



# Abstract Book

## The 2<sup>nd</sup> Israeli Conference for Conservation Science - A Sustainable Future for Humans and Nature

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המסלול לאדריכלות נוף  
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האגודה הישראלית  
לאקולוגיה ולמדעי הסביבה



The 2<sup>nd</sup> Israeli Conference for Conservation Science  
for a Sustainable Future for Humans & Nature

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## **PARALLEL SESSION: ANIMAL AND PLANT CONSERVATION**

### **Human-hyaena Interactions in Ein-Vered, Israel: A Case Study for Conflict Management**

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In Israel, human population growth, coupled with natural habitat fragmentation and destruction over the past few decades, has led wildlife to approach human settlements more frequently and develop a sense of reliance on anthropogenic food sources. The presence of large carnivores such as the IUCN red listed Striped hyaena (*Hyaena hyaena*), provoke strong feelings among residents who mount pressure on the national wildlife authority by means of official complaints to municipal officials, the media, and administrative appeals, to act in favor of evicting the animals from its changing environment. Since the wildlife authority in Israel is not inclined to cull hyaenas, there is a need to manage these situations in an evolving, shared landscape.

A pilot project to minimize human-hyaena interactions was implemented over 5 months (July to November 2018) in the small town of Ein-Vered, located in the heart of the Sharon district in central Israel. The project methodology draws from a range of academic disciplines, including socio-ecology (human dimensions of wildlife), ecology, and citizen science, to reveal a holistic approach to human-wildlife conflict management.

Assessment of wildlife acceptance capacity showed resident responders had more positive (64%) than negative (15%) attitudes towards the hyaena and exhibited more mutualist than utilitarian wildlife value orientations. Sixty-five percent of the resident responders agreed with the statement "I benefit from knowing that striped hyaenas exist in the Sharon area". Hyaena tracks and poultry farm examination showed an overlap between hyaena presence and two specific farms which did not dispose of carcasses appropriately. Additionally, personal interviews revealed a tendency to put forward poultry carcasses in a deliberate attempt to feed the hyaena. Residents reported 29 sightings within the course of the project, most accompanied by exact GPS location, time, date, and video or photographic imaging.

Although quantitative data to demonstrate a decline in fear perceptions among residents was lacking, the project did manage to have a positive impact by building a platform to connect residents and the wildlife authority, which can help inform management decisions. Additionally, the project revealed the true nature of conflict within the specific context of Ein-Vered and a proposed solution to the underlying attractants for hyaenas.

The interdisciplinary framework of the human-hyaena interaction project in Ein-Vered is a novel approach to managing conflicts between humans and red-listed large carnivores in Israel. It serves as a potential management tool for the wildlife authority and a service for local municipality needs. The project provides residents with a sense of involvement in the interests and future endeavors of the community, bringing to light the responsibility of maintaining good sanitary conditions inside the town and a dialogue about the place of wildlife within the community.

## **What can observations of reintroduced Griffon vultures (*Gyps fulvus*) tell us about the efforts to conserve this species in Israel?**

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Israel's population of Griffon vultures (*Gyps fulvus*) had declined dramatically in the past 100 years. Consequently, the species local population is considered critically endangered. In order to stop this decline, a captive-breeding and reintroduction program is operating in Israel since the 1990s, with more than 150 captive bred birds released since 1993. In order to monitor the success of this program, all released vultures are tagged with a unique color ring and since 2007 vultures are also tagged with wing tags; both markings are readable from a distance. These individual markings led to over 5,700 observations of released vultures reported since 1996 throughout Israel. We used these observations to study the factors affecting the success of Griffon vultures' reintroduction in Israel.

In this talk we present the first results of our study which aims to assess the effects of different captive breeding and release protocols on the survival and behavior of reintroduced vultures. We found that 62% of the released birds were observed more than a year after release. The time between a vultures' release and its last observation (the known survival period) was affected by both its release location and rearing method. Movement between the two release sites – Mt. Carmel and the Golan Heights – was frequent, while observations in other parts of the country were rare. Our results present a first and important glance at the potential that this long term database holds for the study and improvement of Griffon vultures' reintroduction in Israel.



## Sex specific genetic structure: the Nubian ibex in the Judean Desert

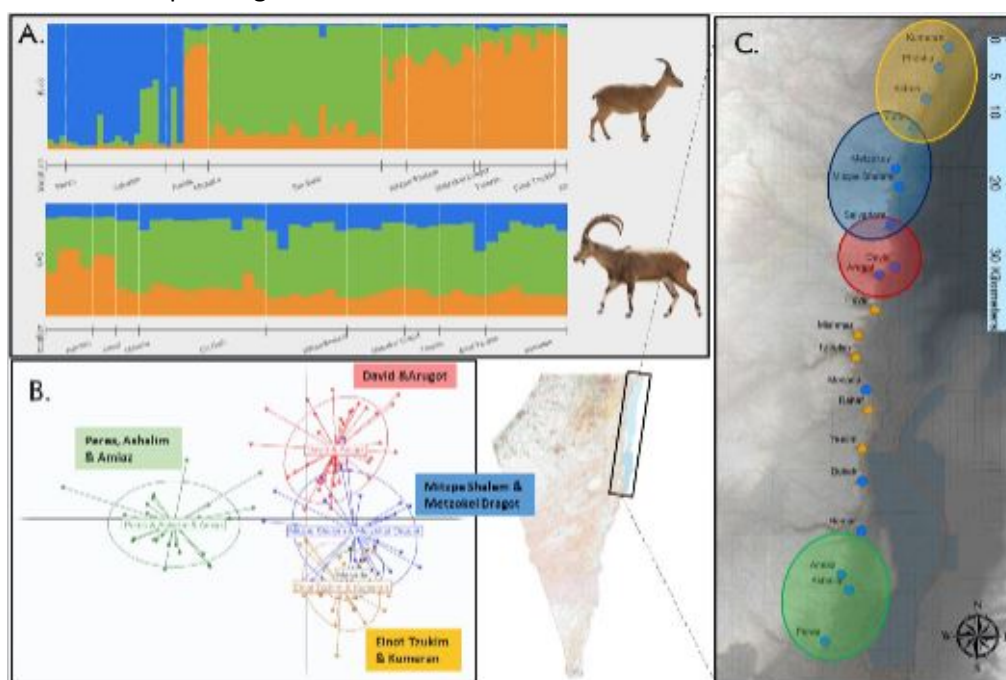
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Dispersal is a key factor shaping the spatial genetic structure of populations. Effective dispersal between populations reduces the chance of local extinction and maintains gene flow which is essential for preserving genetic diversity and the evolutionary potential of populations. This study aims at understanding the spatial genetic structure of the Nubian ibex (*Capra Nubiana*) population in the Judean Desert and the factors influencing it. We hypothesized that differences in space-use between males (that move long-distances in the region) and females (that show site-fidelity) impact gene flow within the population and hence the genetic structure. Samples from 130 ibex were collected using noninvasive and invasive methods and genetically characterized by 13 microsatellites, mtDNA sequence, and sex markers. A spatial genetic structure was identified separating the southern and northern parts of the Judean Desert (). This structure is not a result of isolation by distance alone () and was found among females but not among males. Additionally, female groups exhibited higher genetic relatedness than male groups sampled in the same area. These results of sex-specific genetic structure support our hypothesis, highlighting the role of males in maintaining gene-flow in the population. The world largest Nubian ibex population is concentrated in the Judean Desert (IUCN red-list). Information on its genetic structure can help to protect this vulnerable species. In order to maintain gene flow in the population it is essential to enable long-distance movements of males, mainly during the rut season, by protecting their pathways.

### Sex specific genetic structure: the Nubian ibex in the Judean Desert



Results of sex-specific genetic structure highlight the role of males in maintaining gene-flow in ibex populations. The world largest ibex population is concentrated in the Judean Desert (IUCN red-list).

Information on its genetic structure can help to protect this vulnerable species. In order to maintain gene flow in the population it is essential to enable long-distance movements of males, mainly during the rut season, by protecting their pathways. **A**-STRUCTURE results: spatial genetic structure was found among females (top) but not among males (down). **B**- DAPC analysis: spatial genetic structure was identified mainly between the southern and northern parts of the Judean Desert. **C**- Spatial genetic structure shows clear separation between the south and the north of the Judean Desert, and an internal partial genetic separation with overlapping within the north of the Judean Desert.

