

Israel Adaptation to Climate Change Policy Recommendations

ICCIC 2nd Report

Executive Summary

General

The Israeli Ministry of Environmental Protection is preparing a national program for Israel's adaptation to climate changes. This program is oriented towards policy formation and measures, which will be applied with respect to climatic changes in order to reduce the negative implications of global changes such as increasing temperatures, drought and increase in extreme climatic events, among others.

The Israeli Climate Change Information Center (ICCIC) was founded in March 2011, at the University of Haifa by the Ministry of Environmental Protection. The Work of the ICCIC will be used as a platform for an Israeli national adaptation plan in accordance with the Governments Resolution 474 which was adopted on June 2009. The main goal of the ICCIC is to develop a national scientific knowledge base that will support the development of the national adaptation plan. The Plan will cover the specific areas covered in ICCIC, as well as an integrated plan that will minimize future costs associated with climate change.

Recently, the adaptation policy for climate change had become a key issue in the negotiations on future climate change prior to the termination of the Kyoto Protocol in 2012. The difficulties in applying national and international mitigation policies, and the growing recognition of the impacts of climatic changes, has brought into focus the importance of adaptation in both science and in policy formation.

The purpose of ICCIC is to gather and integrate available research and policy documents concerning adaptation to climate changes, in order to identify knowledge gaps in various relevant areas, to recognize the risks and implications of climate change and to propose a national policy of adaptation. In addition, the purpose of the ICCIC is to collate Israeli

scientific and technological knowledge that can be applied and marketed within Israel and in other countries.

The work process of ICCIC includes activities in the following areas: climate, water resources, public health, biodiversity and green building. All these areas were also re-examined, for their geostrategic and economic aspects. Each area of activity has an appointed scientific director and a steering committee that involves stakeholders from academia, industry and environmental NGOs, as well as participation of representatives from the Ministry of Environmental Protection as well as other Ministries. Each group works together as a multi-disciplinary think tank, supporting the work process. The steering committees in the relevant areas meet quarterly and direct the work of the teams.

In addition, an internet site has been established, allowing access for all the members of the steering Committees as well as the Government's representatives. The site includes relevant research literature, research reports, national adaptation plans to climate change from around the world, summaries of discussions and symposia, etc. The internet site is a platform for expansion with plans to open the site in the future for use of the general public and the scientific community. The first report (which was submitted to the Ministry of Environmental Protection on November 2011) reflects the existing knowledge regarding the implications of climate change on the State of Israel. It was based on scientific research in general, and from Israel in particular, and identified the current gaps in knowledge. The report includes not only the identification of existing research gaps, but also provides detailed recommendations about the prioritized research requirements (short-term and long-term). This will enable the Ministry of Environmental Protection and other Ministries as well, to set priorities for the required research.

In recent months, symposia in each of the areas were carried out including oral presentations, publications and focused discussions of the impacts of climate change with participating specialists from Israel and abroad. The findings of the symposia and comments from the specialists were incorporated and updated in Report 1. The full report (In Hebrew) of the ICCIC can be found [here](#) and an abstract [here](#).

The summary of Report 2, submitted here, is complementary to Report 1 and focuses on the proposed national adaptation policy in the relevant areas and in detailed international marketing of the ICCIC activities.

During the work process of the different teams, all the various measures to cope with climate change were surveyed in order to determine the economic resources that should be

invested, even if the effects of climate change turn out to be less severe. These options are defined as "**No Regret alternatives**".

The specific areas that are investigated in this summary are as follows: First, under Climate, the climate changes that are predicted for the next 50 years are presented. Second, specific policies are presented for water resources, public health, biodiversity and green building.

Finally, the mutual connections amongst the above-mentioned areas are analyzed in a multi-disciplinary manner using Geostrategic and Economic perspectives.

The ICCIC team

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Anticipated Climate Changes in Israel

The Northern part of Israel is characterized by a Mediterranean Climate whereas its Southern part is arid. In the area between the two, there is a narrow belt displaying a semi-arid climate. In this zone of varying climates, there are significant climate changes which, as a result of the impacts of the weather systems, have different synoptic characteristics. This is expressed by a great variability of the temperature and especially precipitation regimes.

