated marine outfalls, rather than the public sewage system. As a result, many industrial plants have begun to dispose of their brines to the sea through marine outfalls which are dispersed along the coast.

C. Agricultural Wastewater

Dairy Farm Wastewater

The dairy farm sector is a leading agricultural sector in Israel with an annual production of some 1,124 billion liters of raw milk per year. Yet, dairy farms are major polluters of the environment due to the uncontrolled flow and infiltration of wastewater and leachates from cowsheds and manure.

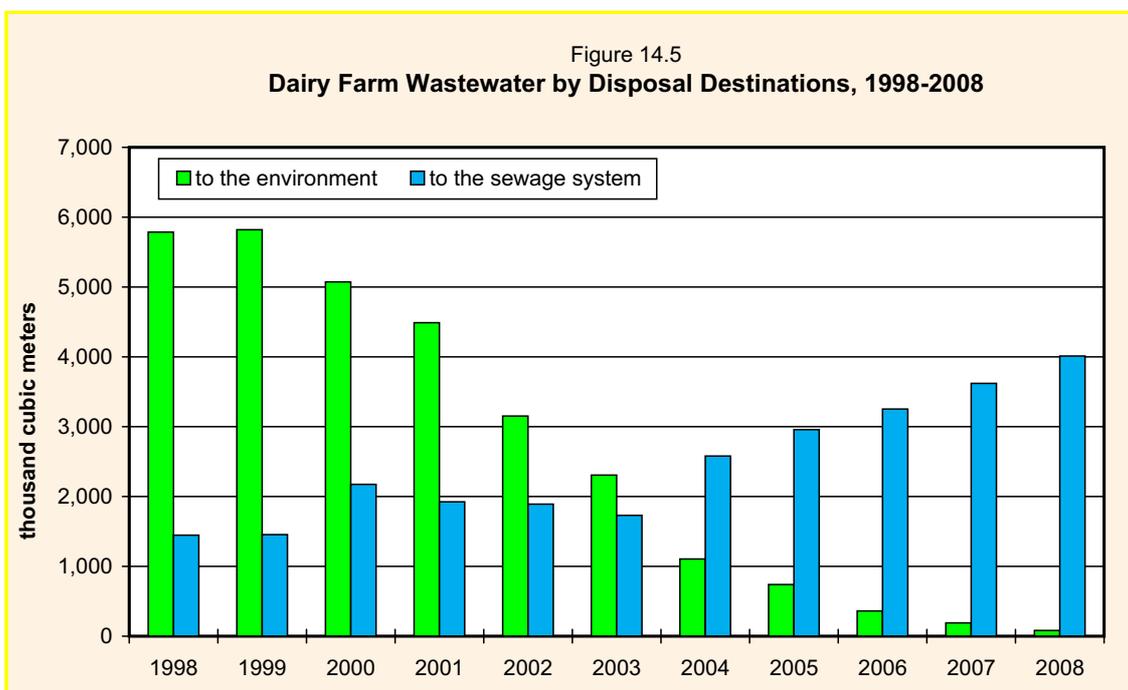
Dairy farm wastewater contains very high concentrations of nitrogen, phosphorus, salts, organic matter, pathogens and other pollutants. Their disposal to the environment without treatment may pollute surface and groundwater, cause odors and lead to aesthetic blight. Treatment of dairy farm wastewater which reduces pollutant concentrations can minimize these hazards.

In 1999-2007, the dairy farm sector underwent a major reform aimed at encouraging greater efficiency in milk production and investing in infrastructure to help prevent environmental pollution from dairy farms.

Indicator 14.5
**Distribution of Dairy Farm Wastewater
 by Disposal Destinations**
 1998-2008

Why is this indicator important?

An estimate of wastewater quantities provides a basis for calculating the scope of infrastructures needed to treat dairy farm wastewater as a pollutant.



Source: Infrastructure Department, Ministry of Environmental Protection

What do the data show?

The total quantity of wastewater decreased in recent years and the percent of treated wastewater increased to nearly 100% of all wastewater.

The increase in treated wastewater goes hand in hand with the reduction in the number of dairy farms, especially small ones, with the establishment of infrastructure for wastewater conveyance and treatment, and with the increased efficiency which is reflected in the reduction of the specific wastewater quantity (cubic meter per cow).