## Nature conservation from an ecosystem perspective: A lesson from the extremely arid desert

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The dry salty marshes of the southern Arava Valley are a unique habitat inhabited by some rare biological assets that deserve conservation. The area has been strongly affected by human activity and by sharp inter-annual climatic fluctuations. Herein we summarize a conservation work-plan based on the current ecological understanding of the principal species.

The keystone trees ***Vachellia (Acacia) tortilis*** and ***V. raddiana*** extract water from shallow aquifers that are recharged by floods and their populations are resilient to the drying weather. The leaves of the ***Vachellia*** spp. trees is the main food of the flagship species of gazelles (***Gazella dorcas***, ***G. arabica***). Long-term monitoring indicated that leaves productivity does not change significantly over the years. Gazelles' populations are heavily affected by the population size of their main predator-the wolf (***Canis lupus***). Lately wolves became partly dependent on available anthropogenic food sources that helped their population to grow sharply.

Consequently, an increase in gazelle predation was observed generating a sharp decline in gazelle populations almost to crash. Management actions taken included: local wolf culling, fencing a large gazelle enclosure, and closing all garbage dumps. ***G. dorcas*** and ***G. arabica*** compete for ***Vachellia*** leaves causing over-utilization of the lower tree canopy creating a distinct "browse line". With time and growing gazelle populations available leaf biomass can be found only higher on the tree so less food is available for fawns. Management acts were to remove 250 dorcas gazelles from the enclosure into open Yotvata NR, and to introduce artificial food pellets to ***G. arabica***. The case of the southern Arava exemplifies the fact that nature conservation in modern time has to apply active management, following an on-going monitoring, to cope with an array of man-and nature-made threats. Wolf culling, gazelle removal, fencing, garbage concealment and feed supplementation are parts of an ecosystem-based management program that has been applied in the region by the Nature and Parks Authority.

## **A nation-wide analysis of tree mortality under climate change: forest loss and its causes in Israel 1948-2017**

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### **Abstract**

Is tree mortality increasing? Are recent mortality events related to climate change? Which tree species are the most affected? Many case studies have been published, but the necessary large-scale and long-term knowledge is still missing.

Here we combined data from forest surveys and satellite imagery, to create the first spatial tree mortality history at the national scale. Israel is a small country with only 7% forest cover, but its large environmental diversity makes it a good 'miniature model' for the task.

Tree mortality events have been increasing significantly since 1991 and correlated well with drought. Among mortality events, 24% of the loss was directly related to drought, and 58% to fire, with 69% of fires occurring over a drought background. Conifers were disproportionally more affected than native broadleaved trees.

Our study opens a way to a better, multi-source monitoring future for forest management and ensuring forest sustainability under climate change.

### Genetic rescue in space: inbreeding depression, ecological fit and the *Iris*.

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General topic: Endangered species

Genetic rescue is a method to overcome reduced genetic diversity in small and isolated populations. It applies to endangered plant species suffering from fragmentation and reduced gene flow, and requires assisted migration to increase genetic diversity. Despite the appeal of such a simple solution, genetic rescue may risk endangered species if the source of imported genotypes is genetically similar and may cause inbreeding depression. Likewise, genetically distant sources from different ecological backgrounds may create maladapted offspring due to outbreeding. An optimal crossing distance (OCD) was proposed as a compromise between inbreeding and outbreeding depression, where fitness of hybrids between populations is theoretically the highest. We used the endangered *Iris atropurpurea*, an Israeli coastal endemic plant species, to test for the applicability of OCD along an environmental gradient in multiple populations. Plants in Netanya site were pollinated with pollen from populations across the whole distribution of *I. atropurpurea*, and fitness was measured as fruit-set, seed-set, seed viability and offspring survival in the maternal site. We found that while ecological distance between sites had the strongest effect on fruit and seed-sets, suggesting intrinsic outbreeding depression, offspring survival suggest lack of extrinsic outbreeding depression and hint for inbreeding depression. These results suggest that genetic rescue is not as straightforward as it may seem and that for efficient conservation practice the genetic relatedness among populations must be studied, alongside ecological divergence and the extent of local adaptation.



## The effect of plant soil feedbacks on the performance of *Iris lortetii*

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The complexity of ecosystems requires an integrated understanding of multiple above and belowground processes. Plant soil feedback (PSF) interactions can help explain how these processes relate to one another. PSF occur when plants alter the biotic and abiotic qualities of the soil they grow in, in turn altering the ability of plants to grow in that soil in the future. Feedbacks can be positive, negative or neutral in regard to plant performance, with rare species tending to display negative feedback. In this study we characterize the feedback direction between the rare and endangered *Iris lortetii* and its native soils. We compared increase in biomass of *I. lortetii* grown in live and sterilized soil, originating from inside and outside the natural patch. Two populations of *I. lortetii* were examined, Malkia a well-known established natural population and Dishon a young population planted for the purpose of field research. We found that *I. lortetii* of the natural population exhibits negative PSF with its soil. Additionally, sterilization reduced the performance of the plants of both populations suggesting that the negative PSF is not caused by an abiotic driver. Understanding PSF of *Iris lortetii* can help explain the current state of this endangered species and possibly other species, thereby benefiting conservation effort in the region.

### The significance of this research:

I would like to propose this research model as a simple, quick and economical way to obtain information on the state of endangered species. A perpetual challenge we face when approaching the conservation of an endangered species is the lack of information on the mechanisms driving population declines. The interaction between a plant and its soil has a vast effect on most life processes of the plant, and can even affect the success of the next generation. Therefore, estimating PSF can be advantageous when trying to develop an action plan for an endangered species. Moreover, characterizing the PSF of multiple species within a reserve can potentially reveal spatial processes affecting functional groups and invasion. In conclusion, this model may serve as a beneficial tool for conservation planning and management efforts.

Figure 1 - Microhabitat effect on growth

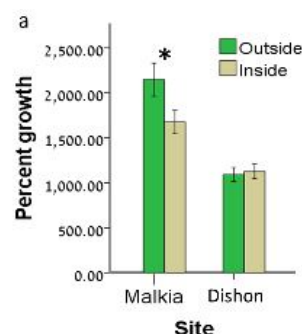


Fig. 1 The combined effects of site with both microhabitat (a) and soil state (error bars represent  $\pm$ SE).

## PARALLEL SESSION: SOCIAL SCIENCES IN CONSERVATION

### A season for all things: phenological imprints in Wikipedia usage and their relevance to conservation

Authors: John C. Mittermeier, Uri Roll, Thomas J. Matthews, Richard Grenyer

Phenology plays an important role in many human-nature interactions, but these seasonal patterns are often overlooked in conservation. We provide the first broad exploration of seasonal patterns of interest in nature across many species and cultures. Using data from Wikipedia, a large online encyclopedia, we analyzed 2.33 billion page views to articles for 31,751 species across 245 languages. We show that seasonality plays an important role in how and when people interact with plants and animals online. In total, over 25% of species in our dataset exhibited a seasonal pattern in at least one of their language-edition pages, and seasonality is significantly more prevalent in pages for plants and animals than it is in a random selection of Wikipedia articles. Page view seasonality varies across taxonomic clades in ways that reflect observable patterns in phenology, with groups such as insects and flowering plants having higher seasonality than mammals. Differences between Wikipedia language editions are significant; pages in languages spoken at higher latitudes exhibit greater seasonality overall and species seldom show the same pattern across multiple language editions. In some cases, seasonal variations in Wikipedia page views are tightly-linked to phenology that there is potential to track phenomena such as bird migration using online page views. These results have relevance to conservation policy formulation, and to improving our understanding of what drives human interest in biodiversity.

