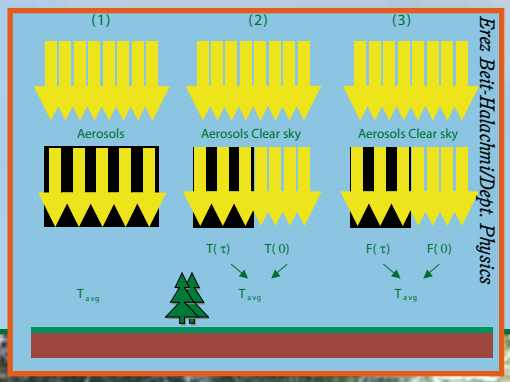
Fields of Plenty

At the Hebrew University, a wide range of environment-related research crosses disciplinary and faculty boundaries

By Anna Wexler



Erez Beit-Halachmi/Dept. Physics

Clockwise from top: Illustration of three different methods for determining the average temperature of the lowest layer of the atmosphere when aerosol particles cover only part of the sky. Conceptual scheme of an atmospheric aerosol particle comprising a mixture of absorbing and non-absorbing soluble and insoluble substances. Setup of a typical remote sensing problem aiming to retrieve the properties of aerosols given the intensity of the sun's radiation reflected towards a satellite

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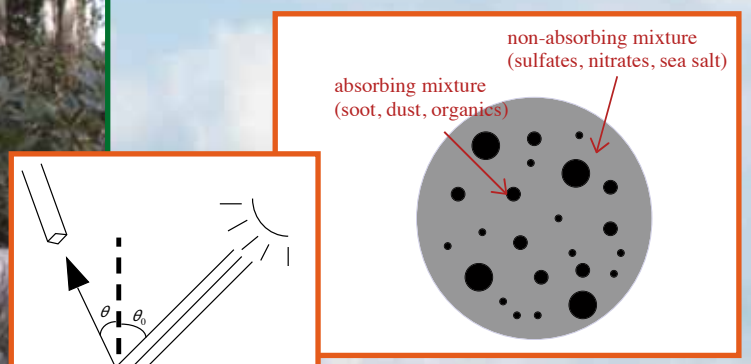
Dr. Carynelisa Erlick-Haspel: Up in the Air

In the mid-1990s, the atmospheric sciences community was focused on the hole in the ozone layer and how chemicals in refrigerants and aerosol sprays were breaking it down, thereby allowing more ultraviolet radiation to reach the earth. At the same time, Carynelisa Erlick-Haspel was completing her doctoral thesis on a different, but related, question: how tiny particles in the atmosphere influence solar radiation.

Dr. Erlick-Haspel, today a senior lecturer in the Fredy and Nadine Herrmann Institute of Earth Sciences in the Faculty of Science, studied both naturally occurring particles, such as water droplets in clouds and residual salt from the sea, and man-made particles, such as those caused by pollution. She found that, by and large, these particles were scattering radiation from the sun. That is, while the ozone hole allows more ultraviolet radiation from the sun to penetrate the atmosphere, these particles scatter some of the sun's radiation back to space. "It is a partially compensating effect," she says.

Since then, Erlick-Haspel has continued to investigate how particles in the atmosphere influence solar radiation. During postdoctoral research at Princeton, she collaborated



with a chemical engineering professor to study more complex particles in the atmosphere, such as those that form when sea salt, sulfates, nitrates, organic carbon, dust, and soot mix together. She found that these complex particles could change the properties of clouds: for instance, they could allow a cloud to absorb more solar radiation, which in turn would heat the cloud layer and cause the air to rise or the cloud to dissipate.

Erlick-Haspel came to Israel from the US in 1999 and was appointed to the Hebrew University faculty in 2000. Though most of her focus is on the role of atmospheric particles in current and future climate change, she has been branching out into related fields. A recent graduate student of hers studied how dust particles may have affected the ice ages. Another studied how underwater particles affect light propagation under water. Her current graduate students are studying topics such as atmospheric electricity and defects in atmospheric ice particles.