The most crucial component in the climate of Israel is the rainfall regime that has impacts on many areas. 75% of available fresh water in Israel comes from the rainfall. Thus, any change in the rainfall regime, namely the total annual rainfall, its seasonal distribution, its instantaneous intensity, the timing of the rainy season, the dry spell distribution during the rainy season, the number of rain-spells, and their yield, are all crucial for the water resources of Israel.

Recent trends in the temperatures in Israel, during the last few decades, reveal a decrease in temperature (minimum, maximum and average) from the 1950's to the 1970s. Since then a rise has been observed through to 2000 and then a stability in the temperatures identified for the last decade, yet, higher than the 50's. In addition, there is a trend of growing uncertainty in the temperature regime. Precipitation over the same period, demonstrated no statistically significant trend in majority of the country, but with a tendency to reduction in amount.

Future predictions show that for most of the surveyed variables (temperature and rainfall regime, extreme weather events – heat and concentrated pollution waves) the scenarios for the future forecast temperature rise, reduction in the amount of rainfall, increase in frequency and strength of specific extreme weather events. Several global climate change scenarios predict a future rise in temperature for our region, at an average rate of 0.3°C–0.5°C per decade. The climate scenarios, if realized, may affect a variety of areas in the economy and society as a whole (including water resources, agriculture, public health, coastal protection, energy, geo-strategy, biodiversity etc.).

The main recommendation of the Climate Team

- a) A need to expand the meteorological network in Israel. It is highly recommended to install new stations in nature reserves, assuming that there will be no anthropogenic stressors there in the future and that the data will be homogeneous and will accurately reflect the environmental conditions (unlike the data in many current meteorological stations which are highly disrupted by the surrounding human activities).
- b) Further research on the relationship between synoptic situations and the precipitation characteristics (quantity, intensity, duration).
- c) Expansion of research in relation to climatic modeling with downscaling to suit Israel with its specific geographical location and topographic variability.
- d) General all-inclusive study, relating to a very long time period, on the distribution of extreme cold and heat events, taking into consideration their intensity, duration, seasonal timing and the target areas.
- e) Enhancement of monitoring of the pollution in urban centers.
- f) Monitoring and mapping of the urban heat island annually, with particular focus on the function of urban parks in the mitigation of the heat and pollution concentrations.
- g) Evaluation of the expected changes in the Mediterranean Sea level based on various global climate scenarios.

The main recommendation of the Water Resources team

The water resources of Israel are going to be highly affected by the expected climate change. A significant reduction of water in Lake Kinneret (Sea of Galilee) is expected as a result of the decrease in precipitation. The reduction in rainfall in the basin shows a wide variation: ranging from 300% in the semi arid areas of the basin, to 50% in the wetter areas. In the last few decades, a reduction in rainfall has been documented in the areas that feed the Jordan River, and this is reflected by the flow of the large springs and the decrease in the volume of water that flows into Lake Kinneret. A significant reduction in precipitation was also found in the southern region of Israel. Changes in the nature of rainfall and the growth of extreme weather events, is likely to increase flooding and surface run-off, and also reduce the replenishment of water storage. The difference between the natural water supply and the demand for water will be bridged by the desalination of saline and sea-water, and undertaken by the expansion of waste-water treatment plants and the improvement of their quality in order to adapt its use to all agricultural crops. Nevertheless, desalination and waste-water treatment consume large amounts of energy and produce various pollutants including

greenhouse gases (GHG). It is necessary to consider the environmental pollution and the extended pollution of the water resources, which are an inseparable part of the processes employed by desalination and waste-water treatment. Henceforth, the discussion of policy alternatives in the water sector will present strategies, measures and methods which are ranked from the most desirable ("No Regret") to the least desirable ("High Regret").

For each strategy the discussion is based on 3 sources:

- 1) Research and policy documents from Israel and the World.
- 2) Adaptation policies (15 adaptation plans are discussed in detail).
- 3) Experts and stakeholders views (steering committees discussions, symposia, stakeholders' survey).