Supplementary figure and caption:

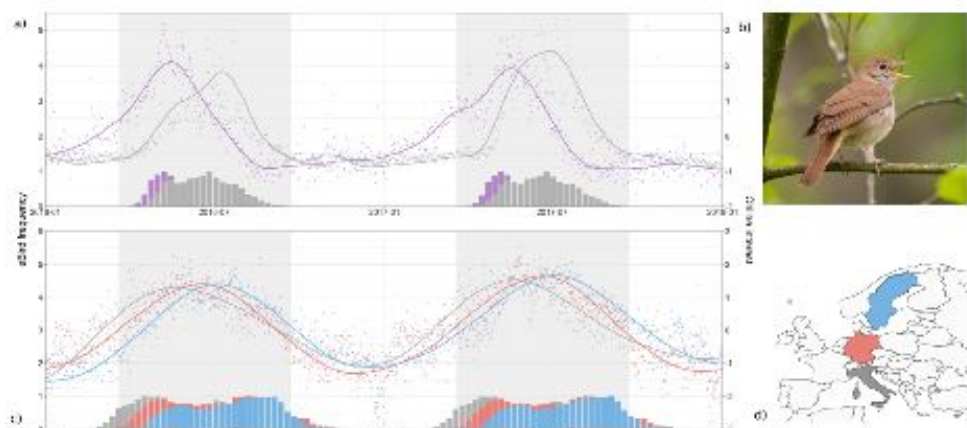


Figure: Wikipedia page views track avian migratory movements across Europe. a) In German-language Wikipedia, page views for the Common Nightingale *Luscinia megarhynchos* (purple; pictured b) peak earlier in the year than those for Common Swift *Apus apus* (gray). This corresponds with the later arrival of swifts to their German-breeding grounds, as evidenced by the eBird frequency of both species in Germany (histograms). c-d) The timing of a peak in Wikipedia page-views in regional European languages tracks the spring migration of Barn Swallows *Hirundo rustica* northward across the European continent. Views to the Wikipedia page for Barn Swallow in a southern European language (Italian, gray) peak first, followed by central European language (German, red) and finally a Scandinavian language (Swedish, blue); this sequence mirrors the spring

arrival of swallows in each country as shown by the frequency with which swallows are reported in eBird in Italy (gray histogram), Germany (red histogram), and Sweden (blue histogram). eBird frequency for each species/region is scaled 0-1 (left axis); Wikipedia page-views are scaled by subtracting the mean and dividing by the standard deviation (right axis) and smoothed with a local polynomial regression of with a set span of 0.2. Image: Rob Zweers, reproduced with permission of the author.

#### Significance to Israel:

Online patterns in page views and other digital metadata provide insight into which types of plants and animals people are interested in, when they are interested in them, and also how and why they interact with them. When coupled with spatial data they also offer data on where people interact with those species. These are fundamental questions with relevance to many local conservation projects and could have multiple applications to conservation in Israel. For example, Wikipedia data could be used to summarize which Israeli species are most popular amongst people online and understand how that popularity varies across different demographics. Is the relative popularity of these species amongst users of Hebrew Wikipedia similar to that of other languages? Likewise, does the popularity of species respond to phenological patterns in Israel? Israel would be an ideal country in which to further develop some of these methods and their applications.

## **Cyber blooming: seasonal human-nature interactions in the field and on the web**

Reut Vardi<sup>1</sup>, John C. Mittermeier<sup>2</sup>, and Uri Roll<sup>1</sup>

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Human engagement with nature is paramount to enable effective conservation. Wildflower blooms attract great attention from people in Israel and globally. Such interactions with nature have been shown to contribute towards peoples' wellbeing. Furthermore, they promote pro-environmental behaviours and increase conservation value of natural open spaces. Here, we aimed to link real and virtual spatio-temporal interactions with wildflower blooms using big-data approaches. We explored timings and locations of real interactions with 20 prominent Israeli wildflowers using citizen science records from the past five years in several popular websites such as "Tiuli" and "Tzemach hasadeh". We further explored online interactions with these species during this timeframe, using their Google search volumes in Israel and the daily page views to their Hebrew Wikipedia pages. We obtained data by accessing the different websites' application programming interfaces, and matched corresponding time-series across datasets. We found a good temporal correspondence across years and between species in real timing of blooms and their digital manifestations. Moreover, for few local endemics, we found a good spatial matching between their natural distribution ranges and the regions from which they are mostly googled. Our results highlight the great potential of using big-data online sources to study human-nature interactions, even at fine spatio-temporal scales. Such insights could then be used to direct reserve visitation, fine-tune conservation campaigns, enable monitoring of natural trends in a changing environment, and generally guide sound conservation management and policy while incorporating human behaviour and promoting wellbeing.

## **“Smell flowers” – Priming as a tool to promote meaningful experiences of nature and increase well-being**

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### **Abstract**

A key contemporary issue is the progressive disconnection of people from nature (so-called ‘extinction of experience’) that threatens the delivery of health, well-being and conservation benefits. While the importance of promoting meaningful EoN has been recently highlighted as a potential solution, very little is known about ways to promote them. We propose here to use priming, a technique whereby exposure to a stimulus (i.e. prime) influences people’s behavior, as a way to promote such meaningful EoN, and we experimentally tested its effectiveness. We conducted a controlled experiment in which 303 participants were asked to spend 30 minutes outdoor in the campus of the Technion with nine different experimental conditions that we expected to impact participants’ interaction with nature. For instance, we instructed participants for ‘observe wildlife’, ‘smell flowers’, ‘touch nature elements’, or ‘turn off their phones’. Participants then returned to the lab and reported their subjective well-being (using PANAS) and richness of nature behaviors. Results showed that four primes (‘touch natural elements’, ‘smell flowers’, ‘take pictures’ and ‘observe wildlife’) significantly increased nature interactions, and in turn, had significantly stronger positive effects on well-being than the control condition with no prime. Touch and smell had the strongest effects. We demonstrate that providing more meaningful EoN increases the well-being benefits retrieved from the EoN, and that priming can promote nature interactions, and therefore increase well-being benefits. Thus, designing stimulus that prime people to get close to nature can serve as a tool to enhance meaningful EoN and mitigate the extinction of experience.



## **Bird postage stamps as symbols of the interactions between societies, governments, and nature**

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Various representations relating to human societies, cultures, and politics have been appearing on postage stamps since the middle of the nineteenth century globally. Stamps enable tapping into interactions in different cultures between societies and governments. Here, our aim was to explore patterns of human-nature interactions as manifested in stamps with bird images on them. These, represent a to-date unknown aspect of interactions between humans and manifestations of nature. To accomplish this, we constructed a dataset of all stamps that have been issued with bird images on them from 1854 to 2018, and added to it an array of other biological and geo-political attributes from various sources. Over 39,000 stamps from over 370 countries have been issued with images of 4300 bird species. Generally, birds appearing on stamps have a larger body-mass, a larger range-size, are more evolutionary distinct, and reside in temperate regions, when compared to birds which have not appeared on stamps. The most popular birds appearing on hundreds of stamps are: few birds of prey, greater flamingo, scarlet macaw, brown pelican, emperor penguin, white stork, barn swallow, and the common kingfisher. Sub-Saharan countries dominate in the number of bird-stamp issues. Conservation is the most popular amongst the series-topics birds-stamps belong to, with 3350 stamps (8%) of all bird-stamps. Furthermore, birds appearing on stamps tend to be more endangered. Trends in human-nature interactions have great importance in enabling sound conservation policy. Stamps provide an excellent and rare opportunity to highlight how government can affect conservation narratives using soft power.

## Tradeoffs between fire regulating and cultural services in Haifa

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**Topic:** ecosystem services

**Abstract:** Urban areas are increasingly at risk from diverse natural hazards. In the Mediterranean area, the risk of forest fires at the wildland-urban interface are generating increasing losses. However, green areas in and around the city have traditionally been considered as a source of fresh air, recreation and educational and aesthetic benefits. Tradeoffs arise between the desire to preserve nature around cities for cultural ecosystem services and the need to manage the forest to reduce the risk of fires. Most of the literature on ecosystem service tradeoffs has concentrated on provisioning versus cultural or regulating services. The potential tradeoffs arising from managing nature for recreational, spiritual, cognitive benefits and for hazard regulating functions in urban areas have rarely been explored. In this paper we assess cultural services and fires risk in the peri-urban forest of the city of Haifa (Israel) using participatory GIS mapping. We interviewed two groups of respondents (recreational users of green areas and fire experts) regarding the spatial extent and location of these services and the management strategies to reduce fire risk. Green space users promoted the idea of a pristine nature and its conservation, mainly for recreational purposes, while experts suggested that improving fire regulating services would require some degrees of forest management with changes in the landscape such as the removal of pine trees and the creation of buffers around the urban core. We conclude that the tradeoffs between cultural and regulating services can generate sources of risk and must be reconciled in policy and management.