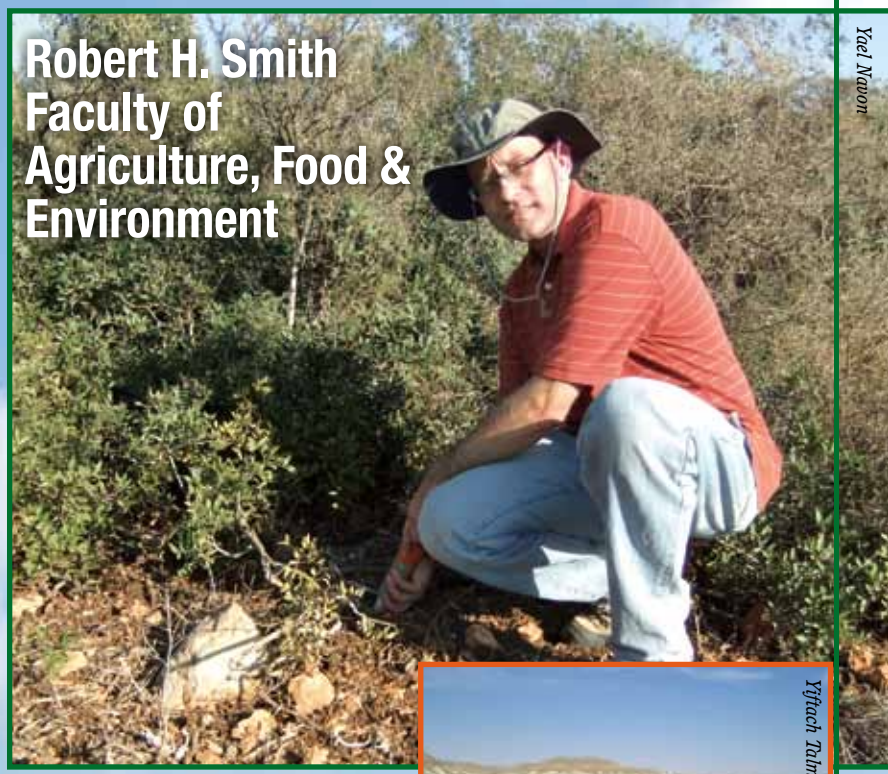
While much of the work on climate change focuses on the effects of greenhouse gases, Erlick-Haspel emphasizes the need to understand the system as a whole, taking into account the effects of atmospheric particles, both natural and manmade. "I'm not saying that my calculations are going to stop global warming, but I feel that this is my small contribution; my work may help inform how we confront environmental problems."

Dr. José Grünzweig: Ecosystem Basics

"Our main focus is trying to understand how ecosystems function," says Dr. José M. Grünzweig, a senior lecturer in the Robert H. Smith Institute of Plant Sciences and Genetics in Agriculture at the Robert H. Smith Faculty of Agriculture, Food and Environment. "Generally speaking, an ecosystem is a biological environment — in the case of my research, for example, a Mediterranean forest or shrubland — which consists of living beings such as plants and animals, but also of soil and climate."

Grünzweig researches the interactions between the ecosystem's components, and how vital elements, such as carbon and nitrogen, cycle among the plants, animals, soil and the air that make up the ecosystem. "This is difficult to grasp, because the cycling is not something that you can see," he says. He can, however, measure different parts of the system. "You can measure how much nitrogen is taken up by the plants from the soil, how fast it returns to the soil, and when it will be available for the plants again."

'the cycling of vital elements is not something that you can see'

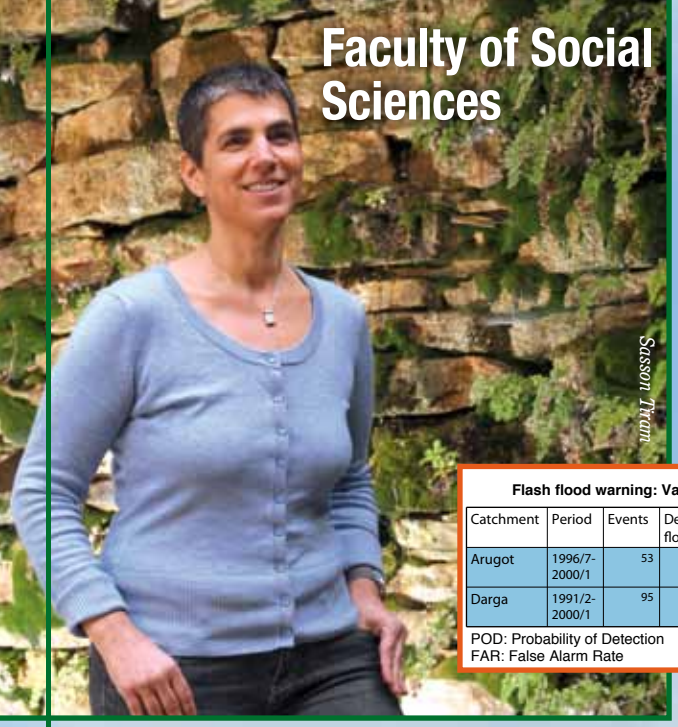


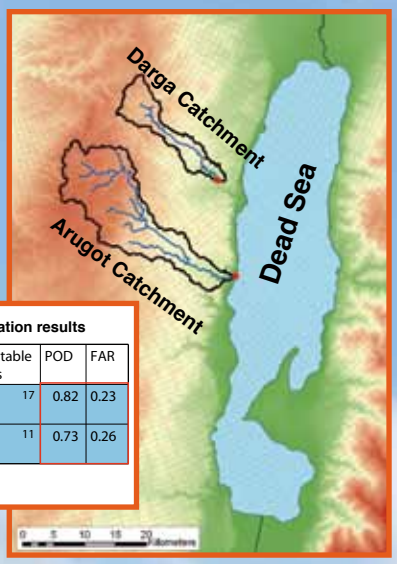
Grünzweig pays particular attention to the fluxes, or how elements move from one area into another. "This is important, because organisms rely on these basic functions of the ecosystem," he says. When these functions change, due to events such as global warming or deforestation, the whole system is altered. The landscape would change, some plants and animals might vanish and humans would also be affected, since forests provide natural "services" to human populations. "A strong, healthy forest might control climate extremes and might filter dust," says Dr. Grünzweig. "When you don't have that forest, people living downwind of the forest will feel the effects."

