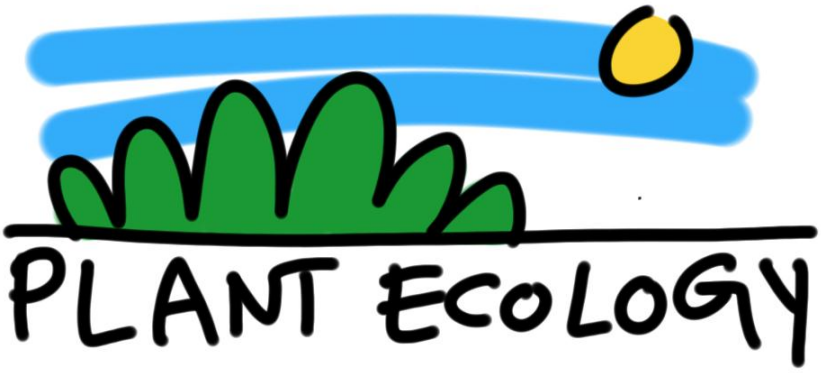
Plant Ecology 2020

Weizmann Institute of Science



Abstracts

Poster

Assessment of forage quantity and quality using remote sensing tools in Mediterranean and semiarid grasslands

Shay Adar[1,2,4], Tarin Paz-Kagan[2], Marcelo Sternberg[1], Eli Zaady[3], Eli Argaman[4], Guy Dovrat[5]

[1]School of Plant Sciences & Food Security, Faculty of Life Sciences, Tel Aviv University, Israel

[2]Laboratory of Geoinformatics and Remote-Sensing Department of Sensing, Information and Mechanization Systems Institute of Agricultural Engineering Agricultural Research Organization (A.R.O), Volcani Center, Israel

[3]Department of Natural Resources, Institute of Plant Sciences Agriculture Research Organization, Ministry of Agriculture, Gilat Research Center, Israel

[4]Soil Erosion Research Station, Soil Conservation & Drainage Division. Ministry of Agriculture & Rural Development, Israel

[5]Department of Natural Resources, Newe Ya'ar Research Center, Agricultural Research Organization (ARO), Israel

shay.adarz@gmail.com

Rangelands are one of the most common land-use types on Earth, with man-managed pasturelands covering >30% of the world's land surface. Therefore, sustainable land management in such areas has significant economic value for food production, as well as ecological implications. In our study, we utilize a multi-scale approach of remote sensing methods (satellite and aerial unmanned aerial vehicle [UAV] images), combined with field sampling for validation, in order to provide large-scale estimation of forage quality and quantity, and to gain insight into appropriate livestock management in the context of climate change. To the best of our knowledge, this is the first time in Israel where different remote sensing approaches are used to estimate forage quantity and quality. Sampling is performed several times along the growing season in two long-term ecological research (LTER) stations – Karei Deshe, (Mediterranean climate), and Migda, (semiarid). Results of this multi-scale project will be presented and challenges of this approach discussed.

Oral presentation

Mediterranean shrub decreases nitrogen fixation in response to increasing nitrogen availability in soil

Moshe Alon[1], Guy Dovrat[2], Efrat Sheffer[1]

[1]The Robert H. Smith Institute of Plant Sciences and Genetics in Agriculture, The Hebrew University of Jerusalem

[2]Department of Natural Resources, Newe Ya'ar Research Center, Agricultural Research Organization (ARO)

moshe.alon@mail.huji.ac.il

Symbiotic dinitrogen fixation in plants (N-Fixers) is the main process by which nitrogen enters terrestrial ecosystems. One strategy of N-fixation, termed facultative, is regulation of fixation in response to varying nitrogen availability in soil. *Calicotome villosa* is a widespread N-fixing shrub, generally considered a post fire early-successional species, which was recently shown in a controlled experiment to display facultative N-fixation.

We measured dinitrogen fixation along a post-fire chronosequence in the Judea Mountains, to determine whether *C. villosa* regulates fixation in the field, since post-fire ecosystems are known to have significantly different soil N availability, depending on the time they had to recover.

We found no correlation between soil N availability and fixation rates at these sites. However, when compared with previously studied sites with significantly lower N levels, we concluded that soil N in our current sites was above the threshold for down-regulation of fixation, and that *C. villosa* is in fact actively regulating fixation through varying investment in nodulation

Poster

Water use strategies and resilience to draught in the transition from Mediterranean to semi-arid climate

Madi Amer[1], Rafael Stern[1], Eyal Rotenberg[1] and Dan Yakir[1]

[1] Weizmann Institute of Science, Earth and Planetary Department, 234 Herzl st., Rehovot, Israel, 7610001

Madi.amer@weizmann.ac.il

This work aims to examine alterations in ecosystem responses to draught stress, in the context of land-use change in water-limited region.

We compared three different ecosystems in southern Israel's timberline; one Conifer-Forest (CF) and a broad-leaf Maquis (BM) near Nehusha (AI=0.4; where AI is aridity index: precipitation/potential-evapotranspiration) and another conifer forest in Yatir (AI=0.2). Short, 1-2 weeks campaigns of Eddy-Covariance measurements were carried out to assess Evapotranspiration (ET), net carbon-assimilation (NEE) and Water-Use-Efficiency (WUE=NEE/ET). Resilience to the summer draught stress was quantified as the ratio between post-stress/pre-stress magnitudes of the above parameters.

The ET resilience in Yatir was ~ 60% higher than in the CF and ~ 70% lower than of that in BM. However, the Yatir site was the lowest in the WUE resilience (~70% and ~20% lower than the CF and the BM, respectively).

While the semi-arid pines were more ET-resilient, the more humid conifers were more WUE-resilient.

Poster

Levels of genetic diversity and loci under selection in *Eruca sativa* populations

Prabodh Kumar Bajpai and Oz Barazani

Institute of Plant Science, Israel Plant Gene Bank, Agricultural Research Organization - the Volcani Center, Israel.

bajpai@volcani.agri.gov.il

In Israel, *Eruca sativa* has a geographical distribution across variable climatic conditions that range from mesic Mediterranean to desert environments. We sampled *E. sativa* over a period of six years to understand the changes in genetic diversity and loci under natural selection. We used 90 amplified fragment length polymorphism (AFLP) loci to assess genetic diversity. The overall genetic diversity is high in all the populations but their level differed at different years. We detected varied number of loci under directional and balancing selection in different years, using the Fst-outlier approach. Analysis of molecular variance revealed different proportion of variance among and within populations over the years; generally, it was high within population and low among populations. We also looked at correlations between plant flower phenology, environmental parameters and genetics. Overall, it appeared that there are different conditions in play, probably climatic, which are responsible for changes in genetic parameters over the years.

Oral presentation

The global mass and average rate of rubisco

Yinon Bar-On & Ron Milo

Weizmann Institute of Science, Plant and environmental sciences department

The enzyme rubisco is responsible for most of the global carbon fixation, and has been claimed to be the most abundant protein on Earth. We provide an updated estimate for the total mass of rubisco on Earth, concluding it is ≈0.7 Gt, ≈20-fold higher than previously thought. We find that >90% of rubisco enzymes are found in the ≈$2x10^{14}$ m^2 of leaves of terrestrial plants. We use our estimate for the total mass of rubisco to derive the effective time-averaged catalytic rate of rubisco and find that it is ≈0.03 s^{-1} on land and ≈0.6 s^{-1} in the ocean. This effective rate in the wild is ≈100-fold slower on land and ≈7-fold slower in the ocean. The lower ambient temperature, and rubisco not working at nighttime, are enough to explain most of the difference from lab conditions in the ocean, which implies that in the ocean rubisco is working close to its maximal catalytic capacity. This is not the case for land rubiscos, and therefore motivates future quantification of many more factors on a global scale.