D. Municipal Wastewater Sludge

Sludge is an organic material generated as a byproduct of wastewater treatment in wastewater treatment plants. Sludge is a waste which contains high concentrations of pathogens, heavy metals and organic pollutants, and its distribution in the environment without treatment is responsible for odors and flies. However sludge can also be transformed into a raw material and a resource to be used as a fertilizer in agriculture after appropriate treatment. Additional alternatives for treatment include incineration and landfilling.

Sludge for agricultural use must be stabilized in order to reduce pathogen concentrations to a level below the threshold set in law. Processed sludge, such as compost, is known as Class A sludge.

The only disposal alternative for sludge which is not Class A is its disposal to an approved landfill. This alternative is significantly more expensive than processing to Class A and includes solidifying the sludge to 25% dry matter and paying a tipping fee and a landfill levy. These costs are meant to assure that most of the sludge will be directed to agricultural use after processing to Class A.

The sludge generated in Israel is characterized by relatively low pollutant concentrations (e.g., heavy metals) relative to sludge in Europe and the USA. Moreover, the obligation to process the sludge to Class A level assures its high sanitary quality. These two factors facilitate the transformation of sludge into a resource suitable for unrestricted agricultural use. Diverting sludge to agricultural use instead of disposing it to sea or to landfills replaces chemical fertilizers and reduces pollution due to its treatment to Class A level.

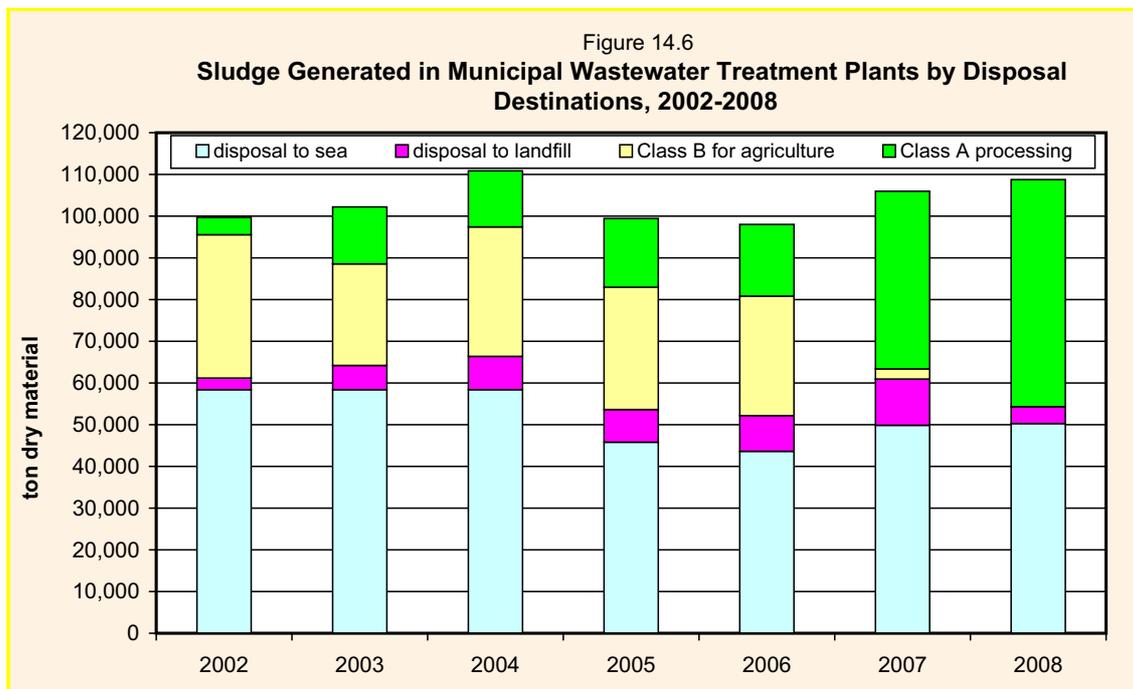
Indicator 14.6

Distribution of Sludge Generated in Municipal Wastewater Treatment Plants by Disposal Destinations

2002-2008

Why is this indicator important?

Follow up of sludge quantities and disposal methods facilitates planning and preparedness for the collection, treatment and distribution of the sludge in the agricultural sector. Furthermore it serves as a tool for estimating the economic potential of the sludge.



