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The Face of Israel's Last Frontier

by Jessica Hanewinckel | May 2011, Popular Stories from SDJJ | 1 Comment »

Ask most Israelis or visitors to Israel, and chances are they've not spent any significant amount of time in the Negev. They may have driven through to reach the resort town of Eilat at the southernmost tip of Israel on the coast of the Red Sea, but most stay closer to Israel's more developed central region.

In contrast, the Negev, the vast and barren desert in Israel's south that comprises 60 percent of the country's land mass but only 10 percent of its population, attracted David Ben-Gurion, Israel's first prime minister, as a place full of potential for Israel's future, ripe for Jewish settlement and productivity. In 1969, Ben-Gurion University of the Negev was founded in the city of Be'er Sheva as an institute of research and higher learning. The hope was to spearhead Ben-Gurion's desire to

make this desert bloom.

"This is the last frontier of the state of Israel," says Amos Drory, vice president for external affairs at BGU. "[The Negev] is where the future will go; there's no doubt about it. The center of Israel is heavily overpopulated…the vast land is here in the south. If you think in terms of the next generation, 30 years into the future or more, there will have to be a massive movement of population, industry and life in the Negev."

It's with this expectation that BGU, an institution with 20,000 students and 800 faculty members spread over three campuses, devotes itself to the development of the region, Drory says. "Development" of the Negev can take on countless meanings, and BGU, through its immense variety of research departments and social programs, covers them all (and consequently makes contributions worldwide as well). We'll look at three ways BGU is working to lift up its region's people, wildlife and infrastructure.

Being Neighborly

In Be'er Sheva, where BGU's main campus is located, much of the population that's not university-affiliated is comprised of poor immigrants, many of whom were settled there by the Israeli government when they arrived, Drory says. Coupled with these inner-city populations living in slum apartments with historically few opportunities, the outskirts are home to handfuls of unrecognized Bedouin settlements, where struggles related to education, infrastructure, assimilation and other issues have been ongoing. Though BGU has taken steps to outreach to the Bedouins — specifically giving women incentives to study there — they've also gone to tremendous lengths to improve at-risk neighborhoods surrounding the university, and signs of BGU's efforts are evident.

At BGU, the Center for Social Involvement involves about 40 percent of the student population in some sort of volunteer community service. Yael Krimgold and Nimrod Rapoport, studying for their bachelors degrees in social work and politics and government, respectively, are part of that group: Krimgold works for the Center for Neighborhood Sustainability, and Rapoport with the Open Apartments program. Both aim to build bridges between the university population and locals while improving their wellbeing and the quality of life in their neighborhoods.

"The Daled neighborhood," Krimgold says, "used to be a slum."

Rapoport describes the neighborhood in the 70s and 80s, before BGU's students entered the picture: "You had junkies all over the street, and homeless, of course. Criminals threw grenades at one another. Things were really quite tough here, and I believe the students here really changed it around."

For his part, Rapoport supervises about 80 other students who live in apartments among the people they aim to help. Additionally, they spend eight hours each week planning and running classes for community members and with a family they "adopt" while living there. In exchange, BGU covers the student's housing costs. (Before he supervised, Rapoport "adopted" an older widowed Russian immigrant woman and worked with kids to teach them constructive play for the program.)

"The most beautiful thing about the program is that it connects the students with the neighborhoods they live in," Rapoport says. "Many people live here from Sunday through Thursday, then they go home to Tel Aviv or Jerusalem [for the weekend] and don't think about the city again. There are more connections to the neighborhoods and city this way."

Krimgold is making connections to the neighborhoods in her own way. As a student with an interest

in ecology and vulnerable populations, she is running a monthly second-hand market with organized displays of donated used goods, baked goods and local art for sale. Live music entertains shoppers, who not only learn the value of recycling and reusing, but also gain a sense of community and camaraderie with their neighbors; they may not have much money, but the market allows them to buy "new to them" goods cheaply while mingling with neighbors and with students and faculty at BGU. Additionally, Krimgold and fellow volunteers work with local non-profits, who often sell their own items at the market to raise funds for their causes.

"It's amazing to see the community collaborations that are growing from the market," Krimgold says. "I love seeing the mixture of different people coming together, and it's still growing and getting better. In the future I want to use the market as a platform for lectures and workshops on ecology and community nature, to expose people to a more sustainable way of life.

"The people look forward to the market every month," she adds. "The best thing is they not only buy things, but they also bring. It's beautiful to see a man who doesn't have much come with pride and bring something to the market. It makes you feel like you're not in need, like you're normal."