Oral presentation

News and updates to the Flora of Israel

Dar Ben-Natan

Deshe - Open Landscape Institute (OLI), Steinhardt Museum of Natural History, Tel Aviv University, Tel Aviv.

In the past year, plant species unknown before from Israel and new sites of rare known species were discovered and observed throughout the country. In addition, some unidentified species found in the last few years have been identified, and some possibly new and yet undescribed species were discovered, collected and researched, in hope of describing them in the near future.

Also, an increased interest in mosses and liverworts by local botanists has led to some discoveries in that area as well.

Many of these findings are shared in social media alone, or inside of small groups of people, creating documentation problems, and sometimes a low reliability to the information thus shared.

Some of the new findings are due to recent surveys in areas that have been somewhat neglected in the past, and some are due to more intense survey and search efforts in more densely explored areas, alongside higher awareness of amateurs and the herbalist community. Prominent findings and updates will be presented in the talk, while addressing systematic problems. A brief review of the re-discovery of the Israeli moss flora, and some of the findings and actions to increase interest and awareness to these plants and their conservation will be given as well.

Poster

The agro-ecological value of edible wild plants

Eyal Ben-Simchon, Smadar Weininger, Oren Shelef

Natural Resources, Plant Sciences, Agricultural Research Organization (ARO)

shelef@volcani.agri.gov.il

Sustainable intensification (SI) of agricultural systems is a combination of two divergent trends, attempting to balance both a world producing more food and improved ecosystem functioning. SI could be achieved by the redesign of food production in agriculture. Therefore, for improved functioning of the agro-ecosystem, studies are exploring redesigning of the agricultural landscape. Agricultural landscape design include concepts as land sharing, land sparing, intercrops, seed cycles, and regenerative or conservation agriculture. However, one aspect that is not extensively studied is the provisional service of the ecosystem. Using more native edible plants has the potential to diversify agriculture, enhancing its resilience in the face of local and global changes. We will present a review of the edible plants in Israel, ranking the accumulated credibility of the current scientific and popular knowledge, profiling the agricultural potential across life forms, edible organs, and plant families. Exploring the agro-ecological value of edible wild plants may add another perspective for conservation ecology.

Invited talk

Mythology in plant ecology

Yohay Carmel

Faculty of Civil and Environmental Engineering, The Technion – Israel Institute of Technology, Haifa, Israel

yohay@technion.ac.il

The science of ecology is increasingly used to support decisions in nature conservation and in land management. As ecologists, we are confident that ecology is a robust and useful science. But how true is this presumption? In this talk, I revisit three central concepts in plant ecology, in order to find out how robust they are. The theories to be inspected are the intermediate disturbance hypothesis, the altitudinal gradient hypothesis, and the notion that livestock grazing is particularly harmful in ecosystems where it was recently introduced. Surprisingly, in all three cases, the evidence against the theory far exceeds the evidence supporting it. At the same time, all three theories are doing well; they continue to be featured in text books, and are passed on to the new generation of ecologists as general laws. This situation may be understood in light of Kuhn's notion of paradigms. In this context, we will look at the fate of findings that contradict a paradigm. I will briefly discuss two possible measures to mitigate this undesirable situation, (1) our own view of ecology, and (2) the way we teach our students, respectively.

Oral presentation

The ecological status of *Eucalyptus cmaldulenis* in Israel: Will the secondary invasion of ectomycchorriza promote its invasion?

Oded Cohen[1], Gil Veber[1], Aviv Guy[1], Stav Livne[1,2], Efrat Shefer[3] and Hagai Shemsh[4]

[1] Shamir Research Institute, University of Haifa, Katzrin, Israel

[2] Department of Plant and Environmental Science, Weizmann Institute of Science

[3]The R.H. Smith Institute for Plant Sciences and Genetics in Agriculture, The Faculty of Agriculture, Hebrew University of Jerusalem, Rehovot, Israel

[3]Department of Environmental Sciences, Tel- Hai College, Tel- Hai, Israel

odedic@gri.org.il

In the last few years, the ecological status of *E. camaldulensis* has been the subject of much disagreement. The species that until recently symbolized Zionist activity in Israel is now suspected to be an invasive plant. The goal of the current study was to produce basic quantitative data about the extent of the spread of this species and to assess the risk of its future invasion, focusing on the secondary invasion of ectomycorrhizal fungi. Results of a country-wide survey show that *E. camaldulensis* has already naturalized in Israel. However, seedling growth is often close to and rarely very far from the parent plants, regardless of the occurrence of the Australian ectomycorrhizal fungi *Rhulandiella*. Our results suggest that the limited ability of *E. camaldulensis* seedlings to establish is unrelated to the presence of invasive ectomycrorrhizal fungi.

Oral presentation

Vegetation-seed bank dynamics in annual communities

Niv DeMalach[1], Jaime Kigel[2], Marcelo Sternberg[1]

[1] School of Plant Sciences and Food Security, George S. Wise Faculty of Life Sciences, Tel Aviv University, Tel Aviv, Israel

[2] Institute of Plant Sciences and Genetics in Agriculture, Robert H. Smith Faculty of Agriculture, Food and Environment, Hebrew University of Jerusalem, Rehovot, Israel

Nivdemalach@gmail.com

Annual plant communities are comprised of standing vegetation and soil seed banks. To the best of our knowledge, the coupled dynamics of these two interrelated sub-systems have never been investigated. We use a long-term dataset from four sites varying in precipitation to test three hypotheses on the soil seed bank-vegetation dynamics. First, the 'resistant seed bank hypothesis' predicts lower temporal variability in the structure of the soil seed bank as dormancy buffers the environmental fluctuations. Second, the 'lagged response hypothesis' predicts that plant communities undergoing succession will have slower compositional turnover in the seed bank due to seed dormancy. Lastly, the 'contrasting seed bank-vegetation hypothesis' predicts that composition of the seed bank will differ from the vegetation's composition because species with high fecundity and low seedling survival will be over represented in the seed bank. Our results support the contrasting vegetation hypothesis but do not support the other hypotheses.

Oral presentation

The evolution of floral host preference in longhorn *Eucera* bees (Hymenoptera, Apidae): is association with bee-flowers advantageous?

Achik Dorchin1, Dafna Langgut1,2, Frank Neumann3, Nicolas Vereecken4

[1]The Steinhardt Museum of Natural History, Tel Aviv University

[2]Institute of Archaeology, Tel Aviv University

[3]Evolutionary Studies Institute, University of the Witwatersrand

[4] University libre de Bruxelles (ULB)

dorchina@mail.tau.ac.il

Flowers with specialised pollination mechanism with concealed pollen, such as in the Fabaceae and Lamiaceae, are pollinated primarily by bees and often referred to as 'bee flowers'. Bees differ in floral host preference, and changes between pollen accessible and restricted flowers would strongly depend on physiological and neurological constraints of bees. It can be therefore hypothesised that exploitation of restricted pollen may have opened a new ecological niche and triggered diversification of the associated bee lineages. So far, no empirical evidence has been demonstrated for such an effect on diversification rates in bees.