Source: Infrastructure Department, Ministry of Environmental Protection

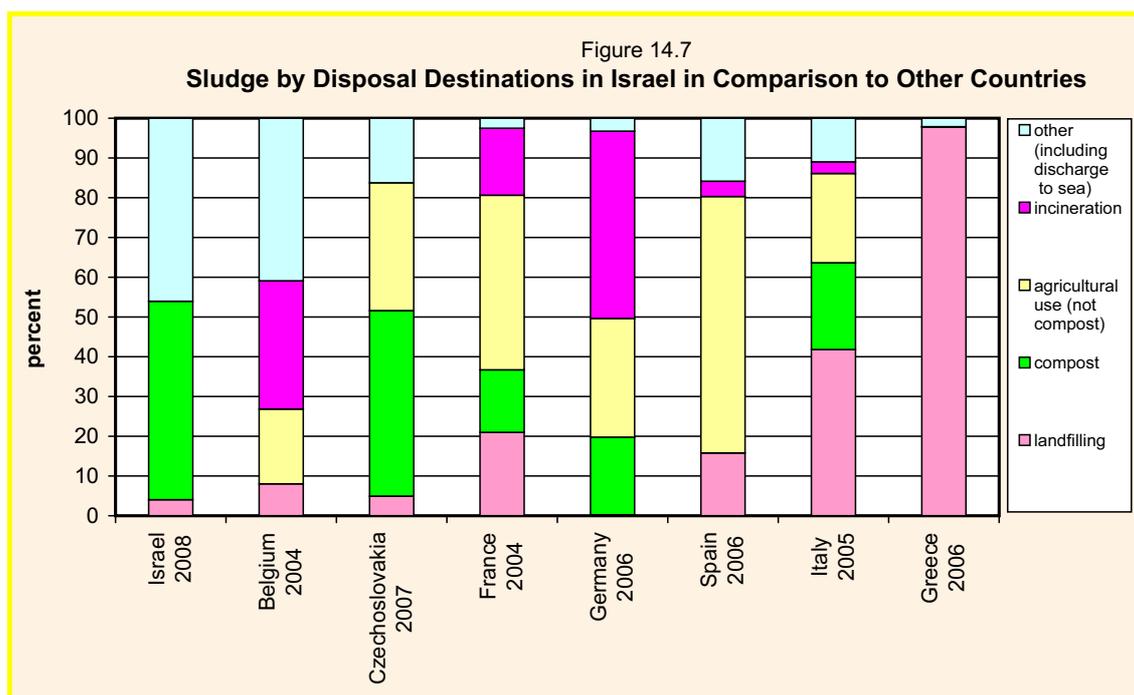
What do the data show?

In 2007-2008, sludge quantities increased along with the increase in wastewater quantities. In this period, the quantity of sludge processed to Class A level increased, and the use of Class B sludge in agriculture was fully stopped in 2008. Today, all of the sludge designated for agricultural application is Class A sludge.

In 2008, 109,131 tons of sludge (dry weight) were removed from 46 municipal wastewater treatment plants. Some 46% of this sludge was discharged to the sea, all of it from the Shafdan Wastewater Treatment Plant which serves the Tel Aviv

metropolitan area. In 2008, some 92% of the sludge disposed to land destinations was used in agriculture, and some 8% was diverted to landfills.

Indicator 14.7
Distribution of Sludge by Disposal Destinations in Israel in Comparison to Other Countries



Source: Israel – Infrastructure Department, Ministry of Environmental Protection; Other countries – European Commission, Eurostat

What do the data show?

49% of the sludge in Israel is directed to the production of compost which is used in agriculture. Israel is the only country where all of the sludge for agricultural use is Class A. Sludge is not incinerated in Israel, but substantial quantities are still discharged to the sea.

Chapter 15

Hazardous Waste

Hazardous waste is generated in industrial plants, hospitals, the agricultural sector, garages and other sectors. These sectors generate, as a byproduct, different types of waste with different risk levels. Additional waste is created from soil contamination (e.g., fuels, asbestos piles) and from industrial raw materials (e.g., organic solvents) which are detected throughout the country and directed for treatment.