## Linking ecosystem services assessment to stakeholders in the Carmel Biosphere Reserve

Hila Sagie

**Supervisor:** Professor Daniel Orenstein

**Other contributors:** Orna Raviv, Maya Negev, Shiri Zemah Shamir, Alon Lotan, Ido Izhaki, Yousef Hassan,

Hani Amasha and Yoav Peled.

### Abstract:

The Madrid Action Plan (2008) made ecosystem service (ES) assessment a central goal for biosphere reserves, but comprehensive assessments have been rarely conducted. Stakeholder integration in such assessments has been found to be highly important, nevertheless is still lacking. In this study, we integrated stakeholders and identified their perceptions of ES and rural development in the Carmel Biosphere Reserve. The study included: fifteen interviews with key stakeholders, a questionnaire completed by 703 residents and visitors, and a stakeholder workshop with 20 environmental managers/activists of the area.

Results show significant differences regarding perceptions of: ecosystem services, landscape preferences and environmental challenges in the Carmel between: environmental managers, ethnic groups and residents and visitors. Underlying motives for conflicting approaches to management, such as: particular cultural-historical relationships of groups to the landscape and recent challenges in the planning approach around fire regimes and expansion of settlements were revealed.

Results highlight the importance of land-use managers to heighten their sensitivity regarding the implications of their decisions for different stakeholder groups, and on different types of ecosystem services, especially in complex socio-ecological systems, such as the Carmel. In addition, the research highlights the significance of integrating stakeholders in ES assessments both for improving the relevancy of the outcomes and for increasing the capacity of their use in decision making.

## **“Walk on the Wild Side”: A New Methodology to Assess Cultural Ecosystem Services**

Yael Teff-Seker

Daniel Orenstein

Faculty of Architecture and Town Planning

Technion – Israel Institute of Technology

### **Abstract:**

Cultural ecosystem services (CES) of natural landscapes are inherently difficult to fully identify and evaluate. Quantitative methods for CES assessments produce data that can be incorporated in financial and other numerical calculations, but miss significant aspects of unquantifiable CES values. Other methods emphasize aesthetic values or address very few aspects of CES and evaluate each one separately. What eludes these assessments is the authentic and complex experience of interacting with a particular natural landscape. The current article proposes a new tool to bridge this methodological gap: walking-focusing interviews. *Focusing*, originally a psychotherapeutic technique, was used here to allow interviewees to become aware of information regarding their nature experience that they previously saw as mere “background”. We designed a focusing-based protocol that allows people to focus on different aspects of the landscape and freely share their thoughts and feelings about them. 120 people in four countries were interviewed using this protocol. Findings indicate that the method was effective in providing new insights into people’s intricate physical, mental, social and spiritual experiences of nature. We used thematic analysis to demonstrate the dominant themes found in each of the four case studies, as well as indicate general (“universal”) themes and methodological insights. Lastly, we suggest how focusing interviews can be used to better understand and address CES values by scientists, planners and decision makers.

**PARALLEL SESSION: MARINE CONSERVATION**

**The role of marine protected areas in mitigating the impact of invasive species**

Ori Frid<sup>1</sup> Ruty Yahel<sup>2</sup> Jonathan Belmaker<sup>1,3</sup>

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“Biotic Resistance” suggests that native species can hinder the establishment of invasive species by utilizing the majority of available resources. For example, with higher native species richness in a community, the amount of available niches are reduced, which may reduce invasive success. However, the generality of this pattern is not well established, and empirical support change from one ecological system to another and with change in scale. This study inspects four MPAs (marine protected areas) in the eastern Mediterranean Sea, with different levels of enforcement. In this invasive-infested marine system, fish communities compose a unique blend of indigenous and invasive species. In order to understand the role of MPA’s in biotic resistance, we examined the association between native and invasive species for multiple facets of diversity such as species richness, abundance, diversity and functional diversity. We have tested how these associations differ within and outside four MPA’s and across seasons. Our results show that the association between native and invasive species changes with enforcement level and season. The most protected area exhibit lower invasive species abundance compared to a non-protected area. However, this result is found only for the oldest and best protected MPA. Seasonality is noticeable, and as temperatures increases in spring invasive species abundance increase compared to native abundance, in all of the study locations. These results emphasize that both MPA’s and season affect abundance of invasive species relative to natives, which may stem from biotic resistance by the native community.



## **Do marine nature reserves enhance the conservation of the Mediterranean Slipper lobster (*Scyllarides latus*)? – Preliminary results**

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The Mediterranean slipper lobster, *Scyllarides latus*, is one of the largest crustaceans in the Mediterranean. In recent years it become relatively rare due to overfishing of these commercially valued lobsters. The goal of the present study was to reveal whether marine protected areas enhance the conservation of this species. *S. latus* can be found on hard substrates of the shallow Mediterranean shelf of Israel, especially in the northern Israeli coast, including the Rosh Hanikra – Achziv marine reserve, where the substrate is rich with crevices and caves. *S. latus* diurnally shelter in these natural dens between 3 and ~30 m depth, mainly between February to July. Number of lobsters, sex, size and presence of berried females were recorded in the reserve during underwater diurnal surveys of specimens found in their dens. These data were compared to that recorded during similar surveys in a close-by unprotected control area, with the same habitat and depth range. Lobsters were also marked with individually numbered plastic T-bar tags and holes punched in their tails. Despite the higher abundance of specimens in the reserve, no demographic differences were found. Marked lobsters were recaptured in the same sites during and between consecutive seasons. An acoustic tagging of lobsters has been initiated in the reserve, indicating nocturnal activity and seasonal usage of the habitat. These preliminary results suggest that a well-protected reserve can enhance the conservation of *S. latus* and serves as a sanctuary that will supply propagules also to unprotected areas, via a spillover process.

## Novel Indices to Quantify Biologically Relevant Marine Habitat Complexity

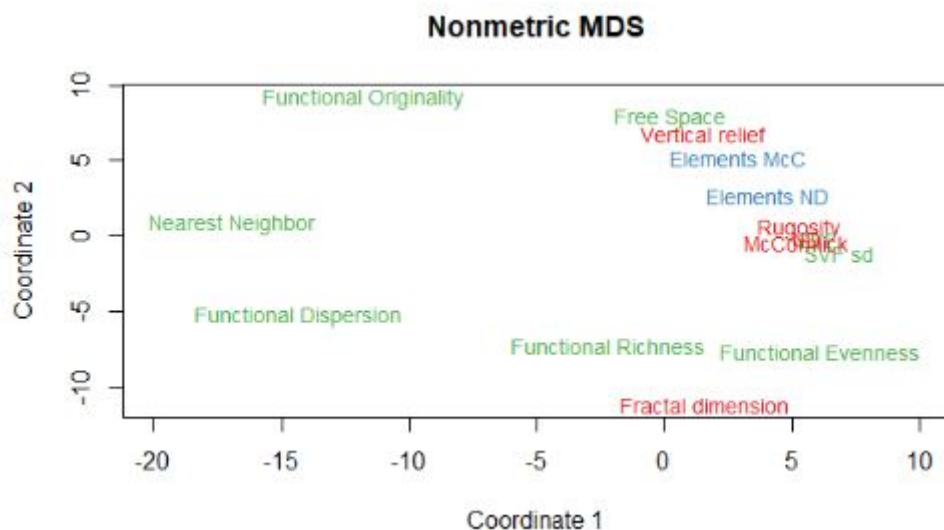
Lazarus, Mai and Belmaker, Jonathan

Structural complexity, defined as the three-dimensional structure of the ecosystem, is a fundamental characteristic of the physical environment – an important driver of ecological and biological processes. To date, structural complexity is mostly quantified using a small number of over-simplified indices. The aim of this study is to compare the performance of established habitat complexity indices with that of several proposed original indices, in explaining sub-tropical reef fish community structure.

To examine structural complexity influence on fish community structure I used fish surveys data from the Israeli Mediterranean coast. Habitat characteristics were estimated from bottom profiles created using high resolution depth measurements.