This study uses phylogenetic inference and determination of pollen grains collected by ca. 390 females from ca. 80 species to trace the evolution of floral host preference in longhorn bees of the widely distributed genus *Eucera*. Reconstruction of ancestral floral preferences using Bayesian methods shows that incorporation of restricted pollen occurred among the more recently diverging *Eucera* lineages. We use state dependent diversification approach to test whether switching from accessible to restricted pollen has increased the rate of diversification in *Eucera* bees.

Oral presentation

Functional reorganization and productivity of a water-limited annual plant community

Guy Dovrat[1*], Ehud Meron[2,3], Moshe Shachak[4], and Yagil Osem[5]

[1]Department of Natural Resources, Newe-Ya'ar Research Center, Agricultural Research Organization, P.O. Box 1021, Ramat Yishay 30095, Israel
[2]Department of Solar Energy and Environmental Physics, Blaustein Institutes for Desert Research, Ben-Gurion University, Sede Boqer Campus 84990, Israel.
[3]Physics Department, Ben-Gurion University, Beer Sheva 84105, Israel
[4]Mitrani Department of Desert Ecology, Blaustein Institutes for Desert Research, Ben-Gurion University, Sede Boqer Campus, 84990, Israel.
[5]Department of Natural Resources, Agricultural Research Organization, Volcani Center, Bet-Dagan 50250, Israel.

dovrat@volcani.agri.gov.il

In water-limited regions, plant size is related to soil resource availability, therefore, inter-annual self-organization process of annual plant communities (reorganization) is expressed through shifts in the diversity and values of plant sizes. In this study, we investigated reorganization through inter-annual changes in species diversity and functional structure. Vegetation composition and biomass were sampled over four years at Lehavim site, Israel. All of the individuals sampled were divided into categories according to plant size. We calculated the inter-annual changes in productivity and examined the relationships between this change and various reorganization indices. Reorganization indices based on both functional diversity of the community (size variance) and functional identity (value of size traits) were strongly related to, and demonstrated similar predictive ability for, inter-annual changes in plant productivity. Different components of functional structure complemented each other during the reorganization process and their relative contributions to changes in productivity varied significantly among years.

Oral presentation

Testing the role of floral neighborhood density and phenology on floral trait evolution

M. Kate Gallagher, Yuval Sapir

The Botanical Garden, School of Plant Sciences and Food Security, Tel Aviv University, Tel-Aviv, Israel

megankgallagher@gmail.com

Oncocyclus Irises come in all colors of the rainbow and are pollinated by male *Eucera* bees in a night-sheltering system. Bees that sleep in irises emerge earlier in the morning than ground-sleeping bees. We asked whether the strength of selection on floral traits varies depending with floral neighborhood density and phenology of a given focal plant? We hypothesized that if irises are rare in an area, bees may not exert strong selection on floral traits because they would rather sleep in any flower regardless of its size or color. However, if irises are common, then we might detect stronger selection on floral traits because bees have the opportunity to be more selective. We tested this hypothesis using the Yeruham *Iris petrana* population. Our results suggest that fine-scale temporal, but not spatial, variation in selection on floral traits could be a mechanism maintaining continuous floral color polymorphism in the Royal Irises.

Poster

Pinus sylvestris L. response to drought in pure and mixed forests along a climatic gradient

Giberti Giulia Silvia[1], Tonon Giustino[1], Giovannelli Alessio[2], Wellstein Camilla[1],

[1]University of Bolzano-Bozen, Faculty of Science and Technology. Bolzano-Bozen (BZ), Italy

[2]CNR-IRET (Istituto di Ricerca sugli Ecosistemi Terrestri), Via Madonna del Piano, 50019 Sesto Fiorentino, (FI), Italy

giuliasilvia.giberti@natec.unibz.it

Forest ecosystems are known to be vulnerable to climate change. Climate extremes e.g. prolonged drought events, already occurred and are expected to increase in duration and frequency in many areas across the globe. Resulting forest dieback can lead to dramatic consequences and nowadays, the need to understand trees response to future drought conditions is crucial. We selected *P. sylvestris* pure forests in contrasting climatic zones of Europe, i.e. temperate (Poland) and mediterranean (Spain), to investigate *P. sylvestris* xylem plasticity related to drought events under different climatic condition. Locally, mixed forests of *P. sylvestris* and *Quercus spp*., were chosen to understand whether the mixing of species with different ecological needs can improve the *P. sylvestris* resilience to drought events. A long-term quantification of the wood anatomical traits (tracheids size and parenchyma rays), will be used as a robust tool to understand trees response to drought under different climatic and stand condition.

Poster

Arabidopsis thaliana induces multigenerational growth promotion in a beneficial microbiota member

Omri Gilhar, Ilana Kolodkin-Gal

Weizmann Institute of Science, Department of Molecular Genetics,

omri.gilhar@weizmann.ac.il

Root-associated biofilms formed by *Bacillus subtilis* support plant growth and fitness. We explore how the symbiotic interaction with a plant host affects the growth and fitness of *B. subtilis*. So far, we found that *B. subtilis* co-cultured with *Arabidopsis thaliana* or its secretions decrease lag time compared with *B. subtilis* grown in isolation. In addition, *B. subtilis* cultured with the plant or its secretions colonized plant roots more efficiently than untreated bacteria and had a marked advantage to the latter during competition. Furthermore, plant treated *B. subtilis* cells also passed a decreased lag time and enhanced root-colonization to their descendants. These results are consistent with a mild activation of c-di-AMP synthase, DisA, during the interaction. Using an unbiased transcriptome analysis, we are mapping additional molecular mechanisms that account for this plant-induced multigenerational growth promotion of *B. subtilis*.

Overall, our work demonstrates a fundamental ecological principle involved in microbial adaptation to plant hosts.

Poster

The impact of cattle grazing on the performance of oak trees at the dry edge of their distribution in Israel

Omri Hasson[1,2], Yagil Osem[2] and José M. Grünzweig[1]

[1] Faculty of Agriculture, Food and Environment, the Hebrew University of Jerusalem, Rehovot

[2] Institute of Plant Science, Volcani Center, Agricultural Research Organization, Beit Dagan

omri.hasson@mail.huji.ac.il

Oak trees (*Quercus calliprinos*) and the large woodland biodiversity they support are threatened by climate change-induced drought. Drought stress in oaks may be mitigated by livestock grazing, but our understanding of grazing effects on water relations, nutrition and growth of trees is very limited. We aimed to assess the impact of cattle grazing on the performance of *Q. calliprinos*, the dominant keystone woodland species at the dry edge of their distribution. A set of six exclosures (non-grazed plots) and adjacent grazed plots was established in 2013 near Amatzia-Hazan, one of the southernmost oak woodlands in Israel. Seasonal measurement campaigns revealed that the water status of oak and accompanying *Phillyrea latifolia* trees was improved by grazing. While oaks did not differ in nutrient status, trees grew to a greater extent in grazed than in ungrazed plots. Our results confirmed that grazing can improve performance of trees subjected to drought.