The stakeholders' survey included (only) 18 respondents. The stakeholders had to rank 19 general approaches for two time-periods: 2011-2019 and 2020-2050. Also, the respondents were asked to identify the regions and governmental levels that will be targeted for the adaptation activities.

Altogether, 31 detailed strategies of coping with the climate changes effect on the water sector of Israel are presented; mostly "no regret" strategies and few are "low regret" strategies. The most widely used strategy in Israel- desalination, is classified as a "high regret" strategy. As the discussion is focused on the "No/Low Regret Strategies", desalination is not included. It is recommended that after 2013, when 600 million cubic meters of desalination-water will be available for the use of the domestic sector, further desalination (already planned to reach 750 million cubic meters by 2020) must be carefully examined and compared to other strategies that produce cheaper water resources with less environmental impacts.

The main recommendations of the water Resources Team:

- a) Research, information collection, education, interpretation, and raising awareness of the public;
- b) Extensive use of water saving devices, the management of water losses from the piping systems and the reduction of water waste;
- c) Further increase in Waste-Water treatment;
- d) Prevention of water pollution, the repair of contaminated wells and the preservation of the quality of water-resources;
- e) Water sensitive planning and the protection of infrastructures;
- f) Rain harvesting from surface areas and small drainage basins;
- g) Re-use of gray water;
- h) Re-use of treated water.

The main recommendation of the Public Health team

Public Health is affected by climate in several ways – directly by physiological effects and indirectly through the climatic impact on chronic and contagious diseases, and also on mortality rates and health problems as a result of external factors.

Climate change may result in long-range negative effects on public health. It is important to note, that the impacts of the climatic change are exacerbated by increased local air-pollution which has significant effects on public health. In light of the great uncertainty, we need to adopt the perspective of "No Regret". This perspective is founded on the resource allocation for preparatory strategy, which will have a positive effect on public health, with, or without climate change effects. The World Health Organization (WHO) calls for reinforcing the public health systems and response plans for emergencies as well as for strengthening the research undertaken around the world.

The national and international monitoring networks and adaptation policies for climate change must be complemented by strategic response in order to be efficient. Direct and indirect impacts of climate change include diseases associated with extreme heat and cold conditions, diseases that are transmitted by vectors and water exacerbation of cardiovascular and respiratory diseases as a result of air pollution, and mental stress.

It is expected that the vulnerability of the population will vary by geographical location, and adaptation efforts must be carried out at the local level. Adaptation strategies for climatic changes must be tailored to respond to acute events and the prevention of future events. This will be crucial for the most vulnerable populations: children, pregnant women, people with chronic diseases and the poorer sector of the population. In the process of adaptation, attention has to focus on both the impact of extreme weather events and on the effects of gradual changes in temperature and rainfall regime.

Interventions that aim at mitigating the composition of the atmosphere such as a reduction in the use of conventional sources of energy also cut the direct impact of air pollution on human health. This is an example of an intervention of "No Regret".

Improvement of air quality, the creation of more "green" neighborhoods and support for healthy lifestyles are also "No Regret" processes. Such processes will reduce the frequency of the risk factors for chronic diseases, and as a result will lead to a decrease in the occurrence of diseases such as osteoporosis, cardiovascular diseases, respiratory diseases and depression.

The main recommendations of the Public Health Team include real-time monitoring and coordinated response to extreme events (heat/cold waves, floods, nature disasters), along

with coordinated adjustments to gradual changes that may bring outbreaks of diseases due to the invasion of new disease vectors.

In addition, the Public Health Team recommend an improvement in the preparedness of the Health System, such as appropriately equipping medical institutions with air-conditioning, training for responding to extreme events, including raising awareness and preparation of the population etc.

The main recommendation of the Biodiversity and Ecosystems Services team

In its widest meaning, biodiversity is defined as the variety of all forms of life, from genes to species, through to the broad scale of ecosystems, landscapes and biomes. Biodiversity is expected to be extensively affected by climate change which will be accompanied by changes in the ecological services the natural ecosystems provide to human welfare.