A. Hazardous Waste*

Hazardous waste is treated by disposal, recovery and export. Hazardous waste disposal consists of treatment which does not recover or use resources such as landfilling, biological treatment and physico-chemical treatments whose products are landfilled, as well as incineration without energy recovery. Hazardous waste in Israel undergoes stabilization prior to landfilling, and in case of non-compliance with mandatory standards, requires pretreatment to reduce contamination risks to soil and groundwater. Recovery of hazardous waste is preferable to its disposal, and treatment within Israel is preferable to export abroad for treatment or disposal. Export of hazardous waste is approved only when there is no capacity to treat it in Israel or where there is an environmental advantage to treating it abroad. In recent years, Israel has developed the capacity to treat most of the waste it generates within the country, thus conforming to the requirements of the Basel Convention on the Transboundary Transport of Hazardous Waste and its Disposal with regard to national self sufficiency in waste management.

Indicator 15.1

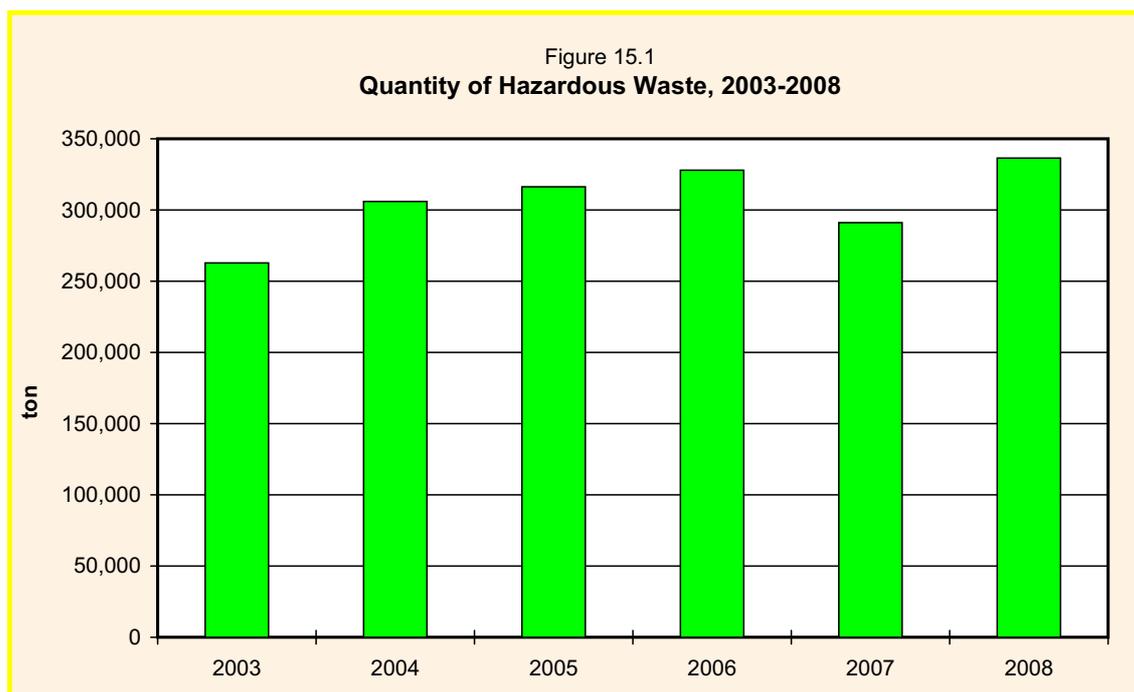
Quantity of Hazardous Waste

2003-2008

Why is this indicator important?

The quantity of hazardous waste is an indicator of industrial activity which uses hazardous substances and an indicator of the risk potential of this waste if not appropriately treated.

* Not including asbestos waste



Source: Hazardous Substances Division and Information and Response Center, Ministry of Environmental Protection

