



Three reports by the Israeli Climate Change Information Center are paving the way for the preparation of national and local adaptation plans in Israel

How to prepare for climate change? How to reduce the adverse impacts of climate change? Countries worldwide have been grappling with these questions for years.

In Israel, an Israeli Climate Change Information Center (ICCC) was set up by the Ministry of Environmental Protection in 2011 in the wake of a 2009 government decision on the preparation of a national climate change adaptation program. Established at Haifa University, in cooperation with Tel Aviv University, the Technion and the S. Neaman Institute in the Technion, the Center is dedicated to compiling the scientific knowledge base and the policy documents which will be integrated in the national plan.

For nearly three years, multidisciplinary think tanks, made up of representatives from government, academia, industry and NGOs, have compiled the existing knowledge in such areas as climate, water resources, public health, biodiversity

and green building and have analyzed these areas on a multidisciplinary basis using geostrategic and economic perspectives. They identified the risks and implications of climate change and the knowledge gaps in each of these areas and submitted their recommendations on prioritized research requirements, on the proposed national adaptation policy, on ways of marketing the scientific and technological knowledge collated by the ICCIC for application in Israel and around the world and, most recently, on the implementation of adaptation measures in local authorities.

Predicted Climate Changes in Israel

The northern part of Israel is characterized by a Mediterranean climate and its south by an arid climate, with a narrow, semi-arid strip in between. Frequent weather changes are common in this climate zone due to the effects of climate systems with different synoptic characteristics.

This is reflected by variations in both temperature and rainfall.

Global climate forecasts predict an average warming of 0.3°C-0.5°C per decade, a reduction in rainfall and an increase in the frequency and strength of extreme weather events such as heat waves and floods in the Mediterranean region over the next fifty years. In practice, the past four decades have demonstrated an average increase of 0.5°C in temperature per decade in the Mediterranean Sea area.

Furthermore, a trend of rising seawater levels, totaling more than 10 cm, was recorded in the Mediterranean Sea over the past two decades, consistent with scenarios which range from 1 to 10 cm per decade. Such a rise is associated with increased flooding along the coastal plain and increased intrusion of seawater to the coastal aquifer which leads to salinization. Wave storms with wave heights exceeding 3.5 meters have also increased along with exceptional storms with a wave height above 6 meters, which are expected to pose major risks to coastal installations and to the collapse of the coastal cliff.

The recognition that current mitigation measures will not prevent climate change calls for a variety of adaptation measures.

ICCC Research Team Leaders:

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- Climate: Prof. Haim Kutiel
- Water: Prof. Nurit Kliot
- Health: Prof. Manfred Green
- Biodiversity: Prof. Marcelo Sternberg
- Green Building: Prof. Guedi Capeluto
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- Geostrategy: Prof. Arnon Soffer
- Economy: Prof. Mordechai Shechter (former Director of the ICCIC)
- Local Level Economy: Dr. Tzipi Eshet



Findings and Recommendations on Climate Change Adaptation at the National Level

Water Resources in Israel

Israel's water sector will be highly affected by climate change. Reduced rainfall and increased extreme weather events are likely to increase flooding and surface runoff as well as to reduce water recharge. The recommendations call for promoting research and raising public awareness, using water saving devices and minimizing water losses, increasing wastewater treatment, preventing pollution and remediating contaminated wells, advancing water-sensitive planning, and reusing greywater and treated wastewater. Given the existence of several seawater desalination facilities in Israel, ICCIC experts have classified the building of additional facilities as a "high regret" strategy.

Public Health

Climate change is expected to affect public health directly through physical influences such as extreme heat and cold events and indirectly through the effect on chronic and infectious diseases and on mortality and morbidity from external sources. The recommendations call for real-time monitoring and coordinated response to extreme events together with coordinated adaptation to gradual changes in temperature and rainfall which could lead to the outbreak of diseases due to the invasion of new disease vectors. In parallel, the recommendations call for strengthening the preparedness of the health system through personnel training and dissemination of information and guidelines to employees and the public.