Complexity indices should be relevant to the studied organisms' ecology. I suggest several novel indices which are based on the way organisms such as fish presumably perceive the seascape. For example, functional diversity indices (functional richness, evenness, dispersion and originality), derived from community ecology field, which represent structural elements diversity.

Index dispersion within a non-metric multi-dimensional scaling analysis showed that most of the established indices depict structural complexity similarly, while functional diversity indices seem to capture different structural complexity aspects. To determine which indices best explain fish community metrics (e.g. richness and biomass) I used multiple regression and relative importance analyses. Thus far, I found that fish community structure is best explained by a combination of both novel and established indices. Therefore, the use of these indices may considerably improve our understanding of structural complexity and its impact on biodiversity.



Non-metric multidimensional scaling of structural complexity indices values for each of the examined bottom profiles in this study. Established indices are in red, novel indices are in green and established indices which were modified are in blue. Stress is 0.0843. Established and modified structural complexity indices are mostly clustered, while novel indices are well dispersed across the multidimensional space.

This study is conducted in the Israeli Mediterranean coast, a sub-tropical region experiencing considerable disturbances such as extensive rise in temperatures, invasive species and overfishing. In this highly disturbed region, valid structural complexity indices are necessary to improve ecological predictions and ecosystem management. A conclusive set of structural complexity indices will allow an accurate characterization of marine habitats physical environment and its impact on fish community structure. Greater understanding of these relationships would enable identification of highly diverse habitats and to monitor the physical state of the seascape. In addition, effective structural complexity indices may be used to prioritize areas in the process of establishing Marine Protected Areas.

## Large breeding aggregations of batoids in the Eastern Levantine coast

S. Chaikin<sup>1</sup>, J. Belmaker<sup>1,2</sup>, and A. Barash<sup>3</sup>

Batoids are globally threatened by overexploitation, particularly so in the Mediterranean Sea. Nevertheless, we have very little information about their ecology, behavior and taxonomy in the Eastern Mediterranean (Levant), where water temperature, salinity and the impact of invasive species is relatively high. Specifically, although it was suggested that some batoids may aggregate in the Levant, it remains unclear: (1) which batoids are present in the coastal rocky reef habitat? (2) what are their temporal dynamics? And (3) what are their sex ratios? This research focuses on assessing batoid identity, their trends of abundance, behavior, and sex ratios in a coastal rocky habitat of the Levant. In order to do so we conducted non-lethal visual surveys, which allow the documentation of batoid behavior and differ from most available data based on fishery catches. The census took place within a Marine Protected Area (MPA) over a total period of three years. Altogether, 675 observations of a diverse communities composed of six different batoid taxa were observed. We found clear seasonal patterns, with observations during spring and early summer, where densities exceeded 27 individuals per km, and batoids absent over the rest of the year. In addition, we found indications of reproduction behavior in *Dasyatis* sp. (e.g. courtship, followed by more active males, the appearance of gravid females, and finally juveniles). We also recorded the first documentation of *Dasyatis* sp. courtship in the Mediterranean. This research revealed large seasonal batoid aggregations in shallow waters that, to our knowledge, have never been documented in the Mediterranean before. The lack of similar aggregations elsewhere in the Mediterranean could attest to data deficiency or represent a unique Levant phenomenon. This study has great conservation implications on batoid research and deepens our understanding of batoid ecology and life history in the Mediterranean Sea.

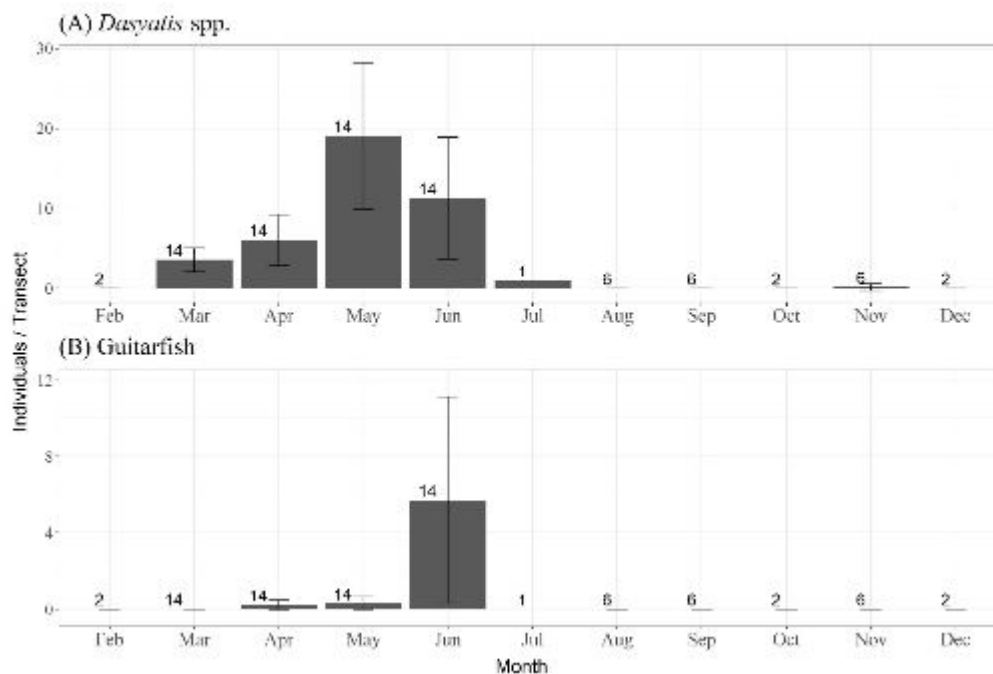


Fig. 2: Mean batoid abundances per transect for each month for the three years of the survey. The numbers below each month represent the number of transects. Error bars represent 95% CI.

The findings of large seasonal aggregations may have large nature conservation implications. The fact that highly exploited and vulnerable taxa aggregate inshore in large numbers but have never been formally documented before is remarkable. The conservation implication is heightened by the fact that the main aggregation reasons, at least for some species, seems to be associated with reproduction. Thus, protecting these aggregations must become a top conservation priority. The situation in which less than 0.25% of Israeli territorial waters are protected is troubling. It is imperative that batoid aggregations and reproduction areas throughout the Levant are identified and protected. This is particularly important given that some of these species are heavily exploited in other countries in the region.

The aggregation of batoids over such shallow depths may also have implication for local ecotourism. Batoids are charismatic species and are sought after by recreational divers and snorkelers. Ecotourism is especially promising as aggregations occurs in shallow waters accessible to the public even for those untrained in SCUBA diving. Promoting batoid-based ecotourism may further support the conservation of batoids by developing public awareness. On the other hand, the high accessibility of the batoids may promote unsupervised ecotourism which may be detrimental. For example, under environmental or physiological stress, females *Dasyatis* sp. may abort. Thus, while ecotourism may benefit the local community, it is important to assure it is done responsibly and under supervision for minimal impact on the natural behavior of the batoids.