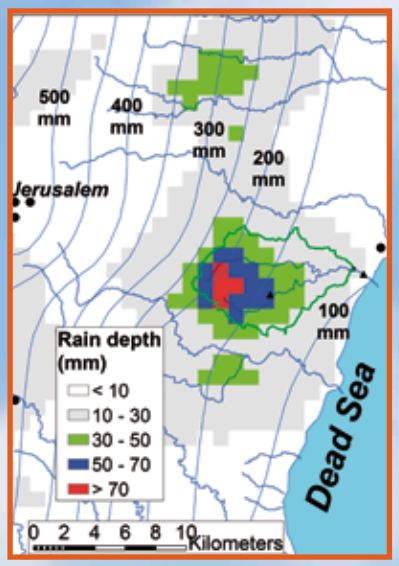
Swiss-born Dr. Grünzweig, who immigrated to Israel in 1986, works together with the Jewish National Fund, government ministries and various agencies to simulate how ecosystems may fare in the future, when the ground will be drier due to climate change. He is currently working on a

From top: Dr. Grünzweig buries a device to track soil nutrients in Mediterranean shrubland. The research team uses various equipment to measure carbon uptake by desert vegetation. An automatic device measures CO^2 emission from the soil surface of a natural ecosystem

Faculty of Social Sciences







Flash flood warning: Validation results

Catchment	Period	Events	Detectable floods	POD	FAR
Arugot	1996/7-2000/1	53	17	0.82	0.23
Darga	1991/2-2000/1	95	11	0.73	0.26

POD: Probability of Detection
FAR: False Alarm Rate

project that examines the effect that drier atmosphere and soils have on trees.

Together with Smith Faculty colleagues Professor Rony Wallach and Dr. Menachem Moshelion, Grünzweig is also working on a project to develop drought-tolerant pines and pistachio trees for afforestation in areas where natural forest services are needed. "It's important to come up with the best possible predictions of how climate change and land use — such as grazing and deforestation — can affect the ecosystem," says Grünzweig. "This is essentially what we need to understand in order to be able to plan for the future."

Dr. Efrat Morin: Extreme Events

"Almost every year in Israel, there is a flash flood, often in the desert," says Dr. Efrat Morin, a senior lecturer in the Department of Geography in the Faculty of Social Sciences and the head of the Hydrometeorology Lab. Flash floods — sudden, powerful floods caused by heavy precipitation — are one of the main causes of human casualties and structural damage worldwide.

Morin studies precipitation and hydrological systems, examining the relationships between the air, soil and water. She specializes in extreme hydro-meteorological events such as flash floods and droughts. For flash floods, Dr. Morin

Impact & Influence

Hebrew University faculty, students and alumni are not only influencing environmental issues through their research but are actively involved in shaping policy, running educational and advocacy programs, and serving on relevant public bodies and in industry. A small sampling includes:

Government

- Almost 40 Hebrew University alumni at the Ministry of Environmental Protection in a wide variety of professional capacities
- Dr. Miriam Haran (top), former director-general, Ministry of Environment
- Dr. Yossi Inbar, former director-general, Ministry of Environmental Protection
- Prof. Eugene Kandel (left), head of the National Economic Council in the Prime Minister's Office, spearheading national plan for developing alternative fuels to oil for transportation
- Avi Moshel, independent consultant, former deputy head of Air Quality & Climate Change Division, Ministry of Environmental Protection
- Dr. Anat Rozen (right), general manager, Ashdod-Hevel Yavne Regional Association for Environmental Protection (see page 9)

Advocacy

- Sarit Caspi-Oron, water scientist, Israel Union for Environmental Defense (see page 10) and colleagues Gilad Ostrovsky (solid waste expert), Dr. Arye Wanger (air quality) and Attorney Dana Tabachnik

- Dr. Eilon Schwartz (left), founder and executive director, Heschel Center for Environmental Learning and Leadership (see page 8) and colleagues Dr. Jeremy Benstein (co-founder and deputy director), Dr. Lia Ettinger (academic supervisor) and Michal

studies storm information provided by meteorological radar data and relates it to the formation of flash floods. Prior to the availability of radar data, there was little information available about precipitation. Rain stations are usually scattered across broad areas, sometimes tens of kilometers apart, and often don't detect the smaller storms that cause the flash floods.

"However, with comprehensive radar data, we really have much more detailed information on precipitation systems and storms," says Morin. "With this knowledge we can better understand the flash flood generation processes and predict more accurately where and when flash floods will occur."

Currently, Dr. Morin is working on a flash flood warning system that can predict a flash flood up to an hour in advance. After obtaining promising results in laboratory models, she is now collaborating with the Israel Meteorological Service to make the warning system operational.

While some of her students study aspects of flash flood events, at the other end of the hydro-meteorological spectrum — drought — one of Dr. Morin's students is working to develop new ways to quantify and classify droughts. Another is studying how past precipitation patterns have affected the water level of the Dead Sea.

a warning system that can predict a flash flood up to an hour in advance

Morin is also investigating the impact of climate change on precipitation and hydrological systems, with one of her students also focusing on the impact of climate change on runoff and flash flood occurrence. Morin's early results have shown that climate in the eastern Mediterranean region is becoming warmer and drier. She is currently examining detailed records of Israeli data from the last several decades to better understand what changes have occurred in temperature and precipitation patterns.