Rosh Hanika coast/Photo: Ilan Malester

Biodiversity

Biodiversity is likely to be extensively affected by climate change, bringing about changes in the geographical distribution of species and in the ecological services provided by natural ecosystems. The recommendations call for reducing the pressure on freshwater ecosystems and recognizing nature's right to water, conserving open areas and the ecological corridors between them, enforcing laws and policies which prevent adverse effects on open areas, managing invasive species and dealing with invasive disease vectors, and expanding the scientific base for preparedness through monitoring and research.

Green Building

Green building addresses the dual needs of mitigation and adaptation. The recommendations call for establishing a government agency to serve as the hub for sustainable green building in Israel, providing economic incentives for green buildings, applying mandatory regulations for energy rating and tagging new and rehabilitated green buildings, raising public awareness, and incorporating courses on energy-saving buildings, sustainable design and climate change adaptation in institutes of higher learning.

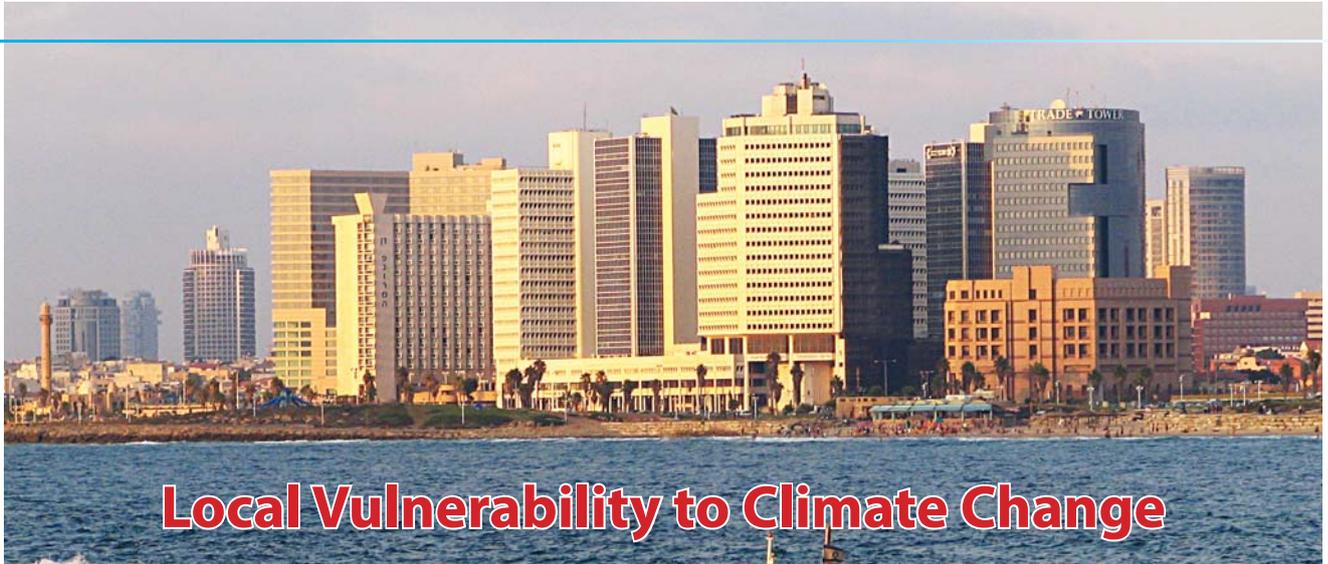
Geostrategy and Economics

Climate change is expected to impact on a host of areas, including tourism, transportation, energy, national infrastructures, food security, migration and geopolitics. A key recommendation is for Israel to transform the risks of climate change into levers for the advancement of projects that should be implemented in any case – whether enhancement of water production, preservation of agricultural land, or securing of food and energy sources such as local natural gas resources. To help professionals and policy makers identify the most suitable interventions for reducing damage, improving adaptation capacity and increasing resilience, a qualitative assessment of the costs and benefits of adaptation options in different areas was initiated. Market failures in the adaptation process were identified along with projects and policies that will enhance social well-being, even if the climatic scenarios are not realized in their full severity.