It is expected that an increase in drought frequency will lead to an extensive mortality of woody vegetation in various geographical locations in Israel. A reduction in precipitation and higher temperatures will exacerbate this trend. Mortality of woody vegetation may have far reaching effects on ecosystem functioning including water regime, soil erosion, nutrient cycling and the abundance of biota and micro-organismic populations. In addition, a shift in wildlife and flora species distribution is expected, particularly at the ecotones between arid and Mediterranean ecosystems. These changes will affect the structure and function of the ecosystems in several areas in Israel. Furthermore, it is expected a rise in the number and duration of fire risk periods in the Mediterranean forests. The greater frequency of fires may overcome the natural generation capacity of the forests and this may drastically change the structure/composition of the flora and the ecosystems.

Aquatic ecosystems were deeply affected through the years by man-made pollution, freshwater overexploitation and development pressures. Considering that climate change will lead to higher temperatures, a greater evaporation and a reduction in precipitation, will enhance water pumping and will consequently aggravate the deterioration of these ecosystems.

Specific species or those which are sensitive to salinity, temperatures and/or oxygen concentration may disappear from the ecosystem and will be replaced by more robust species, either local or invading species.

Reduction in rainfall and the expansion of evaporation will shorten the endurance of seasonal pools or may even halt them completely. Swamps and perennial rivers may degrade permanently and become irreversible as a result of a transition from annual and permanent

presence of water to a seasonal temporal one, in which the biota that needs permanent presence of water will completely disappear.

As for the marine ecosystem, it is expected that in the Mediterranean the current invasion of tropical species from the Red Sea through the Suez Canal will transform the Mediterranean ecosystem, which will lose its unique nature and will become similar to tropical marine ecosystems. The acceleration of sea water acidification (as a result of increasing CO₂ concentrations) may exacerbate the erosion of the sea cliffs and lead to the collapse of the unique abrasion platforms. In addition the benthic and sub-benthic zones, along with their biodiversity, will be influenced by the sea-level rise that is expected as an outcome of temperature rise. In the Gulf of Aqaba, coral bleaching may accelerate, a process connected to the sensitivity of symbiotic algae in the corals to high temperatures leading to the corals mortality. Although, until now, corals in the Gulf of Aqaba were not significantly affected by climate change, the rising temperatures may exacerbate this process. It is expected that ecosystem services will deteriorate in the following: provision of drinking water, genetic resources, prevention of soil erosion, regulation of invasive species, pest control and pathogens, recreation and cultural services.

The fisheries composition and stocks in the Mediterranean Sea will change and will include more species and individuals from the Red sea. As the impacts of climate change on the biodiversity are complex and the existing knowledge is poor, it is important to manage the natural ecosystems with full considerations of the levels of uncertainty. Measures and strategies that are known for having positive effect for ecosystem stability should be adopted in any scale, pace or trend of climate change. Non-fragmented ecosystems are more stable and more resistant to changes. Therefore, the most important strategy to preserve biological diversity under climate change is adopting managerial policy which will reduce the sources of negative impacts which are not necessarily connected to climate change. The main "No Regret" strategy is reduction of the pressure on freshwater ecosystems and realization of nature right for freshwater as stipulated by the Government, and conservation of open areas and the corridors between them. The map of protected areas in Israel must be updated and ecological corridors should be secured between them. Also, development and construction should be limited in accordance with the National Master Plans and illegal construction should be prohibited and "legitimation" of such offences should be stopped.

In reference to the legal systems, enforcement of laws which prevent or limit negative effects on open areas and nature in marine and terrestrial ecosystems must be issued and public awareness to those must be reinforced. Furthermore, the current legislation must be updated and a specific targeted policy for the conservation of the biodiversity must be

issued, together with enhancement of the coordination among legal measures which were established for the preservation of the biodiversity.