Even though she has been studying precipitation for over a decade, Dr. Morin remains fascinated by viewing rainstorms on the radar. "There is still a lot to learn," she says.

Opposite: Dr. Efrat Morin's research results (map and inset) have shown that using comprehensive radar data provides increasingly accurate predictions of flash floods in the Dead Sea area. Map (right) shows radar-based data for an extreme storm in May 2007 that generated a flash flood in the Qumran catchment

Profs. Jonathan Erez & Boaz Lazar: Ocean Acidification

"Only about half of the carbon dioxide emitted by burning fossil fuels accumulates in the atmosphere," says Professor Jonathan Erez. "About 25 percent ends up in land ecosystems like forests, and the other 25 percent is absorbed by the ocean, which makes it more acidic. The amount of carbon dioxide that is present in the atmosphere has been rising steadily since the Industrial Revolution and so oceans have increased their acidity accordingly."

Prof. Erez and his colleague Professor Boaz Lazar, both members of the Fredy and Nadine Herrmann Institute of Earth Sciences in the Faculty of Science, have been investigating the effects of ocean acidification on one specific ecosystem: coral reefs.

"Coral reefs are probably the ecosystem that is most sensitive to this change," says Prof. Erez. Coral reefs, the oceanic structures that house colonies of tiny living organisms called coral polyps, are among the most diverse ecosystems on earth. The reefs are built by the corals

Shami (deputy director, Green Schools network)
- Prof. Alon Tal, founder of the Israel Union for Environmental Defense and the Arava Institute for Environmental Studies

Public Service

- Prof. Yona Chen (right), chairman of Joint Reviewing Committee, Binational Environment and Energy Research Program, France and Israel; former president, Israel Society for Ecology and Environmental Quality Sciences

- Prof. Eli Feinerman (below), member (public representative), Israel Water Authority Council; board member, Open Landscape Institute of the Society for the Protection of Nature in Israel

- Prof. Haim Gvirtzman, member (public representative), Israel Water Authority Council (see page 30)
- Prof. Richard Laster, chair, Kidron Valley/Wadi Nar Basin Steering Committee

- Prof. Boaz Lazar, member, Lake Kinneret (Sea of Galilee) Monitoring Steering Committee, Israel Water Authority (see page 22)
- Prof. Uri Shani (right), former director, Israel Water Authority (see page 5)

Industry

- Yoel Gilon, senior vice president, BrightSource Energy
- Dr. Barak Hershkovitz, chief technology officer, Better Place
- Dr. Amit Mor, CEO, Eco Energy Ltd., previously consultant and project manager at the World Bank

For updated list, see:
www.support.huji.ac.il/hu-people/alumni-2/

themselves, which rely on the calcium carbonate found in the ocean to "calcify" the reef's skeletal structure — much like the human body needs calcium from food to grow and maintain bones.

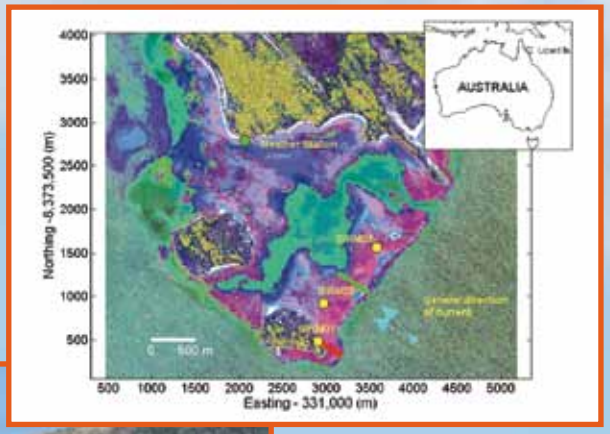
But the coral reef calcification process is only efficient in non-acidic waters. Thus, as the ocean acidifies, the ability of the coral to make and repair their skeletal structures is declining — more rapidly than anyone expected. Models created by Profs. Erez and Lazar and colleagues predict that in just 10-15 years, corals will be calcifying at just 50 percent of the pre-Industrial Revolution rate. Add to that the phenomenon of coral bleaching, wherein coral reefs are dying due to increases in ocean temperature. Models that take into account both effects predict that coral reefs will start to dissolve in 30-40 years. "It's a grave situation," says Erez. "The dissolution of the coral reef structure will convert these magnificent ecosystems into dead piles of rubble."

'this direct measurement fits exactly with the predictions of our previous work in Eilat'

Profs. Erez and Lazar and their team recently validated their predictions by conducting field research in Australia. Their work, which was conducted with colleagues from the Carnegie Institution for Science in the US, showed that the Great Barrier Reef calcification rate was 40 percent less than in the 1970s. "This is a direct measurement and fits exactly with the predictions of our previous work in Eilat," says Erez.