Poster

Establishing tree habitats in urban pavements suitable to Israel's natural maquis habitats

Nir Herr[1] Aaron Manirom[2]

[1]nirforestecosoil, Alon Hagalil 17920

[2]Lev Ganim & Gananim, Rashi 50 Tel Aviv 63265

nir.herr@mail.huji.ac.il

https://www.nirforestecosoil.com

Habitats for trees in urban pavements are usually too small, and this inhibits growth, damages the pavements and causes failures in irrigation systems. Imported methods aimed at enlarging root habitats have not proven satisfactory.

Israel's maquis grows and thrives in its natural habitats, and the principles of its habitat system can be adapted to urban systems. The maquis soil-rock-roots structure and water regime have been thoroughly studied. The soil system has been mapped and the undersoil assessed in a number of cities, and the soil filling of planting holes has been planned in accordance with the local soil properties. Accordingly, an irrigation system with short- and long-term-components has been planned-to guide the development of a broad, deep and stable root system and prevent irrigation malfunctions and damage to pavements. This system will enable the establishment of a sustainable urban forest suited to local conditions and anticipated changes in climate.

Poster

The effect of toxic and hydrophobic components on seed germination in petroleum contaminated desert soils following the oil leakage event at Evrona nature reserve

Alina Hetzroni[1,2,3], Dr. Ellen Graber[1], Dr. Einav Mayzlish Gati[2]

[1]Institute of Soil, Water and Environmental Sciences, Agricultural Research Organization, Volcani Center.

[2]Israel Gene Bank, Agricultural Research Organization, Volcani Center.

[3]Bar-Ilan University

alinashay@gmail.com

The Evrona Reserve underwent two different oil leakage events in 1975 and 2014 resulting in negative effects on the development of native plant species in the area. The purpose of the present study is to analyze the effect of the various components of petroleum contaminated soil on seed germination and plant development. Petroleum contains toxic compounds together with hydrophobic compounds that prevent regular water penetration into the soil and consequently prevent sufficient water absorption by the plant. Using analytical tools, we performed various extractions of the contaminated soils and characterized them by analyzing the constituents of the extraction using GC-MS. These extracts were tested in biological tests to determine their toxicity for germination and plant development. Moreover, we determined the hydrocarbon pollution threshold in the soil that will allow a renewal of new seedlings in the Evrona Reserve. The threshold varies with plant species, type of soil and type of crude oil.

Poster

Reversible leaf xylem collapse: preventing cavitation under fast transpiration dynamics

[1,2]Uri Hochberg, [1]Yong-Jiang Zhang, [1]Alexandre Ponomarenko, [1]Fulton E Rockwell, [1]Noel M Holbrook

[1]Department of Organismic and Evolutionary Biology, Harvard University, Cambridge, Massachusetts 02138

[2]Department of Soil, Water and Environmental Sciences, Environmental Physics and Irrigation, Agriculture Research Organization (ARO), The Volcani Center, Rishon LeZiyon, Israel

Hochberg@volcani.agri.gov.il

The stomata protect the plants from critical xylem tension that might lead to xylem cavitation and permanent loss of hydraulic conductivity. When VPD increases, the stomatal opening is decreased to regulate a transpiration flux that will maintain the xylem tension above the critical cavitation threshold. However, under some scenarios (e.g. transition from shade to light), VPD increase could be substantially faster (1-2 minutes) than stomatal closure (10-20 minutes). This suggests that a much faster regulation is needed to allow high transpiration rates while coping with sudden changes in VPD.

In this study we compared the onset of collapse in minor veins under tension using cryoSEM while simultaneously monitoring xylem cavitation in an adjacent leaf using the optical vulnerability technique. Our findings show that xylem collapse occurs earlier than xylem cavitation. Models of transpiration transients showed that minor vein collapse and mesophyll capacitance could effectively buffer major veins from cavitation over relevant time scales. The results suggest that vein collapse makes an important contribution to plants' ability to transpire near the brink of cavitation-inducing water potentials.

Poster

Pine hybrids (*Pinus brutia* × *Pinus halepensis*) in Israel

Naomi Houminer [1,2], Rakefet David-Schwartz[1], Yagil Osem1 & joseph Riov[2]

[1] Institute of Plant Sciences, Volcani Center, ARO, Bet Dagan 50250, Israel.

[2] Institute of Plant Sciences and Genetics in Agriculture, The Robert H. Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot 76100, Israel.

naomi.houminer@mail.huji.ac.il

The forest in Israel is dominated by *Pinus halepensis* which is native to this region. Since the 1970's KKL gradually turned to the exotic *Pinus brutia* as the leading conifer used for afforestation. Hybrids between *P. brutia* and *P. halepensis* occur where the two species overlap geographically. Naturally occurring hybrids might be of ecological significance for the Israeli forest. However, hybrids are not easy to identify by morphology alone and can be easily mistaken as variants of *P. brutia* or *P. halepensis*. For this reason, we developed Single Nucleotide Polymorphisms (SNP) DNA markers based on transcriptomic data of the two species. By genotyping *P. brutia* stands consist of several suspected hybrids, we have identified 2.5-6% hybrids. Height and diameter at breast high (DBH) measurements revealed that hybrids exhibit hybrid vigor. The DNA markers that we developed in this research allowed us to analyze spontaneous hybridization in forests that undergo regeneration in Israel.

Oral presentation

The effect of natural forces at different spatial scales on functional traits variation in the desert annual *Anastatica hierochuntica*

Nir Krintza[1], Katrin Meyer[2] and Merav Seifan[1]

[1]The Mitrani Department of Desert Ecology, Ben-Gurion University of the Negev, Sede Boqer Campus, Israel.

[2]Ecosystem Modelling Department, University of Göttingen, Germany

krintza@post.bgu.ac.il

Trait variation within plant populations can be extreme because they are shaped by different driving forces: dispersal, environmental conditions, biotic interactions and stochastic factors. Furthermore, the relative importance of different forces can change with spatial scale. We used trait variation to evaluate the relative importance of various driving forces on the desert annual *Anastatica hierochunntica* populations under changing aridity conditions. We examined four populations along an aridity gradient. Within each population, we haphazardly sampled plants of similar developmental stage to represent the site heterogeneity and measured size, leaf membrane leakage and SLA. By comparing trait values and their similarities with the plant spatial distances, soil EC and water flowing direction, we estimated which forces are more dominant at different scales. The results of this study are expected to have strong implications on our understanding of community assembly in arid environments.

Oral presentation

Wetter years promote density-dependent biotic interactions causing long-term increases in tree diversity in a tropical moist forest

Edwin Lebrija-Trejos[1] and S Joseph Wright[2]

[1]Department of Biology and Environment, University of Haifa – Oranim, Israel.

[2]Smithsonian Tropical Research Institute, Apartado 0843-03092, Balboa Ancon, Panama.

edwin-l@sci.haifa.ac.il

Aridity is an important abiotic determinant of plant performance and forest characteristics. Species performance and abundances are also negatively affected by biotic interactions at high conspecific density. Such conspecific negative density-dependence (CNDD) is moreover central to stable species coexistence. In contrast to its effects on plant physiology, impacts of rainfall variation on biotic interactions are largely unknown. We analyzed 20 years of seedling survival data for Barro Colorado Island, Panama, to explore relationships between moisture availability, biotic interactions and their direct consequences for diversity. Seedling survival in areas of low conspecific density was higher in wetter years, yet CNDD was stronger in years with higher soil moisture. We observed higher maintenance of diversity in wetter years and simulated communities confirmed CNDD was an important causal factor. These results hint at important impacts on tropical forest diversity with alterations to aridity.