In addition to the market, the Center for Neighborhood Sustainability (a program of Tor HaMidbar, a group of young adults who aim to improve life in Be'er Sheva and the Negev) also teaches organic urban gardening, composting, water recycling and other sustainability workshops.

Like Krimgold, Rapoport realizes it's the small steps that ultimately make a big difference.

"I remember thinking to myself very clearly [before I left for university] that I want to change the world," Rapoport says. "You can't change the world with a snap of your fingers, but you can do small things in order to try. This was my motivation then, and I believe it's my motivation now. That's why I'm going into politics and government, to hopefully make changes at that level."

Preserving the Negev Sand Sea

A 30-minute drive west of BGU and Be'er Sheva is the border between Israel and Egypt. Viewing the area in a satellite image makes the border strikingly clear. In fact, says Yaron Ziv, a landscape ecologist and macroecologist who teaches at BGU, the border is the most visible in the world, thanks to heavy grazing on the Egyptian side (giving a yellow appearance) and dune over-stabilization by soil crust on the Israeli side (which appears dark brown). Before the 1979 Egypt-Israel Peace Treaty, when Israel withdrew from the Sinai Peninsula, the border as it stands today was not in place. But after more than 30 years, the differing political policies in each of the countries, coupled with drought, have altered the landscape, and therefore the flora and fauna, differently in Israel than in Egypt, despite there being no natural border.

It's these changes in the Western Negev sandy area — and their implications for other ecosystems in the world that suffer from human development and use — that Ziv is studying. He's attracted to this particular part of the Negev, he says, because it's Israel's second-most valuable ecological region based on the number of endemic species that live there, and nowhere else in the world.

"You get a lot of sands from different times and different geological areas, which makes this a very distinct, unique habitat," Ziv says. "From 18,000 to 5,000 years ago, huge storms in this area carried a lot of clay from the Nile. When that started, a lot of animals and plants that originated in Africa moved north with the sands…[animals and plants evolved] and you started getting a local, unique community. That makes this area very special in terms of biodiversity."

Ziv and his Ph.D. students are studying beetles and gerbils, specifically, to see how they've taken to

the changing dunes.

"If you see species with a very small home range geographically, you know they can't live anywhere else. This definitely causes it to be very valuable."

The worry is that a changing habitat will harm the endemic species.

"We know that all three habitats — stabilized sand in the interdune valleys, semi-stabilized sand on the dune slopes and shifting sands on the active dune crests — are important for biodiversity," Ziv says. "Currently, we are losing two habitats, mainly the shifting sand and semi-stabilized habitats because soil crust organisms (creating the stabilized sand habitat) are taking over the entire area, homogenizing the landscape. So we lose the [plant and animal] species that depend on these two habitats."

So what's causing the soil to crust over and harden? The cause is really three-pronged. Part of the problem is human use of the land. The government has designated Ziv's research area as a military firing range, as well as a nature reserve, "something you would only see in Israel, and a very complex situation," Ziv says.

Because the land is closed to all non-military use (with exceptions made for Ziv's research), Israelis in general cannot traverse the land, and Bedoins specifically can no longer graze their sheep herds there, which naturally breaks up the crust (on the other hand, overgrazing can create its own homogeneity on the opposite end of the spectrum, as seen in the Sinai's lack of almost any stabilized crust). Large mammal species that used to be prolific in the area, like gazelles, are now a rare sighting. Their absence also contributes.

A third cause is 15 consecutive years of drought, with a 30 percent average decline in precipitation and a loss of up to 70 percent of perennial plants. This combination of little water and dead flora is a boon for the soil crust organisms, which are well adapted to drought periods. Without natural competition from the perennials, the soil crust organisms survive and thrive, taking over entire dune crests.

"This is why as ecologists, we have a very hard time coming up with solutions," Ziv says of the numerous and complex causes of the changing landscape. "Our main goal, together with the Nature and Parks Authority, is to use practices that will provide the highest habitat diversity known for this region in past years, in order to allow for higher species diversity with an emphasis on the rare, endemic species."

Before a few years ago, Ziv says, it was commonly accepted that the best way to make the region thrive was to avoid all human activity and allow the area to reestablish a rich ecosystem. Now, however, they know this isn't the case. Ensuring habitat heterogeneity, it turns out, requires active management.