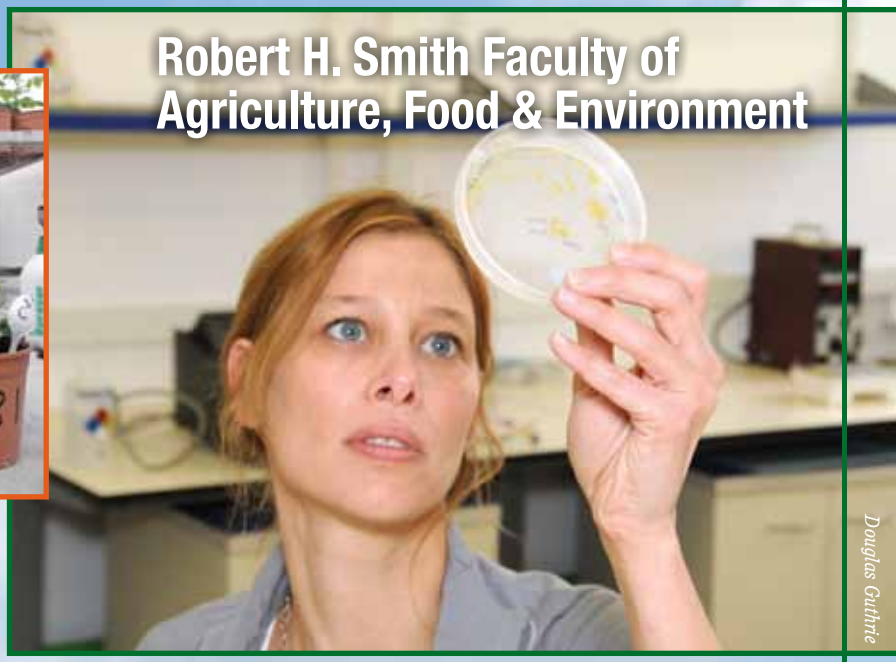
Both researchers credit the Interuniversity Institute for Marine Sciences in Eilat, a Hebrew University facility used by all Israeli universities, as crucial to their research. "Without the Eilat lab and the efforts of our dedicated students and our postdoctoral researchers Dr. Jacob Silverman and Dr. Kenneth Schneider we couldn't have done the work," they say.

"If we don't start to lower carbon dioxide in the atmosphere, we're in for terrible climate and ocean changes," says Erez. "Clearly, we must develop technology to actively remove carbon dioxide from the atmosphere."



Research conducted in the Lizard Island area on Australia's Great Barrier Reef (colorized aerial photo shows coral cover on the reef) by Profs. Boaz Lazar and Jonathan Erez (from left, standing), seen here with their colleagues from Israel and the US, validated their original predictions of a slow-down in coral reef calcification in response to ocean acidification

Robert H. Smith Faculty of Agriculture, Food & Environment



Douglas Guthrie

Dr. Yael Helman's research of beneficial bacteria in soil takes her from the lab where she studies cell-cell interaction to (inset) the greenhouse where she studies plant growth in various soil composites

Dr. Yael Helman: Bacteria Smarts

"Even though they are single-celled organisms, bacteria are very complex," says Dr. Yael Helman, a lecturer in the Department of Plant Pathology and Microbiology which is part of the new Institute for Environmental Sciences and Natural Resources in Agriculture at the Robert H. Smith Faculty of Agriculture, Food and Environment. Helman studies how bacteria interact with one another in the area of the soil called the rhizosphere, the region near the roots of plants that is rich in nutrients, moisture, and organic matter.

In this region, explains Helman, bacteria are in "constant competition" for space and food (organic matter), with each specie's survival dependent on how efficiently it utilizes organic matter and how well it can fight its neighboring microorganism. Dr. Helman's research goals are twofold. First, she'd like to develop new strategies to fight plant diseases. Each year, 25 percent of world crops are affected by plant disease, resulting in an annual loss of $220 billion and also reducing the extent to which world hunger can be alleviated. Today, when a farmer discovers that his crop is diseased, he fights the disease as quickly as possible with the strongest — potentially harmful — chemical he can find.

"But the more we fight these pathogens with chemical agents, the more they develop resistance," says Helman. "However, if we can use bacteria to fight our battle for us, we'll have a more powerful tool. If the pathogens evolve a resistance mechanism, then the opponent bacteria will — likewise — evolve a suitably strong response," she says. In effect, Dr. Helman is studying the "underground chemical warfare" employed by competing microorganisms in the rhizosphere in order to selectively exploit beneficial bacteria in the soil to fight off pathogenic bacteria.

bacteria are in 'constant competition' for space and food

In the second part of her research, Helman is studying how to exploit beneficial bacteria in order to enhance plant growth. "If we can identify a group of bacteria that are both resistant to the antibiotics produced by other bacteria and also produce hormones that can enhance the growth of plants, we can take these bacteria and add them to the soil," she says. Using this method, people could "reduce the use of chemical fertilizers, which is very important in terms of both preventing environmental damage and ensuring safer food resources."

Dr. Helman's work involves a constant interaction between the lab, where she studies the cell-cell interaction between bacteria, and the greenhouse. "We want to use bacterial complexity for our benefit," says Dr. Helman. "But in order to do so, we need to better understand how bacteria work."