Oral presentation

The role of earthworms in the homogenization of the soil microbial community and its implications on plant performance and fungal diversity

Stav Livne-Luzon[1], Oren Perlson[2], Yael Avidan[3], Guy Sivan[4], Thomas D. Bruns[5], & Hagai Shemesh[4]

[1]Weizmann institute of Science, Department of Plant and Environmental Sciences, Israel

[2]Tel-Hai College, Department of Animal Sciences, Israel

[3]Ben-Gurion University of the Negev, Mitrani Department of Desert Ecology, Blaustein Institutes of Desert Research, Israel

[4]Tel-Hai College, Department of Environmental Sciences, Israel

[5]UC Berkeley, Department of Plant and Microbial Biology, Berkeley, USA

stavlivne85@gmail.com

The spatial distribution of ectomycorrhizal fungal (EMF) inoculum is heterogeneous at various scales and can greatly affect plant performance and establishment. Differences among EMF species can lead to spatial variability in inoculum distribution while external processes such as the movement of soil biota are expected to homogenize the soil spore bank. We tested the combined effect of EMF spore heterogeneity and earthworm presence on the performance of *Pinus halepensis* seedlings. Plants were larger if the spore bank was either concentrated in one big patch or completely mixed into the soil, than in the more heterogenous distributions. Surprisingly, earthworm's presence in the complete mixing treatment, led to a strong reduction in plant size. This interactive effect of inoculum heterogeneity and the presence of earthworms on plant biomass raise questions regarding the effect of soil biota on spatial heterogeneity and their cascading effect on plant performance.

Keynote

Considering the consequences of coflowering in the face of anthropogenic change

Tia-Lynn Ashman

Department of Biological Sciences, University of Pittsburgh, Pittsburgh, PA

tia1@pitt.edu

Flowering plants most often exist in multispecies communities where they share pollinators. Anthropogenic activities are increasingly being recognized as forces altering the structure of plant-pollinator communities via both species gains and losses, potentially changing the functional aspects of the of these communities. A key ecological function that is understudied at the scale of the community is that of pollen transfer. The quantity and quality of pollen transferred within and between plant species is well recognized to determine reproduction, population abundances, and mediate selection on floral traits and mating systems, but also may also be critical to pathogen transmission. Here I describe causes and potential consequences of variation in pollen transfer among plants. I first describe how invasions affect pollen transfer on two time scales in a highly invaded ecosystem. And then to illustrate the wide ranging consequences changes in pollen transfer can have on plant , I describe our work on the fitness impacts of heterospecifc pollen transfer and on discovery of pollen as a vehicle for plant viral transmission among plants.

Oral presentation

Herbarium as a tool for ecological studies

Neta Manela[1], Hagar Leschner[1], Naomi Yuval[1,2] and Tamar Avin-Wittenberg[1,3]

[1]National Natural History Collections, The Hebrew University of Jerusalem, Jerusalem, 9190401.

[2]History Department, The Hebrew University of Jerusalem, Jerusalem, 9190401.

[3]Department of Plant and Environmental Sciences, The Hebrew University of Jerusalem, Jerusalem, 9190401.

neta.manela@mail.huji.ac.il

Herbarium is a collection of dried pressed plant specimens with a scientific rational. Herbaria are a remarkable source of data about plants and their environment. It is a main source of information for researchers in various fields, mainly in plant taxonomy and systematics. Modern digitization of natural history collections opens-up possibilities for further scientific fields, and since the 2000's, it is taking the use of herbarium specimens to the next level. Together with online databases (such as GBIF; https://www.gbif.org/), digitized herbaria are made open to a wide public, both professionals and amateurs. The resulting metadata improves all aspects of plant research and conservation tools through high availability to researchers.

Molecular use of DNA extracted from herbarium specimens enables insight into the past. It makes it possible to investigate different phenomena such as phenology, differences between populations, short-range evolutionary processes, plant genetic response to environmental changes etc.

Oral presentation

The biomass distribution on Earth

Ron Milo & Yinon Bar-On

Weizmann Institute of Science, Plant and environmental sciences department

A census of the biomass on Earth is key for understanding the structure and dynamics of the biosphere. Yet, a quantitative, global view of how the biomass of different taxa compare with each other is still lacking. We harness recent advances in global sampling techniques to assemble the overall biomass composition of the biosphere, establishing the first census of the biomass of all the kingdoms of life. We look at the distribution of biomass on Earth across different aspects such as taxonomy, geography, and trophic modes. In this context, we also highlight the historical impact of humanity on global biomass.

Poster

Growth changes of *Acacia tortilis* and *Acacia raddiana* over space and time in the Arava desert.

Felista Nalufunjo

Tel-Aviv University

Acacia tortilis and *Acacia raddiana* are tree species that survive the hottest and driest deserts. They grow in ephemeral river beds ("wadi") and are considered keystone species due to the ecosystem services they provide in arid regions. The survival of these trees in hot and arid environments makes a good model for potential drought resistance approaches in the coming future in trees living in semi-arid regions.

This study involved analyzing changes in tree stem circumference of Acacia species *tortilis* and *raddiana* across 3 sites along the Arava desert with study sites spanning from wadi Sheizaf in the northern Arava, through wadi Shita in the central Arava down to Evrona in the southern Arava, 130 km apart and analysis was for a period of three to four years (2015 or 2016-2018, depending on site). Logging stem increment sensors (DRL26C EMS Brno) were used to ascertain the changes in stem circumference over time. To link growth changes with local conditions, environmental parameters were obtained from local data bases these include; rainfall amounts, basin sizes and slope details.

Increase in stem circumference is expected to occur mainly during seasons of heavy rains, which is during winter especially due to flash floods while summer is expected to involve decrease in tree stem circumference because root water supply from rainfall is much less. Nevertheless, this study proved that growth changes of Acacia trees are not always directly related to rain events especially because the trees rely on deeper underground water sources and not on flood events.

Oral presentation

A rhizosphere interplay between cypress trees and root-associated bacteria during drought

Yaara Oppenheimer-Shaanan, Gilad Jakoby, Maya Starr, Tamir Klein

Department of Plant and Environmental Sciences, Weizmann Institute of Science, Rehovot, 76100, Israel.

Trees are supposed to slow global warming, but these warming lead to trees struggle with drought stress. The root-associated bacterial communities play a main and vital role in maintaining health of the tree host. Here, we exploit *Cupressus sempervirens* (CIP) saplings to the Gram-positive bacteria (*Bacillus Subtills*) and Gram-negative (*Pseudomonas stutzeri*) as a model. We followed the soil chemistry, trees physiological responses to drought and alterations in the interaction between CIP roots and those bacteria under a controlled draught period. We found that trees under drought recruit *B. Subtills* vs *P. stutzeri*. While *P. stutzeri* has been shown to accumulate and enhance colonization on roots in irrigated trees. Furthermore, we demonstrated changes in root exudate profiles of trees inoculated with bacteria compared to trees not inoculated. We propose that potential benefit that trees receive from recruitment of specific bacterial lineages due to environment changing allow them to improve drought tolerance. This study might be an important step in developing strategies to combat drought.