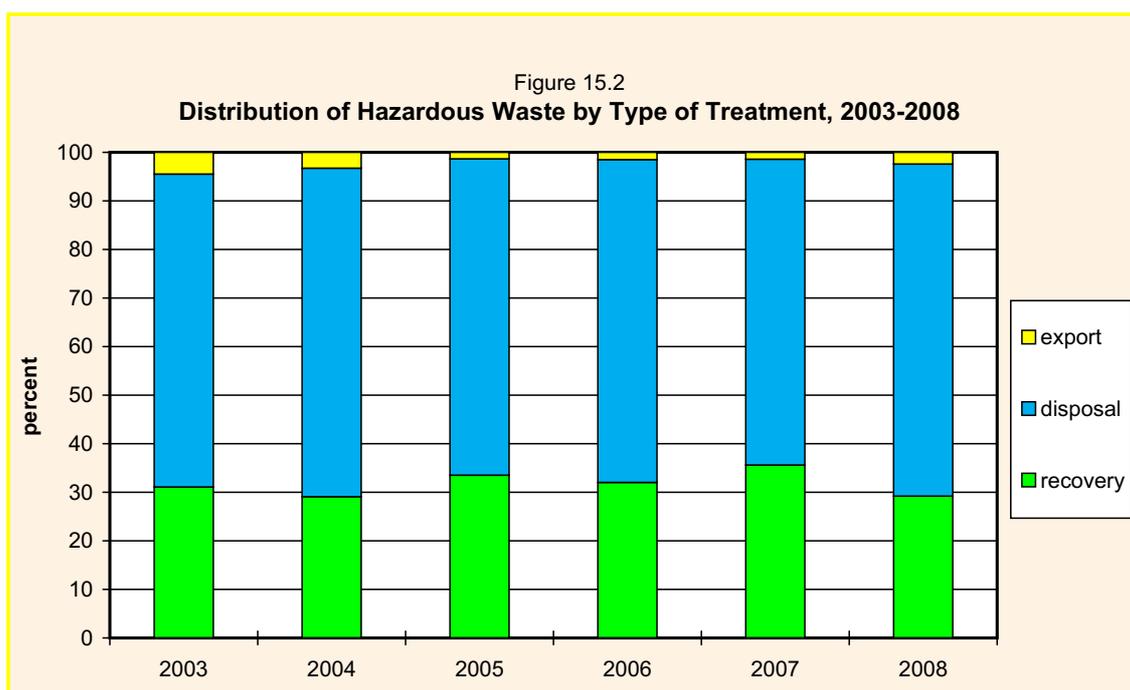
What do the data show?

Hazardous waste quantities have steadily increased over the past decade (the decrease in 2007 appears to be the result of the redefinition of some of the wastes as byproducts with economic value rather than hazardous waste). Some 300,000 tons of hazardous waste per year have been transferred for treatment since 2004, a third of which are treated in the Environmental Services Company Ltd. in Ramat Hovav, Israel's national center for the disposal and treatment of hazardous waste. Since only wastes which are transferred for treatment are reported to the authorities, this increase reflects improvements in environmental management in Israel. In addition, increased waste quantities may also represent an increase in industrial activity in Israel.

Indicator 15.2
**Distribution of Hazardous Waste by Categories:
 Disposal, Recovery and Export**
 2003-2008

Why is this indicator important?

Follow up of the distribution of hazardous waste by type of treatment is important in order to plan actions, including the establishment of infrastructures and enforcement.



Source: Hazardous Substances Division and Information and Response Center, Ministry of Environmental Protection

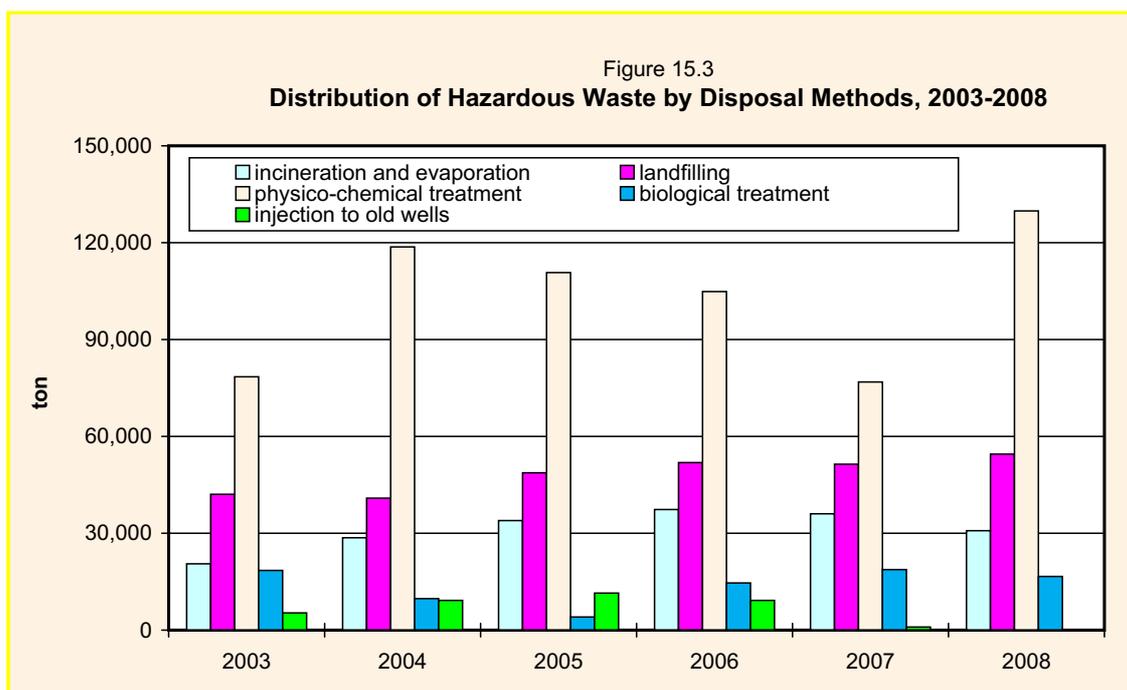
What do the data show?