Dr. Milka Donchin: Healthy Partnerships

Since 1991, Dr. Milka Donchin of the Hebrew University-Hadassah Braun School of Public Health and Community Medicine in the Faculty of Medicine has been leading the Healthy Cities program in Israel. The program, an initiative of the World Health Organization, focuses on how local government can improve overall public health and reduce inequalities.

"We regard health as broad and holistic," says Donchin, emphasizing that it includes physical, mental and social

Dr. Milka Donchin, who heads the World Health Organization's Healthy Cities program in Israel, at conferences in Israel (inset) and Seoul, South Korea

wellbeing with factors related to society, education and environment having an impact. "In order to improve health, we must facilitate intersectoral collaborations," she says. Indeed, program participants include local municipalities, health funds, community centers, the Ministries of Health, Environment, Welfare, Education and Sports, and Braun School faculty members. A committee of representatives from each group meets monthly.

The committee researches individual cities, one by one and in collaboration with the Central Bureau of Statistics, and collects a broad sample of data on aspects ranging from wheelchair accessibility to environmental and health issues. "For example, we ask people how they assess their local environment regarding air pollution and noise and if they have enough gardens, use walking and biking paths, and recycle," says Donchin.

'instead of a stethoscope and laboratory tests, epidemiology is our tool'

Quantitative data, such as information on air pollution, is also collected. The committee analyzes the data and produces a comprehensive report that includes recommendations for improvements. The report, prepared jointly with a local team, is presented to the relevant mayor and municipality, who review it and decide how to prioritize future initiatives. Donchin personally follows the progress of each city.

Although she trained as a doctor, Donchin switched after completing her master's degree in public health. "Instead of a stethoscope and all kinds of laboratory tests, epidemiology is our tool."

Along with her work at the Braun School, Dr. Donchin also heads the Occupational Health Unit at the Hadassah University Medical Center, where she studies ways to improve staff safety, health and wellbeing. In one of her first projects, she investigated back pain among hospital workers and instituted new preventative measures.

Donchin currently heads the health promotion track of the masters in public health program at the Braun School. While track students study environmental topics as part of a mandatory course on sustainable development, Donchin chose to open up the course — as an elective — to other students at the School. It is a move that fits her philosophy of constantly encouraging multidisciplinary interaction. "If you work in a multidisciplinary way, you acquire a broader picture," she says, noting that she hopes to enlist additional partners to the Healthy Cities program. "My goal is to bring people together to work in partnerships."

Profs. Daniel Felsenstein & Eran Razin: Coastal Clarity

"Coastal areas are prime candidates for conflict, because a lot of interests clash there," says Professor Daniel Felsenstein of the Department of Geography in the Faculty of Social Sciences. These clashing interests include tourism,

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beachfront development, environmental protection and preservation projects, military and security needs, residential development, and heavy infrastructure requirements such as ports, power stations, and desalinization plants.

"And as well as these pressures and conflicts, there is the general issue of development versus preservation," says Felsenstein. Along with colleagues Professor Eran Razin, Dr. Itay Fischhendler and several graduate students, Felsenstein is studying coastal conflicts as part of a four-year project called Solutions for Environmental Contrasts in Coastal Areas (SECOA). Funded by the European Union, SECOA brings together research groups from eight European and Asian countries.

"It's a cross-disciplinary project," says Felsenstein, explaining that the first objective of SECOA is to identify and model physical, environmental, economic and social issues related to coastal areas. For the physical geography aspect, researchers will identify issues related to climate change and oceanography, such as sea level rise and the probability of flooding and inundation along the coast. Others will create environmental and ecological profiles for specific coastal sites in each country. Researchers will also identify urban development processes and run simulations to determine how these processes will influence coastal zone development.