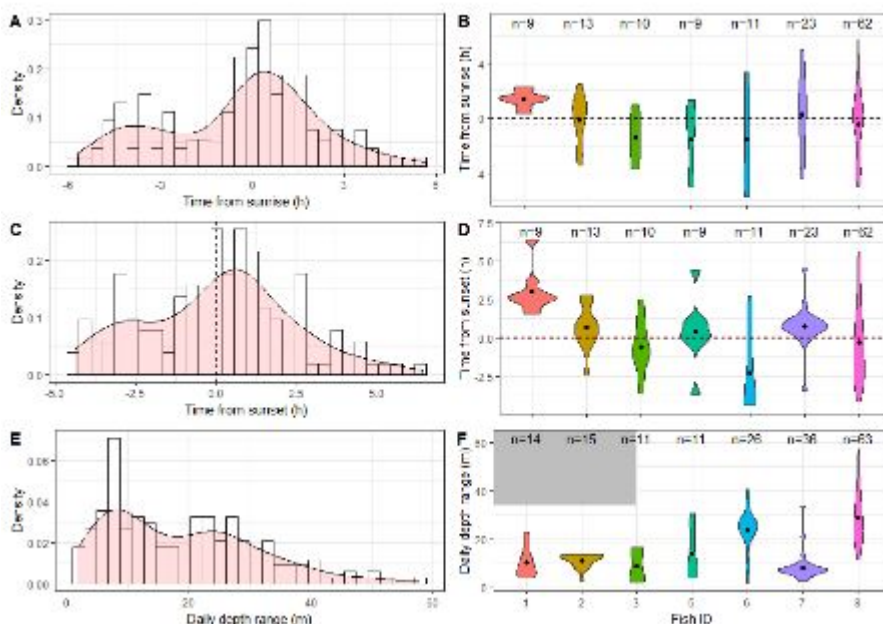
## Behavioral plasticity in lionfish (*Pterois miles*) in the Gulf of Aqaba

Gavrieli Tal - School of Zoology, Tel Aviv University, Israel

Invasive species are a major threat to the marine environment and have severe ecological consequences. One of the most harmful marine invasive species is the lionfish, *Pterois miles*. The generalist fish *Pterois miles* managed to populate and spread rapidly through the western Atlantic Ocean. The lionfish invasion to the Atlantic Ocean led to declines in reef fish populations, changes in community structures, and habitat degradation. Recently, *Pterois miles* also managed to invade the Mediterranean Sea. Generalist species, who use a broad range of environments and food sources, are often successful invaders. However, generalism may emerge from two separate processes. Each individual may be a generalist and be able to use the full range of niches occupied by the species. Alternatively, individual specialization may result in each individual using a specific resource while across the entire population the species use diverse resources and hence considered to be generalists.

This study examined plasticity in lionfish activity pattern and depth preference. To explore the degree of specialization in activity and depth distribution of *Pterois miles* in the wild I used an acoustic telemetry system with a time resolution of minutes over several months. I detected large within-individual variation in both activity times and depth use. These results support the hypothesis that the Red Sea *Pterois miles* population is constructed from generalist individuals. The ability of individuals to exhibit wide range of behaviors might improve the ability of the species to exploit local conditions and adjust quickly to new conditions while invading.

### *Pterois miles* shows large within-individual variation



Density plots for all tagged *Pterois miles* individuals (left column) and for each individual (violin plots in the right column) across days. (A) and (B) represent maximum activity time relative to sunrise (the sunrise denoted by a dashed black line). (C) and (D) represent the maximum activity time relative to the sunset (the sunset denoted by a dashed black line). (E) and (F) represent the daily depth range. For the right panels, the mean value for all the fish specifies by the red dashed line. The dots in the

violin plot represent the mean value for each fish. In F, the grey shaded area denoted the Vemco transmitter depth limitation. N represents the number of days used for each violin plot.

### **Study significance**

Many studies have examined invasive species behavior and ecology in their invasive range. However, much less is known about the trait of these species in their native range. Nevertheless, such information is critical for understanding what enable species to become a successful invader. This study revealed the generalist nature of *Pterois miles* individuals. This generalism in the individual level might facilitate lionfish establishment in novel environments.

### Habitat use of dusky and sandbar sharks at a warm water discharge of a coastal power plant

Adi Barash<sup>1\*</sup>, Aviad Scheinin<sup>1,2</sup>, Eyal Bigal<sup>1,2</sup>, Ziv Zemah Shamir<sup>1,2</sup>, Stephane Martinez<sup>1,2</sup> and Dan Tchernov<sup>1,2</sup>

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In Israel, dusky and sandbar sharks (genus *Carcharhinus*) aggregate every winter at the warm water discharge of coastal power plants. This over wintering pattern is likely thermoregulatory in nature. Sightings of these species are increasingly rare in the Mediterranean, where shark populations have declined by 95% over the last decades.

Sharks were tracked by acoustic telemetry, which enables detecting acoustic transmitters ('tags') by fixed underwater receivers. Since 2015, 17 sharks have been caught, measured and tagged in Hadera's hot waters, using acoustic tags and satellite tags. Acoustic tags are inserted into the shark's abdominal cavity, and satellite tags were attached to the dorsal fins. Both acoustic and satellite transmitters also recorded depth, and water temperature.

Sharks were detected at the site for a long period (66 days  $\pm$  33.3 SD), and remained in the hot discharge while sea temperature kept decreasing. Daily movement analysis show sandbar sharks remain close to the bottom during daytime and moved to shallower water at night, while dusky sharks occupied very shallow water at all times. Data retrieved from one satellite tag showed a sandbar shark maintained the daily depth movement throughout its journey in open water.

While one theory maintains that these aggregations are related to the gestation period in females, the residency of both female and male sharks suggest both gender benefits from the warm water. Learning of the usage of sharks of the warm water is crucial to understand the implications of this phenomenon in order to adequately manage it.

**The discovery of cold seep communities and cold water coral gardens at the Palmahim Disturbance- science based prediction of biodiversity hotspots in the deep Mediterranean.**

Weissman, Adam<sup>1</sup> Bialik, Or<sup>2</sup> Makovsky, Yizhaq<sup>2</sup> Shemesh, Eli<sup>1</sup> Tchernov, Dan<sup>1</sup>

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**ABSTRACT**

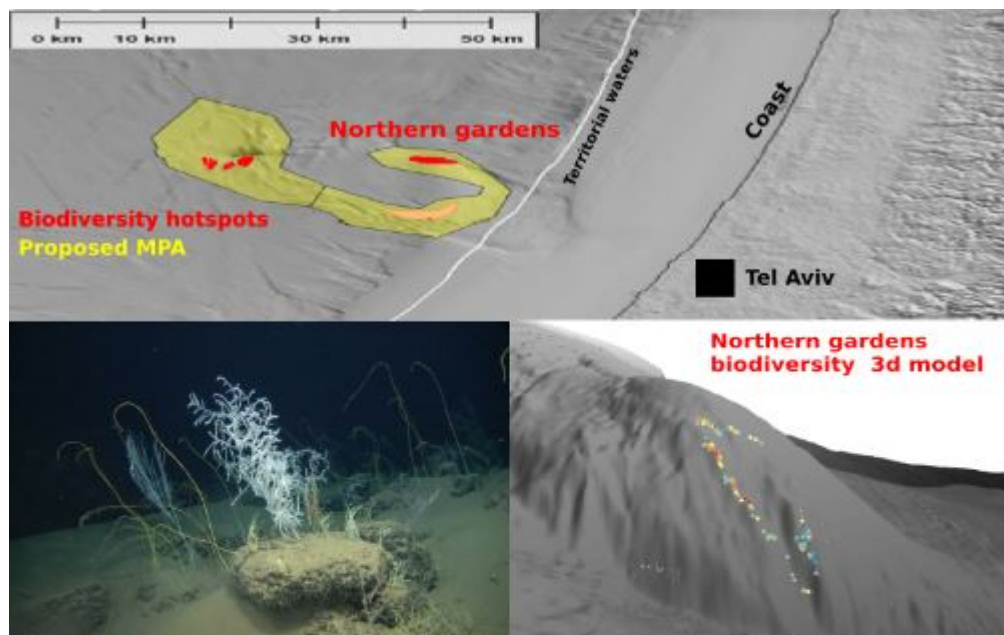
The Palmahim Disturbance is a 20x10 km submarine slide deforming the Israeli continental shelf in water depths of 100-1200 meters. Four multidisciplinary and international expeditions were made to the site, utilizing geophysical surveys and remotely operated vehicles (ROV). Two unique ecosystems were discovered for the first time in the south-eastern Mediterranean, biodiversity hotspots of high conservation priority in an otherwise surrounding marine desert. These discoveries have greatly expanded our knowledge of the fauna inhabiting the deep south-eastern Mediterranean. We have explored rare cold water coral gardens that flourish 500-800 meters deep on the margins of the Palmahim Disturbance, identifying numerous endangered species found in the IUCN red list, as well as describing a new species of black coral. Additionally, we have investigated cold seep communities which live off chemosynthetic based production 1000-1200 meters deep.

Compound specific stable isotope analysis of amino acids has revealed that although both of these unique ecosystems were found in the same vicinity, two distinct food webs exist. The gas escape along the Palmahim Disturbance facilitates the succession of cold seep communities feeding off chemosynthetic primary production, promoting the formation of authigenic carbonate rocks. Once the seeps become inactive, cold water corals exploit the hard substrate now available for settlement, feeding on photosynthetic based marine snow.