Between 30% and 40% of the hazardous waste undergoes recovery processes. This figure has remained stable through the years.

Indicator 15.3
Distribution of Hazardous Waste by Disposal Methods
 2003-2008

Why is this indicator important?

See Indicator 15.2.



Source: Hazardous Substances Division and Information and Response Center, Ministry of Environmental Protection

What do the data show?

Between 2003 and 2007 the quantity of landfilled waste increased, although the percent directed to landfilling did not increase significantly and remained about a quarter of the total hazardous waste disposed (about 50,000 tons per year). Fluctuations are evident in the quantity of hazardous waste for incineration and evaporation and in the quantity of waste undergoing physico-chemical treatments. Only one incinerator for hazardous waste operates at full capacity in Ramat Hovav in Israel, and some 35,000 tons of waste undergo incineration and evaporation in this facility. The quantity of waste which undergoes biological treatment varies since most of this waste originates in soils contaminated by organic matter, which are discovered during tests conducted by the Ministry of Environmental Protection or during spills from tankers rather than during production processes. In recent years, additional plants which offer physico-chemical

treatments outside of Ramat Hovav have been established, and a third of all of the hazardous waste undergoes these treatments. The quantity of waste injected into old oil wells has decreased sharply and was finally stopped in 2008 as per a directive of the Ministry of Environmental Protection.