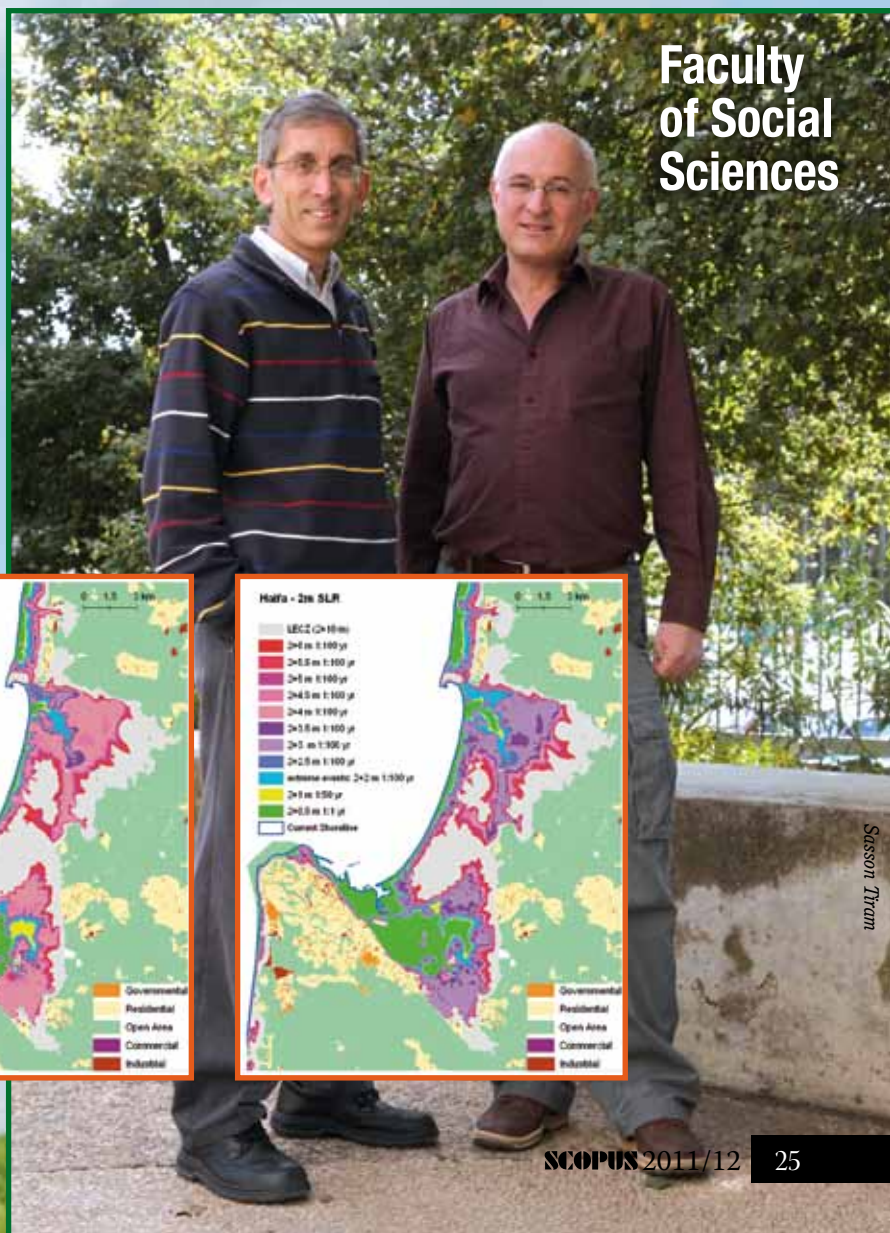
Another major goal of SECOA is to qualitatively assess coastal conflicts and develop methods for their resolution. The researchers aim to formulate management guidelines and policy tools that would allow governments to protect the coastal areas while preserving national interests and allowing for economic development.

Prof. Felsenstein, who immigrated to Israel from England, specializes in urban modeling and urban simulation. Prof. Razin's background is in both economics and geography, with expertise in local government, urban planning and urban policy. Dr. Fischhendler specializes in environmental politics.

'tools used in one country can be useful for others'

Each of SECOA's participant countries has two or three end users — representatives of national or local government or NGOs — who attend SECOA meetings and offer input to the research process. Their participation ensures that the project ultimately moves from the academic to the practical realm.

Prof. Razin highlights the importance of working with such a broad variety of countries. "Obviously we each come



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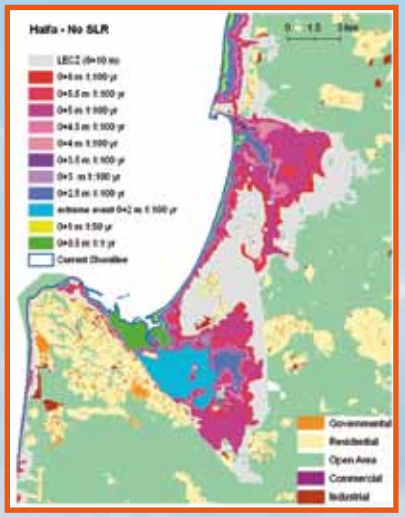

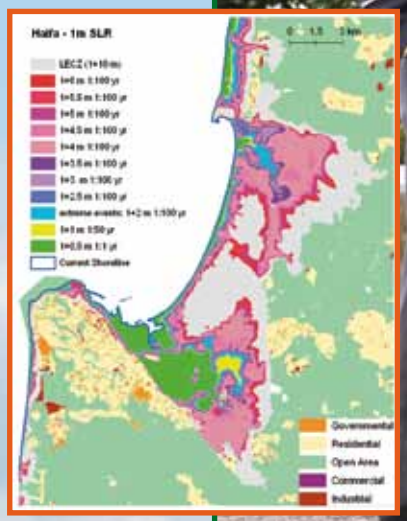

Profs. Daniel Felsenstein (left) and Eran Razin. Inset: Maps, based on estimates by the Hebrew University SECOA team (opposite), forecast coastal inundation for the Haifa area under various scenarios of sea-level rise (from left: no inundation, one meter rise and two meter rise) and also show areas likely to be flooded by flash-storm waves of up to six meters

from different political cultures, different administrative political frameworks and different planning systems. And the physical problems also differ — you can't compare the typhoons in Vietnam to the flooding in Mumbai," he says. "But still, tools used in one country can be useful for others. We all have a lot in common and a lot to learn."

Prof. Erella Hovers: Ancient Environments

"For a long time people thought that there was a linear evolutionary progression from Neanderthals to modern humans," says Professor Erella Hovers of the Institute of Archeology in the Faculty of Humanities. "That was how things seemed to pattern, because in Europe you find Neanderthals between 250,000-40,000 years ago, and then you find modern humans. This European story was the universal model."