In addition, management of invasive species must be dealt with by a professional committee which will establish criteria for the introduction of new species to Israel and will provide recommendations, priorities, and means to deal with invasive species which succeeded in their invasion. Agencies which are responsible for law and enforcement will be responsible for application of those recommendations and act in order to locate and eradicate invasive species. In this context, the health aspects of the invasive species, particularly invasive disease vectors should be dealt with. In general, the recommendation is to invest conservation efforts to preserve natural ecosystems and habitats in its integrity and not in few individual or target species. For species that the major stressor is climate change, conservation of those outside their original range may have educational or scientific value, but their contribution to the existence of the natural systems is low.

In order to improve the capacity to adapt to future changes, the existing knowledge must be reinforced. There is a special need in a long-term monitoring research into evaluation of thresholds of climatic variables which may de-stabilized ecosystems and targeted research on management of sustainability of natural habitats and ecosystems to a more arid climate, and development of strategies to rehabilitate affected ecosystems.

Also there is a need to reinforce the multi-sources ecological system ("Maarag" in Hebrew) as a national body which will strengthen the ties between science and management and which will apply in the management of nature systems the acquired knowledge.

The main recommendation of the Green Building team

Green Building is often perceived as an area in which mitigation of GHG can be accomplished, since the building sector is responsible for 40% of the global energy consumption and for one-third of greenhouse gases emissions. Nevertheless, the expected climate changes force us to shift our perception in relation to the adaptation of cities and buildings to it (shading, wind exposure, thermal comfort in the buildings themselves and in open areas, and the adaptation to extreme events such as fires, flooding, sea-level rise, etc). It is important to note that most of the benefits of mitigation are not felt in the short term, but after a few decades, hence, adaptation is necessary in order to respond to impacts at the present and in the near future. Thus, with no mitigation, the impacts of climate change will reduce the effectiveness of the adaptation to it significantly.

The challenges that are caused by the accelerated rates of urbanization exacerbate the responses to climatic changes, on the one hand, but open opportunities for the establishment

of general strategies of adaptation and mitigation, on the other. The population, companies and municipalities will become a central factor in the development of these strategies.

The measures needed for the advancement of Green Buildings are categorized as legislation, economy, training and education and information. All these four "wheels" are essential for the ignition of the process and coordination amongst the four is necessary for an efficient policy.

The main recommendation in the Green Buildings sector includes the establishment of a governmental agency that will become home for the promotion of the idea of sustainable green buildings in Israel. This agency will coordinate activities and share information, and within that framework, information centers for planners and users will be developed.

There is a great importance in raising public awareness to climate change and to sustainability and energy savings in buildings in particular. Short term targets, that will enable these savings, in combination with the provision of economic incentives for the encouragement of Green Buildings as well as the application of mandatory regulations for energy rating and tagging of new and rehabilitated buildings, need to be updated on a regular basis.

A long term target for the reduction in energy use and the mitigation of GHG emissions within buildings and construction must be mandated.

As a norm, educational and public buildings should be designed as Green Buildings in order to serve as an example to all other sectors. On the subject of training, courses on energy saving buildings, sustainable design and coping with climate change should be integrated at all levels of study at the universities.

The main recommendation of the Geo-strategy team

The interdisciplinary geostrategic perspective on climate change points to three major risks induced by climate changes that will affect Israel. These are water scarcity, sea level rise, and an increase in temperature that means warming, increased drying and larger number of extreme events. In addition, many other areas will be influenced by the combined effects of Climate Change: transportation, energy, the possible effects on national infrastructures, tourism, fires, migration, geopolitics etc. Other possible conflicts resulting from climatic changes include food security, impacts on the Israel Defense Forces (IDF) and the whole defense system, Israel's foreign policy and national security.

The effects on Moslem states and the possible dependence on foreign aid in times of crisis will have to be allocated for preparedness and adaptation in the future. .

The analysis of those processes is carried out in four spatial circles: Within Israel, the closest circle of neighboring countries to Israel, a secondary circle which includes the Arab Moslem states nearby and the rest of the world in the third circle. It was found that climate changes will have profound effects on Israel and her neighbors. It was also realized that there is a lack of sufficient knowledge in areas such as shifts in the geostrategic balance of power in the Middle East, issues concerning water resources, migration patterns to Israel, around Israel or through Israel, accelerated energy consumption, food availability and preparedness for the forthcoming climatic changes of the Defense system.