Oral presentation

The ecological significance of phenotypic differentiation in floral traits between populations of *Eruca sativa*

Ben Perez, Haggai Wasserstrom, Oz Barazani

Institute of Plant Sciences, Israel Plant Gene Bank, Agricultural Research Organization, Bet Dagan 50250, Israel

benp@agri.gov.il

Plants of *Eruca sativa* (Brassicaceae) from desert and Mediterranean populations in Israel differ in flower color and size. The desert population has a higher abundance of flowers with cream color and longer petals, whereas the Mediterranean population has higher abundance of flowers with yellow and shorter petals.

An entomological survey of *E. sativa* herbivory in those regions showed that a specialist moth -*Plutella xylostella*, which also serves as a pollinator, was twice as prevalent in the desert habitat, where pollinators are less abound.

Choice assays with *P. xylostella*, confirmed our hypothesis that adult moths are more attracted to the flower morph of the desert habitat, while the larvae and ovipositing females are less attracted to the leaves of the same desert plants in comparison to the Mediterranean ones. These results suggest that in the desert habitat, plants have evolved a defense strategy and floral traits as an adaptation to *P. xylostella*.

Oral presentation

The global biogeography of polyploid plants

Anna Rice, Petr Šmarda, Maria Novosolov, Michal Drori, Lior Glick, Niv Sabath, Shai Meiri, Jonathan Belmaker and Itay Mayrose

Deciphering the global distribution of polyploid plants is fundamental for understanding plant evolution and ecology. Many factors have been hypothesized to affect the uneven distribution of polyploid plants across the globe. Nevertheless, the lack of large comparative datasets has restricted such studies to local floras and to narrow taxonomical scopes. We present a map portraying the worldwide polyploid frequencies, based on extensive spatial data coupled with phylogeny-based polyploidy inference for tens of thousands of species. This allowed us to assess the potential global drivers affecting polyploid distribution. Our data reveal a clear latitudinal trend, with polyploid frequency increasing away from the equator. Climate, especially temperature, appears to be the most influential predictor of polyploid distribution. However, this effect is mostly indirect, mediated predominantly by variation in plant lifeforms, taxonomical composition and species richness. Thus, our study presents an emerging view of polyploid distribution that highlights attributes that facilitate the establishment of new polyploid lineages by providing polyploids with sufficient time (i.e., perenniality) and space (low species richness) to compete with pre-adapted diploid relatives.

Oral presentation

Soil niche partitioning influences Mediterranean trees activity

Ido Rog, Stav Livne-Luzon, Gilad Jakoby, Shachm Megidish, Rotem Cahanovitc, Assaf Jakoby, Yael Wagner, Tamir Klein

Department of Plant and Environmental Science, Weizmann institute of Science, Rehovot, Israel

ido.rog@weizmann.ac.il

Tree roots diverge in their soil niches as a strategy to survive extreme environmental conditions. In this study, we investigate how soil niche partitioning of forest trees affects tree activity. We combined hydraulic measurements with molecular identification of mycorrhizal species in a forest plot with co-occurring conifers (*Pinus* & *Cupressus*) and broadleaves (*Quercus*, *Pistacia* & *Ceratonia*). We found that *Ceratonia* roots grow deepest and maintain minimal leaf water-potential of -3.0 MPa, whereas *Cupressus* roots grow shallower and drop below -6.0 MPa during the summer. Water-use patterns reflected niche partitioning, with *Ceratonia* active year-round, and *Cupressus* shutting down during summer. Among the five species, *Ceratonia* had the lowest level of mycorrhizal community similarity with the other host species. The shallow, horizontally-rooted *Cupressus* had higher mycorrhizal diversity, unexpectedly hosting ectomycorrhiza in addition to arbuscular. Our findings link the physical properties of the soil and roots with morphology and symbiotic interaction with fungi.

Oral presentation

Pollination in *Fritillaria* – from bees to birds, and back again?

Katarzyna Roguz[1,2], Marcin Zych[1]

[1]Botanic Garden, Faculty of Biology, University of Warsaw, Poland.

[2]Botanic Gardens, School of Plant Sciences and Food Security, The George S. Wise Faculty of Life Sciences, Tel Aviv University, Israel.

kaska.roguz@gmail.com

The genus *Fritillaria* consists of 140 to 160 species of bulbous plants, native to temperate regions of the Northern Hemisphere. The species are generally insect-pollinated but at least two shifts to ornithophily (bird pollination) occurred. We assessed the evolution of floral characteristics due to the shift in pollination mode by measuring 15 floral features related to pollination in 57 *Fritillaria* taxa. Based on phylogenetic analysis we traced the evolutionary trajectory of these traits using ancestral trait reconstruction. Results suggest that the common ancestor of *Fritillaria* was most likely insect-pollinated with small purple flowers and rich in rewards. It is also quite clear that some flower features evolved as a consequence of the selective pressure exerted by bird pollinators. We found that character shifts from insect to bird pollination corresponded with the evolution of several characters predicted by the pollination syndromes. Surprisingly, we recorded reversals from bird to insect pollination.

Poster

Plants taking charge: Autonomous self-pollination as response to plants-pollinator mismatch in *Fritillaria persica*

Katarzyna Roguz[1,2], Yuval Sapir[2]

[1]Botanic Garden, Faculty of Biology, University of Warsaw, Poland.

[2]Botanic Gardens, School of Plant Sciences and Food Security, The George S. Wise Faculty of Life Sciences, Tel Aviv University, Israel.

kaska.roguz@gmail.com

Floral colour is a visual cue to pollinators and of great importance in shaping plant-pollinator interactions. Directional selection creates uniformity of floral colour, but rare cases of colour variation are important to study the evolution of floral colours. In the geophyte *Fritillaria persica*, both cream-greenish and purple floral colour morphs were described. We aim to test the hypothesis that existence of both colour morphs is maintained through differential pollinator spectrum and visitation rate, due to differences in colour perception and nectar properties (sugar and amino acids). We propose also increased autonomous self-pollination is response to seasonal mismatch between flowering and pollinator emergence, and/or to differences in the pollination efficiency, which is hypothesized to vary between colour morphs. Studying preferences of pollinators and chemical analysis of floral reward properties may help us to understand the role of this factors in distribution and frequency of flower colour polymorphism in *F. persica*.

Keynote

Life beyond Earth: past, present and future

Lynn J. Rothschild

NASA Ames Research Center

lynn.j.rothschild@nasa.gov

The key to life anywhere, including off planet, will be focusing in an ecological approach, both understanding the relationship of the organisms to their environment, and to each other.
This includes the fundamental questions of astrobiology: “Where do we come from?”, “Where are we going?” and “Are we alone?” For over a decade NASA has used synthetic biology, which is in simplest form, is creating new capabilities with life, as an enabling technology to answer these questions. Examples will be given for the search for life elsewhere, and notably, the use of synthetic biology as an enabler of human exploration. We have a current satellite mission that combines synthetic biology and the first steps towards enabling a human colony off planet using an ecological approach.