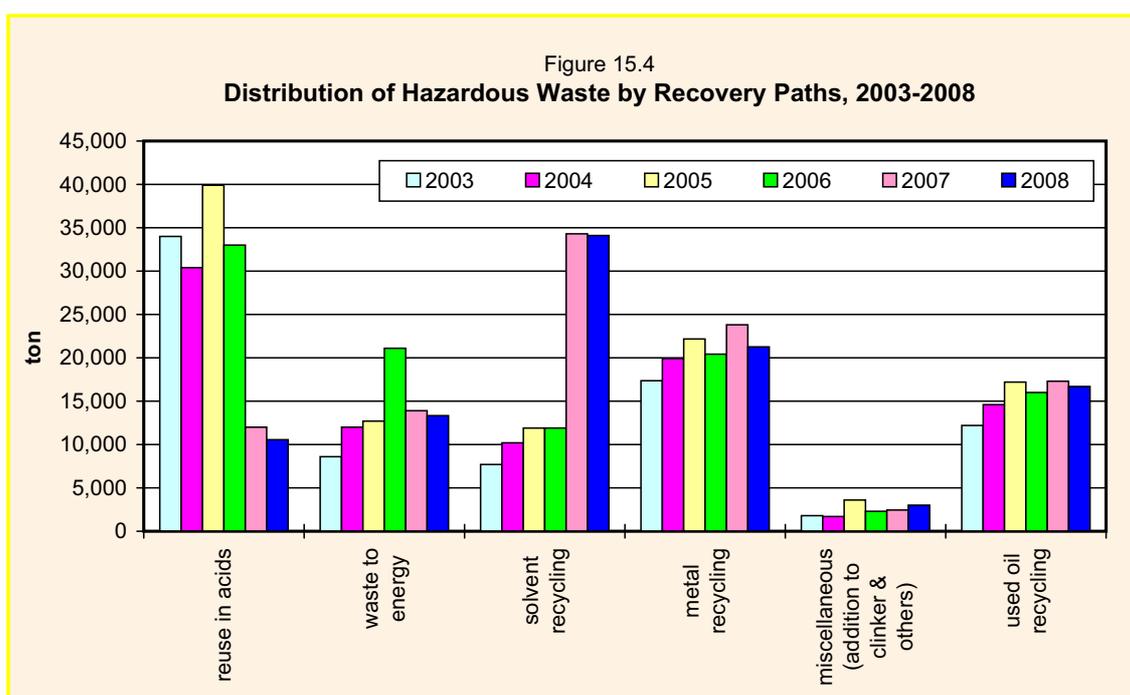
Indicator 15.4

Distribution of Hazardous Waste by Recovery Paths

2003-2008

Why is this indicator important?

Follow up of recovery trends of different types of hazardous waste facilitates a review of its environmental and economic potential so as to increase the percent of recovered waste beyond the rate of landfilling or incineration.



Source: Hazardous Substances Division and Information and Response Center, Ministry of Environmental Protection

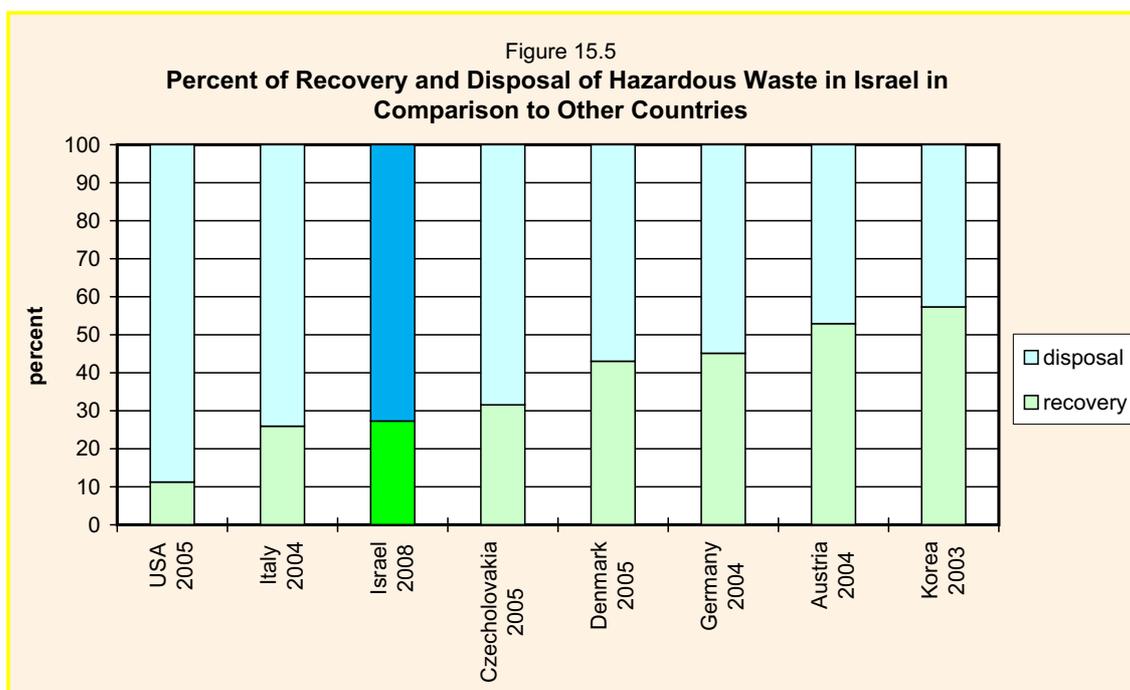
What do the data show?

Recycling of industrial solvents increased significantly in recent years and is largely attributed to the growth in production in the pharmaceutical industry. The increase in solvent recycling and oil recovery may also reflect the increased economic value of

recovering these materials, as well as increased enforcement of the collection of this waste. On the other hand, acid recycling has declined sharply, which is attributed to the redefinition of certain types of waste which are no longer included in the total count of hazardous waste types.

Incineration with energy recovery largely takes place in the Nesher Ramle cement plant since 2001.

Indicator 15.5
Percent of Recovery and Disposal of Hazardous Waste in Israel in Comparison to Other Countries
 2003-2008



Source: Israel - Hazardous Substances Division and Information and Response Center, Ministry of Environmental Protection; Other countries – OECD Environmental Data Compendium 2006-2008

What do the data show?