The main recommendation is that Israel will turn the threats and risks of climate change to a lever to advance projects that Israel has to carry out any case ("No Regret" strategy): enhancement of water production; completion of the construction of separation fences between Israel and her neighbors; preservation of agricultural land; securing food supply and storage; new policy in the development of sub-ground constructions; securing energy supply including local natural gas resources, and perhaps nuclear energy in the future; Adaptation of the IDF to the changing conditions including the location of facilities and bases (for example their proximity to forests with high fire hazard, and other forms of vegetation); changes in army training regimes, construction of installations and facilities that are better adjusted to the changing conditions and further adjustment of military outfits, food and disease prevention.

The main recommendation of the Economics team

The interdisciplinary economic perspective relates to all the impacts presented by the various teams and estimates their effect on the Israeli economy. The economic costs of expected climate changes without any actions of mitigation and/or adaptation are estimated for developed countries, as Israel, on average at 0.5% of GDP per year and is expected to grow to 1-5% a year (of GDP) until the end of the 21st century and beyond. The economic chapter focuses on qualitative evaluation of costs and benefits and the activities and policies of Israel in each area, as well as the preparedness to activate it at the right time by providing policy makers the appropriate managerial and financial resources. The focus on policies is carried out for activities that are classified as climate change "No Regret" strategies producing benefits even in cases where no climate changes occur.

In order to guarantee economic efficiency, we recommend public promotion of adaptation strategies in markets where the private sector alone cannot reach socially optimal levels of adaptation. Therefore, with the aid of the other teams of the ICCIC, the markets' failures in the process of adaptation were identified and also projects and specific "No

Regret" policies that will expand social welfare, even if the climatic scenarios are not realized in all their expected severity. Structural transformations as well as minor changes were considered.

The alternative recommendations are presented in each of the surveyed areas and include the following:

- Description of the priorities;
- Reference, Governments relevant resolution;
- Accompanying benefits;
- The recommended policy for application;
- Identification of possible barriers;
- Identification of relevant Government Departments.

The development of the adaptation policy for climate change included initially the outline climate change and economic growth scenarios in order to depict the possible impacts of climate change (ICCIC Report 1). Next, examination of possible adaptation strategies and their risk were assessed. Accordingly, a general evaluation of the adaptation policies was carried out by using data from existing evaluations and/or feedback from specialists (The steering committees of the various teams). The following steps of the process should include detailed research on selected adaptation policies, recommendations on the appropriate policies, a determination of the efficiency index, a time range for each type of policy and an evaluation of the efficiency of all the policies.

Thus, it is possible to summarize the recommended policies in 3 main categories:

1. **Enhancement of the availability of information:** the major conclusion of the interdisciplinary analysis of the initiated adaptation is that availability and distribution of information will improve the economic efficiency. In our view, a "No Regret" adaptation policy should focus on these activities that prevent market failure of "asymmetric information".
2. **Water resources strategy change:** Change the focus from managing water supply to prioritizing and managing the water demand. In contrast to Israel's current policy for water resources, the efforts should maximize the improvement of water supply efficiency, water recycling, prevention of water losses and the improvement of the water demand management before investing in desalination plants that carry out high external costs.
3. **Regulation that stimulates the autonomous adaptation of markets:** there are areas where private benefits of adaptation are greater than costs; yet autonomous adaptation activities are avoided as a result of lack of public awareness or due to bureaucratic

limitations (e.g. green building). We suggest implementing public policies and regulations focusing on supporting autonomous adaptation actions that alternatively would not be implemented.

Based on the findings of the report, an international marketing program was prepared stating the capabilities of ICCIC, its relative advantages in comparison with similar centers around the world and the means to marketing itself to the world. In order to promote ICCIC to an authoritative leading organization on a global scale, marketing activities are described in detail.

In addition, other areas which are vulnerable to climate change were not treated, yet, by ICCIC. Those include energy and electricity, agriculture, tourism, transportation, sea level rise, local government and more. Without dealing with those areas in depth, no general picture of Israel's needs in adaptation can be drawn.