Right now, Ziv and his research students are looking for a way to retain the shifting sand habitat. They're currently experimenting, alongside the Nature and Parks Authority, with using an ATV and attached tilling device to break the soil crust on dune crests. Hopefully, he says, they should have results within the next few years.

"Natural ecosystems, including our sandy habitats that may look simple and unharmed, are much more fragile and need much more attention," says Ziv, who studied rodent diversity while earning his Ph.D. at the University of Arizona. "[The Southwest U.S. deserts and the Negev sand sea] are different in many respects, but I think our findings are relevant to many other ecosystems in the

world that experience human development and use."

From Brackish to Sweet: Finding Solutions to Roadblocks in Water Desalination

Israel is no stranger to water reclamation. In fact, says BGU professor and researcher Jack Gilron, Israel recycles 70 percent of its municipal wastewater, specifically for agricultural use — by far the highest extent anywhere in the world. Israel also acquires much of its drinking water from desalination of brackish water and seawater.

Gilron is on the forefront of water treatment technology: he's a member of the Department of Desalination and Water Treatment within the Zuckerberg Institute for Water Research at the Jacob Blaustein Institutes for Desert Research on BGU's Sede Boqer campus. Gilron, who studies technologies and policies for the sustainable use of water resources, says that since dry lands occupy more than one-third of the earth's land surface, including most of the Middle East and Israel, dwindling water supplies and deteriorating water quality can impede on sustainable development of dry lands and the wellbeing of the population. Working with water researchers worldwide, Israel has proven it's possible to turn to underground brackish water and seawater as a viable option for drinking and irrigation.

However, even in Israel, and especially in countries without the desire or financial means to support such a costly water desalination operation (like Jordan, where Gilron says their technology could really be useful), improvements need to be made in technology to reduce the monetary and environmental cost of brine disposal and the amount of energy necessary to operate the process, as well as increase the recovery of fresh water during desalination.

In collaboration with water treatment researchers worldwide, Gilron and his team are developing innovative solutions to these challenging problems, specifically in the area of concentrate treatment. In other words, what to do with the leftover brine that results from desalination? The small amounts of water left in the brine are not technologically or economically practical to salvage, and the goal at this point is to concentrate any leftover brine to a solid so it takes up as little volume as possible when disposed. In inland areas, disposal means a double-lined enclosed space in a landfill.

"In seacoast installations, concentrate disposal isn't such a problem," Gilron says. "What you get out of the sea, you put back into the sea and diffuse it over a wide area or dilute it using cooling water from a nearby power plant. Inland, it's a terrific problem. You can't dump it on the ground, because it's brine. It'll salt the soil and destroy it [and possibly further concentrate groundwater supply below]."

Many inland areas opt for evaporation ponds, but that uses a lot of land, which increases the interface with and effect on the environment. Also, the largest need for water is usually in urban areas, where the cost of land is higher. As Gilron says, "you're using prime real estate just to evaporate water."

One of the techniques Gilron and his team have developed to reduce brine volume is enhanced evaporation using vertical surfaces, "almost like a giant outdoor clothesline," he says. "Instead of having one square meter of pond for one square meter of footprint, we can have 40 square meters of evaporating surface on one square meter of footprint."

As he describes it, a pump brings brine sitting in a container to the top of the vertical nets, distributes it across them and lets the brine fall down the nets in a film. The wind blows through, picks up the water vapor and carries it off. Italian researchers are interested in using the process to recover

calcium carbonate and sodium chloride from this highly concentrated brine, but it also works to simply reduce the cubic meters of space the brine uses in disposal. It saves money, creates efficiency and is more environmentally friendly.

But what about extracting more product water (from 80 cubic meters to 90 or 95 of every 100 cubic meters), and reducing the amount of remaining brine to half or even a quarter of what it originally was? Gilron is working on that too. In fact, he's founded his own company, ROTEC Reverse Osmosis Technologies, to carry his research through to applications in water treatment plants worldwide.

His invention, flow reversal, is a fairly simple process, though the mechanics of how to achieve it are quite complicated. In summary, desalination works by forcing water through multiple chambers at high velocity. It enters each chamber through one valve and exits through another valve into the next chamber. As the brackish water passes through each valve, it must flow through a membrane, which blocks passage of and diverts some of the salts, making the water less and less salty with each passage to a new chamber. Over time, some of the blocked salts can build up on the membrane, eventually crystallizing, or scaling, and lessening recovery of product water.