Yarkon promenade /Photo: Eyal Ya'affe





Local Vulnerability to Climate Change

Based on the understanding that urban areas are especially vulnerable to extreme weather events, cities worldwide have been seeking ways to increase their resilience by preparing the physical infrastructure for emergencies, creating coordinated systems, increasing alerts and reaction and raising public awareness and participation. Therefore, the most recent report of the ICCIC seeks to delineate a path toward climate change adaptation by local authorities. This is especially important in Israel where some 90% of the population resides in urban localities.

The urban climate has two major characteristics which differentiate it from nearby open areas: an urban heat island and a higher level of pollutants. Research has shown that during the 20th century temperatures in city centers rose by a higher rate than temperatures in adjacent open areas. The combination of urban heat island together with a rise in the concentration of pollutants can lead to a greater frequency of days with high heat burdens and/or days with pollutant concentrations which can be dangerous to public health in general and vulnerable populations in particular.

Recommendations on Climate Change Adaptation at the Local Level

Water

Local authorities in Israel must play a major role in adapting to changes in water sector management. To do this, data on the vulnerability of each locality as well as institutional and research limitations should be gathered. The recommended strategies include:

- Improving the information available to local authorities and the public, promoting education and information on water saving and conservation, and increasing public awareness of the importance of sustainable management of the water sector.
- Promoting water saving and efficiency, using smart water devices, and reducing water losses.
- Treating wastewater and increasing the use of greywater and effluents, including for public gardening, fire-fighting and street cleaning.
- Preventing water pollution and remediating wells.

- Promoting rainwater catchment and water sensitive planning.
- Preparing for emergencies including better provision of information to the public.

Health

Emergency centers in local authorities should be established and competent authorities should be designated to deal with the health impacts of climate change including monitoring, education and environmental management. Preparations should take account of both extreme events and gradual climate change. The recommended strategies include:

- Establishing a monitoring system which is accessible to local authorities in real time and includes data on mortality and morbidity, populations at risk and meteorological data.
- Ensuring continuous data collection on the presence of vectors which can serve as disease carriers in different local authorities.
- Providing guidelines to the public and to civil servants on heat waves and cold waves and preparing emergency response plans, especially for vulnerable and high risk groups.
- Providing information to the public and to civil servants on



preparedness for climate change through websites, lectures, and more.

- Promoting urban environmental management including green building, maintenance of urban infrastructure, control of pest breeding sites, and air conditioning of public institutions.

Urban Nature and Biodiversity

Increased awareness of the link between urban biodiversity and climate change, as highlighted in the Local Action for Biodiversity (LAB) program, is vital. Therefore, biodiversity considerations should be integrated in local adaptation plans. The recommended strategies include:

- Promoting education and awareness of biodiversity in the urban space, with special attention to the impacts of floods, fires, desertification and invasive species.
- Basing urban planning and ecosystem management on surveys of urban natural assets.
- Conserving urban biodiversity by such means as protected areas around natural assets (e.g., nature reserves or parks), ecological corridors, and creation and protection of habitats, and reducing the impacts of urban heat islands through urban forestry and green roofs.

Planning and Building

Cities are especially vulnerable to climate change due to the impacts of the urban heat island. To build urban resilience and increase adaptive capacity, both mitigation and adaption are needed. Local government can play an important role in responding to the challenge of energy efficiency. The recommended strategies include:

- Assessing the risks of climate change at the local level, identifying the main threats and setting priorities for adaptive action.