Oral presentation

Oranges and apples? Plant responses to insect herbivores of distinct feeding guilds

Asaf Sadeh[1], Michal Eldar-Liebreich[1,2], Moshe Coll[2], Yahyaa Yahyaa[3], Michael Reichelt[4], Jonathan Gershenzon[4], Mwafaq Ibdah[3]

[1] Agroecology Lab, Dep. of Natural Sciences, Agricultural Research Organization, Volcani Center

[2] Dep. of Entomology, Hebrew University of Jerusalem

[3] NeweYaar Research Center, Agricultural Research Organization, Ramat Yishay

[4] Max Plank Institute of Chemical Ecology, Jena, Germany

asafsa@volcani.agri.gov.il

Plants face a diversity of biotic challenges in the field. To understand plant responses to multiple herbivory challenges, chemical ecologists generally employ arbitrary herbivore loads in factorial presence-absence treatments of two species, or additive density designs. These experiments do not disentangle herbivore species-specific responses of plants from responses to the experienced herbivory pressures.

We suggest a novel conceptual approach for determining *functionally equivalent loads* of each herbivore species, exerting on the plant similar herbivore pressures. We calibrated equivalent loads of caterpillars and aphids for similar damage to cabbage seedlings, coupled with the quantification of plant chemical responses.

Vegetative growth decreased linearly with the loads of each herbivore species, producing a one-to-one mapping between equivalent herbivore loads. Consequently, differences between plant chemical responses to the herbivores could be attributed to the identities of the herbivore species, therefore removing the common confound of unstandardized herbivore pressures in multiple herbivory experiments.

Oral presentation

The effects of dryland ecosystem mosaic on the surrounding climate

Rafael Stern, Madi Amer, Eyal Rotenberg and Dan Yakir

Weizmann Institute of Science, Earth and Planetary Sciences Department, 234 Herzl st., Rehovot, Israel, 7610001

rafael.stern@weizmann.ac.il

This work is investigating the variations in the balance between biogeochemical (carbon sink) and biogeophysical (albedo, heat fluxes) effects among different vegetation types (planted pines forest, maquis - oaks dominated - ecosystem, wheat field and grassland) under similar climatic conditions in central Israel. We used a state of the art field laboratory to carry out measurements of fluxes between the ecosystems and the atmosphere. We did the measurements in different seasons in the years of 2016, 2017 and 2018. Our main results show that the pines ecosystem is the one with the lowest albedo, which translates into the greatest sensible heat flux among all the ecosystems. This was termed the "convector effect". Pines are more conservative than the maquis ecosystem by reducing their activity in extreme conditions of heat and drought, and this could be one of the explanations for their success in spreading more southern (Yatir forest) than the maquis. Grassland and wheat have the greatest Net Ecosystem Exchange among all ecosystems in their short growing season.

Oral presentation

Plant community composition and biodiversity patterns in urban parks of Portland, Oregon

Michelle L. Talal[1] and Mary V. Santelmann[2]

[1]Environmental Sciences Graduate Program, Oregon State University, Corvallis, OR, United States

[2]College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, OR, United States

Urban parks are biodiversity hotspots and integral components of urban nature. This study explored relationships between plant communities and environmental and species traits in urban parks of Portland, Oregon. We examined how different urban park types preserve native species and/or harbor non-native and invasive species. We used a stratified random sampling design to select 15 parks and found a total of 178 plant species belonging to 141 genera and 65 families. Multivariate analyses were used to explore vegetation composition and associations of species assemblages with environmental variables. Statistically-significant differences in species richness and biodiversity indices were found between park types, with more native species in natural-passive use parks, more non-native species in multi-use parks, and more invasive species in natural passive-use parks than recreational-active use parks. Attributes such as natural-passive use park type, wetlands, steep slopes, native species origin, non-native species origin, and vine and tree plant forms were most strongly correlated with species abundance/distribution. These findings may assist managers in aims to promote native species, reduce invasive species, or achieve additional urban park goals.

Oral presentation

Earth's natural fertilizer: Foliar uptake of phosphorus from desert dust stimulate plant growth

Sudeep Tiwari[1,2], Adi Bier Kushmaro[2], Ran Erel[2] and Avner Gross[1]

[1] Department of Geography and Environmental Development, Ben-Gurion University of the Negev, Beer-Sheva, Israel

[2]Gilat Research Center, ARO, Israel

sudipnst@gmail.com; avner.gross@gmail.com

Phosphorus (P) scarcity constrains plant growth in many ecosystems worldwide. Because plants take up their P primarily from the soil, plants that grow on P impoverished soils have evolved specialized functional traits to acquire P through root adaptions. Here we describe an unrecognized P acquisition trait which is decoupled from the soil-root system and play a large role in plant nutrition: In a greenhouse experiment we found that the growth of plants that naturally evolved in ecosystems downwind to deserts (chickpea, wheat and maize) is enhanced by 20 to 70 % through foliar uptake of P from desert dust deposited on their leaves. P starvations induced morphological and chemical modification of leaf surfaces. These modifications increased leaf dust retention capacity and promoted solubilization of mineral P which is considered unavailable according to theory. In addition to P, dust also transferred substantial amounts iron (Fe) and Potassium (K) to the plants. Our results suggest that 'foliar dust traits' enable plants in dusty regions to acclimate to nutrient poor conditions. As both P limitation and dust deposition are projected to increase due to global environmental changes, plants adopting dust traits will gain competitive advantage over other species.

Poster

Regulation of carbon reserve use in olive trees under heat, drought, and recovery

Mor Tsamir[1,4], Shifra Ben-Dor[2], Ester Feldmesser[2], Yaara Oppenheimer-Shaanan[1] Rakefet David-Schwartz[3], Alon Samach[4], Tamir Klein[1]

[1]Plant & Environmental Sciences department, Weizmann Institute of Science, Rehovot, Israel

[2]Department of Biological Services, Weizmann Institute of Science, 76100 Rehovot, Israel

[3]Institute of Plant Sciences, Volcani Center, ARO, Bet Dagan 50250, Israel

[4]The Robert H. Smith Institute of Plant Sciences and Genetics in Agriculture, The Robert H. Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot, Israel

Mor.tsa2@gmail.com

Carbon reserve use is a major drought response in trees, enabling tree survival in conditions prohibiting photosynthesis. Still, regulation of starch metabolism under drought at the whole-tree scale is poorly understood and arise questions regarding the exact cellular components involved in response to drought, heat and recovery. To address these queries, we combined measurements of non-structural carbohydrates (NSC), tree physiology and starch metabolism enzymes expression. The experiment was conducted on twelve olive trees under seasonal warming and drying. Fast heat-induced starch degradation appeared in all trees, reversed in a week in watered trees only. Mannitol production was a major drought response. We identified the gene family members potentially relevant to long-term or stress-mode carbon storage, with different expression trends. Partitioning of function among beta-amylase and starch synthase family members were observed. Our results demonstrate specific, stress-related, starch metabolism genes, correlated with NSC fluctuations during drought and recovery.