The percent of recovered waste in Israel is similar to countries such as Czechoslovakia and Italy and significantly lower than countries such as Korea and Austria.

B. Asbestos Waste

Asbestos is a hazardous dust which is a proven carcinogen. Asbestos only poses a health hazard when it is crumbled or crushed and when fibers are released to the air. Asbestos-cement is used as a construction material in industrial, agricultural and residential buildings, and as a material from which flat and corrugated sheets are made to cover walls and roofs, water and sewage pipes, chimneys, drainpipes, roofing tiles, planters and water containers. Crumbling may be caused by drilling, sawing, cutting, sanding and more.

Friable asbestos is an asbestos containing material which can be crumbled or reduced to powder by hand pressure when dry. Friable asbestos-containing materials have a much higher potential for the release of fibers than asbestos-cement.

Asbestos products are no longer produced in Israel and the use of asbestos in new building is prohibited as of 2005.

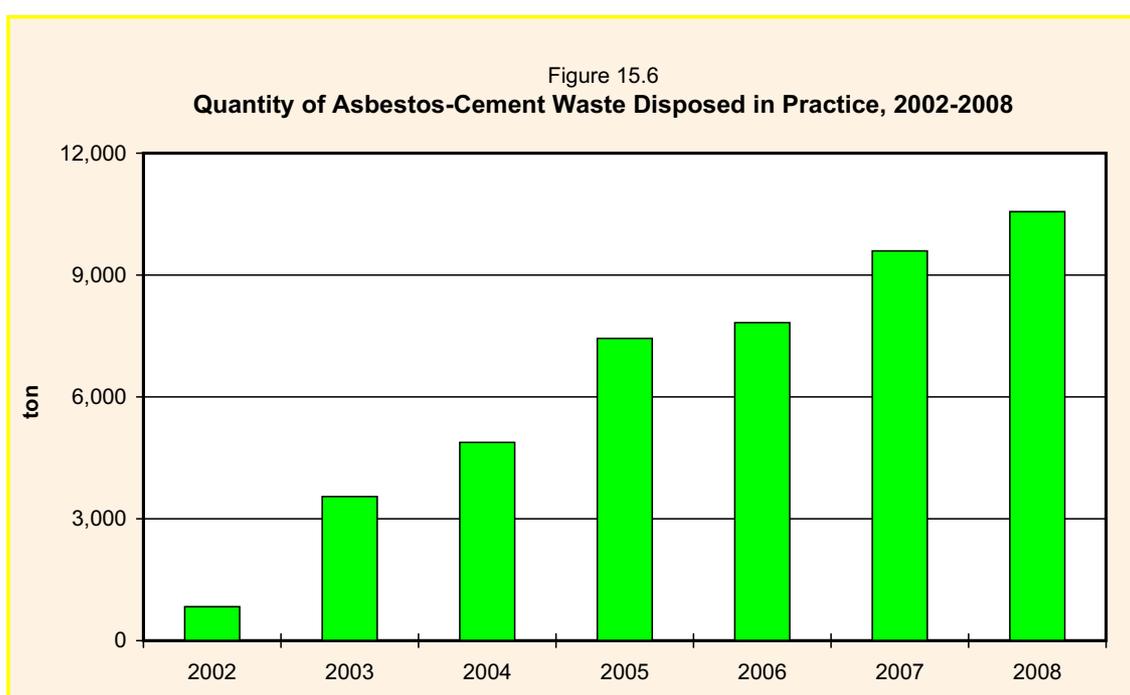
Indicator 15.6

Quantity of Asbestos-Cement Waste Transferred to Approved Landfills for this Waste

2002-2008

Why is this indicator important?

The quantities of asbestos waste which are transferred to landfills in an appropriate manner reflect the growing regularization of this field and the awareness of safe treatment and disposal of asbestos waste.



Source: Asbestos and Hazardous Dust Division, Ministry of Environmental Protection

What do the data show?

The quantities of asbestos waste which are transferred to regulated landfills have increased sharply in recent years. This demonstrates that gradually less asbestos waste is haphazardly discarded to the environment.

This trend of increase is expected to continue in coming years as a result of increased public awareness, the enactment of a new law on the prevention of asbestos hazards, and government allocations for the removal and disposal of asbestos cement structures and for the cleanup and disposal of friable asbestos from the Western Galilee.



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