- Reducing the sources of anthropogenic heat and air pollutant emissions.
- Planning the density and height of buildings in such a way as to reduce the urban canyon effect and improving ventilation and heat and pollutant dispersal.
- Increasing open space and vegetation, including green roofs.
- Using reflective materials which absorb less heat.
- Increasing tree shading along streets and pavements.
- Promoting water sensitive planning.
- Utilizing the underground space.
- Establishing buffer zones to protect cities from fires.
- Adapting existing and future infrastructures.
- Promoting sustainable building through institutional, legislative and economic tools, accompanied by awareness raising, training and research.

Economic Aspects of Urban Adaptation to Climate Change

The benefits of investing in the development of an adaptation strategy exceed the costs and are expected to lead to future savings as well. According to experts, every \$1 spent in preparing for flooding and other climate-related events can ultimately save the country \$8 in future costs related to rehabilitation, restoration, and compensation for climate-related damages.

Because of the challenges in deciding on adaptive strategies in the face of major uncertainties in climate change projections and impacts, the most flexible and resilient solutions should be chosen for different scenarios. Public-Private Partnerships (PPPs) can play a crucial role in obtaining the necessary funds to address climate change risks and assure the quick recovery of infrastructures.



Agricultural fields irrigation / Photo: Ilan Malester



Risks and Responses

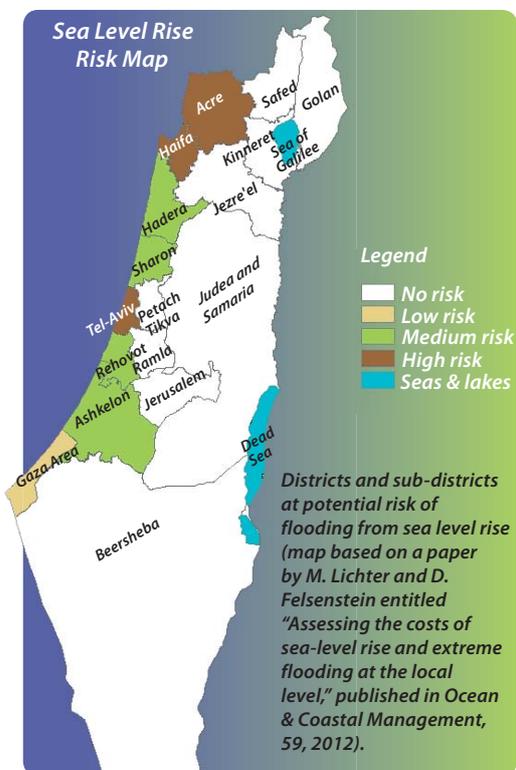
The ICCIC report on local adaptation presents a series of maps which delineate districts and sub-districts in Israel which are at a potential risk of flooding due to sea level rise and river flooding as well as districts vulnerable to forest fires, dust storms and air pollution. The maps, based on climate change research conducted in Israel and worldwide, on a 2012 paper by Lichter and Felsenstein on the socio-economic costs of sea level rise and coastal flooding, and on statistical data of the Central Bureau of Statistics and the Hydrological Service, show that based on the continuation of current trends, some 2.5 million people residing in coastal districts such as Haifa and Tel Aviv may potentially be at risk due to inundation and some 2.8 million may be threatened by river flooding. Similarly, the incidence of forest fires is expected to increase due to rising temperatures and increased frequency and intensity of heat waves, with high risk areas including the

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Carmel region in northern Israel and the Jerusalem hills. Air pollution, especially in densely populated and industrial areas poses an increased risk in the Haifa region and the central coastal area, while an increase in the number of days in which dust storms occur is expected in the south of the country. These risk maps are expected to help local authorities better assess their vulnerability to the impacts of climate change – and to act on these assessments by formulating and implementing local adaptation strategies.