It was a series of discoveries in Israel, says Hovers, which helped turn that theory on its head: anatomically modern skeletons were found among stone tools typically associated with Neanderthal remains in Europe. It was determined that these skeletons dated back some 100,000 years, predating Neanderthals in the region by 40,000 years and thus indicating that modern humans were not Neanderthal decedents. "The whole paradigm changed," says Hovers, whose own research has helped inform the complicated story of the evolution of the human lineage.

Today, scientists believe that the human lineage emerged in Africa where the first stone tools date back about 2.5 million years. Thereafter, beginning 1.8 million years ago, there was a series of dispersals, one of which led to the evolution of the Neanderthals in Europe. At the same time, several types of humans evolved in Africa. "One appeared in our region 100,000 years ago and a further dispersal 50,000 years later led to the global colonization of Eurasia and Australia by modern humans," says Hovers. "Also, shortly before this last dispersal, Neanderthal groups moved south from Europe into the Levant."

'environmental change here was not as dramatic as in Europe'

Whether these early modern humans persisted is debatable. Some scientists propose that global climatic changes impaired the Levant's capacity to support stable human populations and that the early modern humans (and later, the Neanderthals) became extinct. Hovers opposes this environmental explanation. "Based on data from many excavations and from paleo-environmental studies, environmental change here was not as dramatic as in Europe."

In her ongoing research of the Neanderthals and modern humans discovered in Israel, Hovers is studying their stone tools, whose shape and design often yield clues about their behavior. She also works with scientists who study geology, sediments, paleo-climatology, and plant and animal remains to deduce what the ancient landscape and environment might have looked like. Her research suggests that the Levantine ecology could have simultaneously supported Neanderthals

Prof. Erella Hovers (below) and (right) at the Ein Qashish middle paleolithic excavation site in northern Israel where the skeleton (inset) of an auroch, an extinct wild ox, was found


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Faculty of Dental Medicine

and modern humans. And since they mostly lived in small groups, she believes that they could have exploited nearby territories without being in intense competition with one another.

"I'm trying to understand the environmental background to what people were doing because my assumption is that they had to relate to the environment to survive," she says. "But I think they did it in a very flexible way — while their actions were constrained by the environment, they were not determined by it."

Prof. Doron Steinberg: Water Flow

While his research has taken him on an unusual path — from teeth to medical implants to desalinization plants — there is a common theme to Professor Doron Steinberg's work: the study of how bacteria adhere to surfaces and form biofilms.

The head of the Biofilm Research Laboratory at the Institute of Dental Sciences in the Faculty of Dental Medicine, Steinberg's initial interest stemmed from dentistry where biofilms that form on teeth are commonly known as dental plaque. Since then, and for the past decade, Steinberg has focused on the problems of biofilms in the water system.

"The government plan is that within a few years, all the drinking water in Israel will come from desalination plants," says Steinberg. At present, desalination plants are only marginally cost efficient, he says. Beyond the costly reverse-osmosis membranes that filter out the salt and the similarly costly energy required to pump seawater to the plant and through the membranes, biofilms form on the membranes every few months. Not only do these biofilms "clog" the membranes so that more energy is required to pump the water, but they often necessitate the membranes to be replaced at great expense.

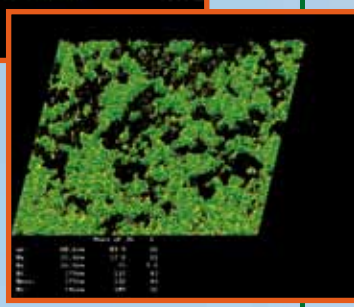
Biofilms also create problems elsewhere in water utilization: much of Israel's agricultural water is recycled water, and biofilms form on everything from the large cement pipes carrying the purified water to the small drip-irrigation pipes. In each case, the cleaning and replacing of pipes — and sometimes an overhaul of the entire drip-irrigation system — can be very expensive. "If we can avoid, delay or prevent the formation of the biofilm, it will reduce the cost of water purification and recycling," says Prof. Steinberg.

biofilms form on everything from large cement pipes to small drip-irrigation pipes

Working with Professor Morris Srebnik from the Institute of Drug Research at the Hebrew University's School of Pharmacy, Steinberg is doing just that. The two scientists built on recent research showing that bacteria communicate with one another by secreting chemical agents and use this "crosstalk" to join together and form biofilms, which help protect them from environmental hazards.

Steinberg and Srebnik synthesized a line of molecules — now patented with Yissum, the Hebrew University's technology transfer company — that interferes with the crosstalk, thus impeding biofilm formation. Following successful laboratory trials they have begun working directly with the companies that manufacture reverse-osmosis membranes, cement pipes and drip-irrigation pipes. So far the results look promising.

"We're working here in a university, which is a public institution," says Prof. Steinberg. "If we can provide better, or cheaper, water for agriculture or for drinking, we will be compensating the public for their investment in research."



Prof. Doron Steinberg and his team. Slides show that a surface covered with a biofilm (top) becomes clogged but, once treated, it is clearer (below) and water can pass through