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Report on the Conference "Organisms as Environmental Engineers, Climate Change and their Relationship", Mar. 30-31, 2017, by The Midreshet Sde-Boker regional library:

This conference was organized as a tribute to Prof. Moshe Shahak. It dealt with the subject of "environmental engineers" organisms and their relationship to recent climate changes. A species of environmental engineer (or environmental designer) is a biological species that creates significant changes or destroys the habitat in which it is located, and in doing so, changes the distribution of other organisms. In the past, ecological research focused on distribution and variety of organisms in relation to various characteristics, such as weather, topography, food availability, competitors, predator-prey relations, etc. Environmental engineer species is a relatively new term that belongs to the field that has developed in recent years and deals with ecological interactions in habitats.
The term "environmental engineer species" was first proposed in an article by Clive Jones, John Lawton, and Moshe Shahak in 1994, inspired by the studies of Shahak, Jones and Granot in the Negev in the late 1980s. Environmental engineers are species that alter the resources available to other species by physically changing the biotic and abiotic environment.
The "engineers" are divided into two groups, depending on the nature of their impact on the environment: allogens and autogenic engineers.
An allogenous engineer - or "behavioral engineer" - changes his environment by changing external resources. It usually depends on the organism's behavioral mechanisms. Thus, for example, the Canadian beaver builds dams, diverts the river path in the habitat and completely changes its population composition; Woodpeckers, which puncture holes in trees, create habitats for small invertebrates; Larvae, which form niches from leaves, create a hiding place for other invertebrates after the departure of the larva. Most of the allogeneic engineers are organisms with motile organisms such as vertebrates or insects, but this is not always the case. Some plants and fungi also exhibit allogenic properties, for example: certain plants or fungi planted in soil contaminated with heavy metals, sucking metals into them and cleaning the soil, thus allowing more sensitive plants to thrive in the clean soil. An autogenic engineer - or "self-engineer" - changes his environment by changing his body. Trees in a growing tropical jungle shield their lower environment, preventing light from the lower plants and slowing their growth; the tendency of certain corals to create coral reefs dramatically influences the regime of the currents in the habitat, affecting many other organisms. Autogenous engineers are often motionless, like plants, corals, and oysters and other organisms often sit on them. Dead organisms can also function as autogenic engineers - large fragments of trees inhabit whole colonies of invertebrates, and marine organisms can also settle on the limestone skeleton of dead corals.
Many examples of such studies were presented during the conference on species such as environmental engineers of both types, studies on climate change and, finally, studies on the relationship between such species of environmental engineers.
The following are excerpts and summaries of the lectures:

The first session (Mar. 30st) dealt with the relationship between environmental engineers and climate change.

1) The anchor lecture was a lecture by Prof. Shahak himself, dealing with the place of the environmental engineers in the ecosystem.
2) Dr. Tarin Paz-Kagan of the Institute for Desert Research spoke about the use of remote sensing to examine the impact of climate change on the ecosystem.
3) Dr. Eli Zaadi, a researcher at the Volcani Institute - The Gilat station, spoke about the crusts as environmental engineers and how they respond to climate change of the present era.
4) Mr. Buzi Raviv of the Institute for Desert Research (Prof. Gideon Grapi's laboratory) spoke about the ways in which the plant distribution units (and the seed shell) alter the bacterial environment of the seed in the soil in order to help the seed resist bacterial and virus attacks.

The second session dealt with various examples of research in organisms which are environmental engineers.

1) Dr. Moran Segoli of the Ramat Negev Desert Agro-Research and Southern R & D organization spoke of the predation as a limiting factor in the distribution of isopods (*Hemilepistus reaumuri*) during the pre-climatic crisis.
2) Mr. Yigal Granot, an ecologist from Midreshet Sde Boker, spoke about the connection between the cumulative decline in rainfall and the catastrophic changes in the population of the *Hemilepistus reaumuri*. In this lecture, it was suggested that the isopodic disappearance was caused by the reduction of moisture accumulated in the soil.
3) Mr. Moshe Zaguri of the Department of Ecology, Behavior and Evolution at the Hebrew University of Jerusalem also spoke about the changes in the population structure of the *Hemilepistus reaumuri* as a result of an ongoing climate crisis.
4) Dr. Harel Agra of the University of Haifa spoke about the effect of the dense plants on the herbaceous vegetation along the rainfall gradient in Israel.
5) Prof. Efrat Morin of the Institute of Earth Sciences at the Hebrew University of Jerusalem spoke about the gap between the cumulative rainfall data (which do not show any significant decline at present) and the models that show that there is such a decline and it will continue in the future. She argues that the explanation for the gap is the inability of the statistical tests to find clear trends within data that have a high variance of the data. Also brought a number of signs that could be interpreted in her opinion that there is indeed a trend of dehydration and it will also continue.

Third session (Mar. 31st): special phenomena.

1) Mr. Niv de Malach of the Hebrew University of Jerusalem spoke about how the drought affects the changing landscape of dense plants at the Lehavim experiment site.
2) Dr. Asaf Zoar, a South Region Ecologist at the Israel Nature and Parks Authority, spoke about the ways to restore and preserve the ecosystem of the loess plain in the Zin field, and the principle of this conservation process is the use of "techniques" by environmental engineers to reconstruct the system of this plain (Digging many small pits - similar to the excavations of the environmental engineer, the Indian porcupine - in order to increase the fertility of the plain.
3) Dr. Hezi Yitzhak of the Institute for Desert Research, who spoke about the strange phenomenon of "fairy circles" in Namibia and Australia (circles of annual plants). The

conclusion of this study is that the circuits are formed as a result of termite activity or as a result of competing for water that spreads evenly in all directions. The current study tended to accept the second proposal, but it was explicitly stated that more research was needed to reach a decision.

4) Dr. Moran Segoli of the Ramat Negev Desert Agro-Research and Southern R & D organization spoke about the *Sarcopoterium spinosum* as an environmental engineer - and claims that the rescue of the *Sarcopoterium* dictates the distribution of the annual plants around and below the plants.

Yigal Granot & Ziv Yoffe