There are two types of impacts, says Dr. Sinaia Netanyahu, Chief Scientist of the Ministry of Environmental Protection: long-range, gradual impacts which will see temperatures climb over time and sea water levels rise and sudden and extreme events which will include heat waves, droughts and floods. In planning for climate change adaptation, she says, “we have to plan for more frequent probabilities of such events, and infrastructure engineering will have to take account of low frequency scenarios.”

To cope and respond to the adverse impacts of climate change, continues Dr. Netanyahu, “municipal and national authorities should adopt no-regret measures such as stopping pipeline leaks, establishing flood barriers, increasing the diameter of drainage pipes, capturing rainwater for reuse or groundwater recharge, and maintaining infrastructure, which are within their domain of responsibility in any case.” Most importantly, municipal awareness of the potential impacts of climate change must be raised in order to assure wise management under extreme events. Municipal authorities, for example, must be ready to apply a variety of approaches in order to increase their resilience to extreme events by such means as infrastructure redundancy – so that if one system fails, whether electrical power or wastewater treatment or potable



Carmel fire/Photo: Nir Herr



water supply, another can take its place until replacement or repair is complete. In parallel, the planning system should take note of gradual, long-term impacts which may require changes in agricultural practices such as types of crops and their geographic location.

A Path to Action

It is well-recognized that, despite the uncertainties, developing adaptation strategies to cope with the climate change impacts which are anticipated over the coming decades is imperative. Inaction is not an option. Israel has identified a range of no regret and low regret options that will yield benefits even in the absence of climate change. Acting on these options will not only minimize climate risks but have social, environmental and economic benefits.

As has been demonstrated in the water sector, Israel has long recognized that it cannot rely on its natural water resources alone. In fact, it has experienced seven consecutive years of drought in the 21st century alone. To deal with climatic uncertainty and water scarcity, says Dr. Netanyahu, Israel's water policy is based on the integration of demand and supply side management. The former includes water conservation and water use efficiency while the latter is based on the development of innovative water production and treatment technologies. Israel's achievements in transforming challenges into opportunities have led to the highest wastewater recycling rate in the world, the highest ratio in the world of agricultural crop yield per water unit due to such developments as drip irrigation, and cost-efficient seawater reverse osmosis desalination plants. Based on its experience in overcoming water scarcity, Israel is well poised to serve as a global lab for water innovation and to contribute of its experience to countries worldwide.

In order to accelerate the formulation of a climate change adaptation plan for Israel, Environmental Protection Minister MK Amir Peretz has renewed the deliberations of the interministerial committee set up within the framework of the 2009 government decision on climate change adaptation. The committee is headed by the ministry's Director General David Leffler and includes representatives of 16

relevant government ministries. It is currently finalizing its recommendations on a climate change adaptation plan that will be presented to the government.

The goal is to mainstream adaptation strategies in master plans and action plans in such fields as water, energy, biodiversity, agriculture, public health, sustainable building and more.

Sustainable Adaptation Policies: Local Solutions for Global Problems, Indian and Israeli Experiences

The Ministry of Environmental Protection and the Keren Kayemeth Lelsrael-Jewish National Fund (KKL-JNF) partnered with the National Council for Climate Change, Sustainable Development, and Public Leadership, an Indian NGO, to run a side event on sustainable adaptation policies at the Warsaw Climate Change Conference in November 2013. Ministry of Environmental Protection Chief Scientist Dr. Sinaia Netanyahu spoke about Israel's planned framework for climate change adaptation and detailed the anticipated impacts of climate change on Israel, including floods, forest fires, and sea level rise.

JNF representatives spoke about water recycling practices for adapting to climate change under conditions of water scarcity and about dryland afforestation as a means for promoting adaptation.

Indian representatives spoke about prioritizing agriculture for climate change adaptation and mitigation and local level action plans for sustainable and climate resilient agriculture.

Additional lectures focused on strategic plans for coping with extreme climate events.



Conference Side Event/Photo: Ministry of Environmental Protection