Gilron's technology reverses the flow of the water periodically, washing away the salts before they have time to crystallize and block the flow of water. The flow constantly reverses, creating a high-recovery desalination process. He combines his technology with a sensor, developed by University of Colorado at Boulder professor Alan Greenberg, that can detect the induction period before scalants begin to crystallize and therefore prompt the flow reversal to occur.

"I know there are projects in different parts of the U.S. and other parts of the world that they've not even started because they don't have an economic solution to brine disposal," Gilron says. "As a result of using this process, a modest-sized plant could save $900 per day, or $320,000-330,000 in a year. We hope that as a result of this, [Jordan] will see that they have a technological way forward to start developing their aquifers."

Many inland areas of the Southwest U.S. struggle with these very same problems. Even California is affected, because it's competing with those states for the same water flowing down the Colorado River. In 2002, the U.S. Bureau of Reclamation said inland desalination plants could cost twice as much to operate in part due to higher concentrate disposal costs and higher energy costs.

Gilron's technology could be useful in those cases, but, says UCLA Professor and Water Technology Research Center Director Yoram Cohen — who has collaborated with Gilron and other BGU researchers on water treatment and has participated in student exchanges with them — the U.S.'s largest academic desalination program is actually right here in California, at UCLA. Because Israel and Southern California share so many similarities in climate, geography and water resource problems, they're interested in much of the same research and work with many of the same companies and researchers worldwide to develop the best and newest strategies for water treatment and desalination.

California, though it's not known for it, actually has quite a few water treatment plants (Orange County has one of the world's largest, which serves as a model to other nations looking to build their own). In fact, says Cohen, though it treats a smaller percentage of its overall wastewater than does Israel, the amount it does treat is still significantly greater, simply due to the difference in size and population of the two entities. Though California is lagging behind Israel in building seawater desalination plants, it's not for lack of technology (though, surprisingly, plans for a massive seawater desalination plant in Carlsbad are currently underway and several small ones already dot the

coastline).

"That has to do with the fact that California has a coastal commission, which controls the coast, and to approve a plant in California…well, in Carlsbad it took seven years. It's more political than technological. San Diego killed its initiative for larger-scale wastewater reclamation because politicians fought it with the term, 'From the Toilet to the Tap.' As long as Californians think they can afford to pay for water without having to tap the sea, that's what will happen. In Israel, it's a different story. Israel has gotten to the realization that if they build desalination plants for drinking water, then they could give up certain rights for groundwater to the Palestinian Authority, and that's a lot cheaper than going to war."

It's also a smart way for Israel to survive, and thrive — not to mention work in cooperation with its neighbors — in the middle of the desert, something Ben-Gurion University has grown quite good at in its 41 years of searching for ways to make the Negev bloom.

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Small Café, Big Dreams

At Rehov Ringelblum 86 in Be'er Sheva's Daled neighborhood, amidst old apartment complexes and near Ben-Gurion University, is Café Ringelblum, a two-year-old restaurant that combines a for-profit business plan with a social program that rescues at-risk teens — mostly high school dropouts — from a downward spiral by giving them job training and job experience.

Established by Tor HaMidbar — a non-profit organization of young adults that aims to create social change in the Negev by enhancing public infrastructure through the establishment or improvement of services in Be'er Sheva — the café took up residence in a building that stood vacant and decrepit for two decades. Noam Horowitz, of Tor Hamidbar, had already been working with the youth of Daled for several years before he realized job training could help them.

He then partnered with social venture fund Dualis, whose founders are social entrepreneurs that aim to build for-profit social businesses. The two groups established the gourmet kosher (dairy) restaurant, have now graduated 17 teens and are working with the second group of about 15. On staff full time is a licensed clinical social worker who works with each group of youth that participates in the one-year program.

"We have good relationships with BGU and the student council," says Allen Barkat, Dualis founder. "The faculty are our frequent customers, and we have strong ties with lots of people at the university."

Specifically, the café employs adults and BGU students to work with youth in the program and train them to wait tables and serve diners, as well as the basics of responsibility and holding down a job. In the kitchen, professional chefs, led by Chef Kim Nave, and the kitchen staff train the youth to prepare food and run a kitchen.

"If we're very successful, we convince the army to take the youth into army service [upon their graduation]," Barkat says. "Others we help find jobs hopefully in Be'er Sheva restaurants or other areas." Either way, they're off the streets, out of trouble and contributing productively to their community.

For more information on Café Ringelblum or Dualis' other social venture restaurant, Liliyot, in Tel Aviv, visit *www.dualis.co.il*.

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