Combining multidisciplinary data, we created sensitivity maps of these biological treasures, predicting where we may locate additional biodiversity hotspots in the Israeli deep sea in need of conservation measures, which are used to design deep sea marine protected areas.

**Significance for Conservation in Israel**

Exploration of the deep Israeli shelf has revealed sensitive biodiversity hotspots, such as cold water coral gardens and cold seep communities reported for the first time from the Israeli shelf. Our research has discovered numerous species first time sighted in Israel, of which many of them are listed in the IUCN Red List. Combining multidisciplinary research methods we are able to predict sensitivity areas in the deep sea, mapping potential marine protected areas used by the Israeli National Parks Authority in marine spatial planning. In collaboration with the Society for the Protection of Nature in Israel, I have recently published a book and a short film, bringing to the Israeli public and policy makers the rich biodiversity thriving in the Israeli deep sea, highlighting the importance of protecting it by creating deep sea marine protected areas.



Species	Red list category	CITES annex
<i>Isidella elongata</i>	Critically endangered	II
<i>Leiopathes sp.</i>	Endangered	II
<i>Antipathes dichotoma</i>	Near Threatened	II
<i>Swiftia pallida</i>	Data deficient	
<i>Callogorgia verticillata</i>	Near Threatened	
<i>Funiculina quadrangularis</i>	Vulnerable	
<i>Desmophyllum dianthus</i>	Endangered	II
<i>Viminella flagellum</i>	Near Threatened	
<i>Parantipathes larix</i>	Near Threatened	II

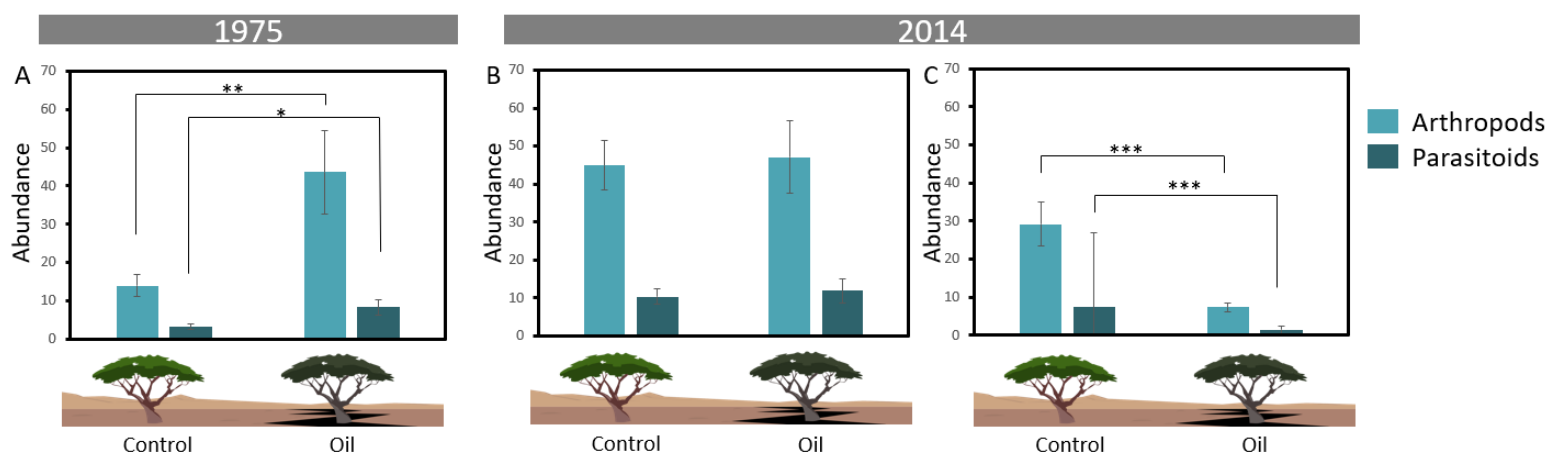
Proposed marine protected area at the Palmahim Disturbance based on our predictions. Zooming in on the northern coral gardens, the colored dots on the 3d model indicate coral biodiversity, with the color gradient going from red (high biodiversity) to blue (lower biodiversity). The corals, all of whom are described for the first time in the south-eastern Levant Sea are listed along with their IUCN red list category and legal conservation status under the CITES agreement.

WEDNESDAY, APRIL 17<sup>TH</sup>, 2019**PARALLEL SESSION: IMPACTS OF HUMAN ACTIVITIES ON BIODIVERSITY CONSERVATION 1****The Impact of terrestrial oil pollution on arthropods associated with *Acacia* trees in Evrona Nature Reserve, Israel**Daniella Möller<sup>1</sup>, Marco Ferrante<sup>1</sup>, and Michal Segoli<sup>1</sup><sup>1</sup>Mitrani Department of Desert Ecology, Ben-Gurion University of the Negev, Midreshet Ben-Gurion, Israel

Oil exposure may affect arthropods directly (i.e. toxicity) and/or indirectly (i.e. by altering host plants quality). We examined the impact of oil pollution on the arthropod communities associated with *Acacia* trees in a desert ecosystem (Evrona Nature Reserve, Israel), where two major oil spills occurred (1975 and 2014). Our aim was to evaluate the short- and long-term effects on arthropod abundance, diversity, and species composition in this area.

Using a suction device, we sampled canopy-active arthropods from *Acacia* trees, a keystone genus in this ecosystem. In one site affected by the 1975 oil spill and two sites affected by the 2014 oil spill (North-2014 and South-2014). Parasitoid wasps, a diverse group with high sensitivity to environmental changes, were identified to morpho species and their abundance and composition were compared in oil-polluted vs. unpolluted trees.

We found no significant differences between polluted and unpolluted trees in the North-2014 site, both for the abundance and diversity of arthropods and parasitoid wasps. In the South-2014 site, unpolluted trees had a significantly higher arthropod ( $p < 0.001$ ) and parasitoid ( $p < 0.001$ ) abundance and higher parasitoid species diversity than polluted trees. However, in the area affected by the 1975 oil spill, oil-polluted trees had higher arthropod ( $p = 0.002$ ) and parasitoid ( $p = 0.038$ ) abundances than the unpolluted trees. Parasitoid community showed no difference in composition in any of the sites. Our results suggest that polluted trees may be less suitable as food source and/or habitat for arthropods, but that the arthropod and parasitoid communities may recover with time.

**Main results:**

**Figure 1.** Mean (±SE) arthropod and parasitoid abundances on unpolluted ("Control") and oil-polluted ("Oil") *Acacia* trees during 2016 and 2017 in Evrona Nature Reserve, Israel, on three sites: A) Site affected by the 1975 oil spill, B) Northern and C) Southern sites affected by the 2014 oil spill. Significances are coded as follows: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

### Significance for biodiversity conservation in Israel:

Desert ecosystems are particularly vulnerable to anthropogenic disturbances, as recovery may take centuries without active restoration measures<sup>1</sup>. Studies of the impact of oil contamination on desert habitats are limited, and those regarding the effects of oil spills on terrestrial arthropod communities are particularly scarce. The Evrona Nature Reserve is within a hyper-arid desert area of Israel, and it includes the last well-preserved salt marsh in the region<sup>2</sup>. However, despite the scale of the past and recent oil spills that have occurred in this area, attempts to restore the natural conditions<sup>2,3</sup> were limited because of insufficient knowledge about the oil spill effects on this ecosystem. Thus, quantifying the long and short-term impacts of these oil spills is crucial for understanding how desert arthropod communities respond to major disturbance events, as well as for taking appropriate rehabilitation measures, ultimately contributing to the conservation of this fragile ecosystem.

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3. Nothers, M., Segev, N., Kreyling, J., Hjazin, A. & Groner, E. Desert vegetation forty years after an oil spill. *J. Environ. Qual.***46**, 568–575 (2017).