Oral presentation

Acacia trees in a hyper-arid desert: higher photosynthetic activity during noon and summer times

Daphna Uni[1,2,3], Efrat Sheffer[2], Gidon Winters[3], Tamir Klein[1]

Daphna.uni@mail.huji.ac.il

[1]Department of Plant and Environmental Sciences, Weizmann Institute of Science, Rehovot, Israel

[2]Institute of Plant Science and Genetics in Agriculture, The Robert H. Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot, Israel

[3]The Dead Sea-Arava Science Center, Tamar Regional Council, 86910 Neve Zohar, Israel

Among living tree species, *Acacia raddiana* (Savi) and *Acacia tortilis* (Forssk), species of the legume family, populate some of the hottest and driest places on earth. Our research investigates the physiological processes underlying the unique survival of trees in extreme environmental conditions, a major point of interest in light of ongoing climate change. We measured Acacia trees in their natural habitat once a month for two years to unravel the water relations and photosynthesis dynamics. Leaf gas exchange and water potential were measured, as well as atmospheric and soil parameters. Daily and annual gas-exchange curves showed higher activity during 1800 µmol nd radiation are maximal (44°C,noon and in summer, when temperature a), and the air is dry (21% RH). Additionally, even after five months of drought, 1-s 2-mpre-dawn water potential was practically zero (-0.2 to -0.8 MPa). Our results suggest that water did not limit photosynthesis but rather light and temperature, despite the harsh conditions.

Keynote

How does *Solanum dulcamara* survive abiotic and abiotic stresses? A Bittersweet story

Nicole van Dam

Molecular Interaction Ecology

German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig

nicole.vandam@idiv.de

Plants evolved a wide diversity of strategies to survive biotic and abiotic stresses. These strategies include phenotypic plasticity, such as responses to drought or herbivory. Simultaneously, heritable intraspecific variation, e.g. in metabolomic profiles, evolved to resist different types of herbivores. *Solanum dulcamara* (Bittersweet nightshade) is a plant species that grows in a wide range of habitats, ranging from dry coastal sand dunes to wetlands and reed boarders. In addition, it has a rich herbivore community, which includes specialist beetles. We studied the responses of *S. dulcamara* challenged with drought stress and two different herbivores. Based on the transcriptomic response and phytohormonal signature, we concluded that drought affects the response to specialists and generalist herbivores. In addition, we found that *S. dulcamara* displays chemical diversity in steroidal glycoalkaloids (SGA): one chemotype lacked common SGAs and was very susceptible to slugs; however it received less damaged from specialist beetles suggesting differential selection.

Oral presentation

Evidences for the negative effect of drought period on woody plant communities in the Mediterranean region in Israel.

Yoni Waitz, Ron Drori and Efrat Sheffer

Institute of Plant Science and Genetics in Agriculture, The Robert H. Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot, Israel

yonyonw@gmail.com

Climate predictions indicate that Israel is expected to experience a most severe drying, ~20% reduction in rainfall. Such climatic changes are unprecedented and therefore are likely to impact local flora.

Here, we evaluate the effects of the recent and relatively arid decade (2008-2018) on the cover and the diversity of trees, shrubs and vines in various vegetation formations. A combination of field surveys and high-resolution aerial image analyses in multiple sites throughout the Mediterranean region was conducted, comparing the vegetation cover of 2008/9 and 2018/9.

The analysis revealed a coherent result of a decline in the woody cover in most of the sites, and that the magnitude of decrease in cover is significantly correlated to the mean annual precipitation. There was no significant trend of the change in diversity between both field surveys. Our results emphasize a negative change in the vegetation, influenced by the ongoing drying trend in Israel.

Oral presentation

News in Threatened Plants conservation 2019

Margareta Walczak & Merav Lebel

Israel Nature and Parks Authority

- The Minister of Environmental Protection signed the new list of protected plants, extending legal protection to all plant species of the "Red Data Book" (Shmida at al. 2007, 2011).
- Based on updated data, ten species have been added to the Red List whereas eight species have been removed as they no more meet the Red Data Book criteria.
- The Red Plants Steering Committee started estimating the status of Israeli endangered plant species following IUCN categories and criteria.
- Israel joined the International COST Action “An integrated approach to conservation of threatened plants for the 21st Century”.
- The network of INPA refuge gardens for threatened plants keeps growing. First educational programs for refuge gardens should be ready this spring.
- More reintroduction actions take place, e.g. *Alkanna glilaea* on Mt. Gilboa.
- More seeds of additional species have been stored in Gene Bank.

Keynote

Using *Arabidopsis thaliana* to understand climate-driven adaptation

Detlef Weigel

Max Planck Institute for Developmental Biology, Germany

My group is addressing fundamental questions in evolutionary biology, using both genome-first and phenotype-first approaches: (i) Where do new genetic variants come from? (ii) Why are some variants maintained for a much longer time than others? (iii) And why are some combinations of variants incompatible with each other?

The background for these questions is our population genomic work in *Arabidopsis* and the related genus *Capsella*. In collaboration with Bergelson, Ecker, Mott, Nordborg, Schmid and others, including Monsanto, we have been describing whole-genome variation in wild isolates of *A. thaliana* (http://1001genomes.org). This has, for example, led to the discovery of a Neanderthal-like group that has apparently survived since the Last Glacial Maximum. A similarly surprising finding that emerged from the *Capsella* work with Neuffer, Slotte and Wright is the ubiquity of long-term balancing selection, specifically at immunity loci. On the other end of the spectrum, we are analyzing new DNA mutations and epigenetic variants that have arisen under laboratory conditions or in a natural mutation accumulation experiment. The latter studies take advantage of an *A. thaliana* lineage that was apparently introduced to North America in historic times and accounts for about half the population there (with Bergelson and Burbano labs). We have been able to support what we see in the extant North American population by whole-genome sequencing of herbarium samples from the 19th century.

The ultimate goal of our top-down studies is to understand how genetic and epigenetic variation interact with natural selection to shape geographic patterns of diversity. One example is our effort to predict which *A. thaliana* populations will and which will not be able to adapt to climate change. In my talk, I will focus on a rainfall manipulation experiment carried out in Spain and Germany with over 500 *A. thaliana* accessions with complete genome information. Integration of fitness data with climate metrics reflecting where genetic variants occur geographically allows us to deduce the strength of selection driven by local climate across the range of the species. With rapidly increasing droughts and rising temperatures in Europe over the coming century, we forecast a wave of new directional selection forces moving North, causing genetic turnover and decimation of native *A. thaliana* populations.

Additional information about our work can be found on our website, http://weigelworld.org.

Oral presentation

Restoration of phosphate mining sites in Zin valley: a study of the plant community

Tom Zylberberg, Guy Rotem, Yaron Ziv

Department of Life Sciences, Ben-Gurion University of the Negev

tom.zylberberg@gmail.com

Plants and their seed banks are extremely important for ecological restoration processes. In my study, I focused on three phosphate mining sites, restored in different years, along Zin river valley, comparing the plant community of restored plots within these areas to adjacent natural plots. I asked whether germination potential differs between the restored plots and the adjacent natural plots. I hypothesized that: (1) there is a lack of seed bank in the restored plots; (2) the altered soil composition at the restored plots inhibits germination. I used soil samples collected from the different mining sites and arranged greenhouse experiments. Results indicated that limited seed bank is the major factor restricting plant community recovery. The younger sites differed significantly from their natural areas, while the oldest site showed no significant difference. My findings specify constraints on vegetation growth and are the basis for further experiments that test prospective practices for restoration.