### **Evidence for a multi-layer ecosystem damage in the polluted Ashalim desert channel**

Ron Chen<sup>1</sup>, Idan Shapira<sup>1</sup>, Harel Dan<sup>1</sup>, Irina Levinsky<sup>1</sup>, Carmit Ish-Shalom<sup>2</sup>, Ofir Katz<sup>2</sup>, Einav Mayzlish-Gati<sup>3</sup>, Yaron HersHKovitz<sup>4</sup>, Ittai Renan<sup>5</sup>, Rotem Golan<sup>6</sup>, Harel Ben-Shachar<sup>6</sup>, Noam Leader<sup>6</sup>, Asaf Tsoar<sup>6</sup>, Yehoshua Shkedy<sup>6</sup>

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<sup>6</sup>The Israel Nature and Parks Authority

Ashalim ephemeral channel lies within a nature reserve and is part of an important ecological corridor between the Negev and the Judean deserts in Israel. On June 30<sup>th</sup>, 2017, Ashalim was polluted when 100,000-200,000 m<sup>3</sup> of strong acid containing high concentrations of phosphorus, sulfur, fluorine and sodium, alongside heavy metals and other materials, overflowed from the upstream Rotem-Amfert factory into the channel. This event prompted the establishment of a comprehensive five-year program, aimed at characterizing the content and distribution of pollutants in the channel's ecosystem as well as their temporal effects. A year and a half after the pollution event, several key results emerge: The channel is polluted with phosphorus, sulfur, fluorine and sodium, some of which penetrate tens of centimeters deep. Plant density and species richness are low, and germination is considerably reduced. Ephemeral rock pools support populations of flying insects, however primitive crustaceans are found only in adjacent, unpolluted channels. The arthropod community in Ashalim is different from nearby unpolluted plots, and is characterized by the absence of granivores from the sandy unit and an overabundance of plant pests in the alluvial unit. Arachnid abundance is low, especially in the central part of the channel's cross section. These initial results suggest that despite three floods that occurred since the pollution event, Ashalim's ecosystem is still damaged in multiple layers: soil, primary producers, primary consumers and predators. As more results accumulate it will be possible to better characterize the damages and their dynamics as well as potential restoration actions.

## **Possible effects of environmental contaminants on breeding success of the Eurasian Griffon vulture (*Gyps Fulvus*) in north Israel**

Yael Choresh<sup>1, 2</sup>, Brice Appenzeller<sup>3</sup>, Emilie Hardy<sup>3</sup>, Tamar Trop<sup>1</sup>, Ido Izhaki<sup>4</sup> and Dan Malkinson<sup>2, 5</sup>

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The population of the Eurasian Griffon vulture at Gamla Nature Reserve in northern Israel is experiencing a severe decline. This decline is associated with the low breeding success at Gamla, which is 30% on average as opposed to the 70% average in European countries. Thus, we assumed that the vultures at Gamla are exposed to sub-lethal, persistent factors such as endocrine disrupting chemicals in higher levels than those in Europe. These chemicals are not affecting mortality directly, as acute poisoning does, but impair fitness by disrupting reproduction, and may be one of the causes for low breeding success.

In the years 2012-2017, 132 naturally shed flight feathers were collected from Israel, Crete, Bulgaria, Italy, Spain and France for comparison. The chemical analysis of these feathers revealed the presence of over 100 contaminants, 19 of them are known endocrine disrupting chemicals (EDCs). The analysis also revealed the presence of 10 veterinary drugs from the nonsteroidal anti-inflammatory drugs (NSAIDs).

The presence and levels of contaminants in the feathers differed among the countries. Some of the EDCs, were higher in Israel than in feathers collected in Europe. Distinct differences were found between the contaminants in feathers collected in three geographic areas in Israel – Golan, Carmel and Negev – showing a unique chemical profile each.

The massive presence of contaminants shows that the exposure is not anecdotal, but vast and ongoing. Such an exposure could be associated with low breeding success and could contribute to the many factors causing the population's decline.

## **How does fire effect the arthropod community in thicket and scrubland habitats**

**The Entomology Lab for Applied Ecology, Steinhardt Museum of Natural History, School of Zoology, Tel Aviv University**

Carmel Herold, Ittai Renan and Tamar Dayan

In recent years fires have become increasingly frequent as a result of climate change, deforestation, declines in grazing pressure and increases in abandoned agricultural plots. In November 2016 many fires broke out in Israel, two of them in Kfira National Park in the Judean Mountains. Scrubland fires are characterized by a fast burn at low temperatures in a homogeneous pattern, while thicket fires are characterized by a long burn and at higher temperatures in a patchy pattern. Arthropods are highly diverse and sensitive to environmental change, offering a potential tool for evaluating and assessing the effects of fire. We investigated the changes in the arthropod community over the past two years since the 2016 fires. Ground-dwelling insects were sampled in burnt and control plots using pitfall traps, in thicket and scrubland habitats. Arboreal arthropods were sampled in the thicket habitat, using the “beating” method. Although richness did not differ significantly in the pitfall method, arthropod community composition was different between treatment and control, across both habitats. In the beating method, there was significant higher diversity in the low fire intensity compared to high fire intensity. Several Bio-indicator species with high aversion to post-fire condition were found. In general, high intensity fires altered biodiversity and composition of the arthropod community, and proactive management is needed to prevent future high intensity fires.

## **Managing an invisible pollutant: using soundscape recordings from Horesh Adulam nature reserve to better understand noise pollution and its consequences in Israel**

Yael Lehnardt and Oded Berger-Tal

The Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Midreshet Ben-Gurion, Israel

### General topic: Conservation planning

Anthropogenic noise pollution is a widespread pollutant that affects the acoustic environment (soundscape) worldwide, predominating urban areas, open landscapes and protected areas. It is associated with reduced breeding success, elevated predation risk, chronic stress and other negative effects on wildlife, reducing individuals' fitness and eventually negatively impacting biodiversity. Despite its extensive impact, noise pollution is frequently overlooked in environmental impact assessments or development plans. To be able to mitigate the hazardous effects of noise pollution, we need to properly measure and define it. However, describing noise is challenging because of the complex characteristics of sound (e.g. loudness, frequency range, and temporal changes). In the last few decades, automated continuous recordings of soundscapes are used for research and conservation worldwide, allowing us to better describe the acoustic patterns and thus recognize disturbances caused by noise. For the first time in Israel, we sampled the soundscape at an open landscape, with and without artificially added noise. We recorded hundreds of hours at Horesh Adulam Nature Reserve, and during ca. 150 of them we also broadcasted sounds produced by a wind-turbine. Examining the recorded soundscape reveals that it was shaped by natural processes but also prominently affected by anthropogenic noise sources. Furthermore, adding wind-turbine noise playback caused drastic changes to the soundscape. Our findings highlight the importance of noise pollution management for the planning of future infrastructure, especially of wind turbines, and thus can assist planning that considers acoustical aspects of nature conservation.

## **The impact of oil spills in the Avrona Nature Reserve on the distribution of ground-dwelling arthropods**

Nitzan Segev 1,2 , Oded Berger-Tal 1 , Amos Bouskila 1 , Elli Groner 2

1 Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Sede Boqer Campus, Israel

2 Dead -Sea & Arava Science Center, Israel.

Land invertebrates, while comprising the lion's share of global biodiversity, remain grossly under studied, a lacuna which is particularly pronounced in desert habitats. The Arava Rift valley is a hyper arid area that suffers from severe anthropogenic disturbances. Avrona Nature Reserve in the Arava Valley was contaminated twice by crude oil, in 1975 and again in 2014. Oil spills may cause widespread and immense short-term acute damage to species and ecosystems, and may also cause long-lasting residual effects. Consequently, in 2016, a five-year multidisciplinary monitoring program was initiated in this area to evaluate the effects of oil spills in this desert ecosystem. In this work I aimed to examine the effects of recent and past oil spills on the spatial and temporal distribution of ground-dwelling arthropods. I sampled this group twice a year, in four different treatments: Oil 1975, Control 1975, Oil 2014, and Control 2014. Sampling was conducted using 180 dry Pit Fall Traps, open for four consecutive nights. Results from the initial three years of survey demonstrate different abundances of arthropods in contaminated versus control plots. Most arthropod groups exhibited a significant preference towards uncontaminated plots, excluding some ant groups. Nevertheless, none of the groups was completely absent from contaminated plots. The results so far (2016-2018) showed no significant effect of oil on beetles, and various effects on ants and other arthropods. We found significant differences between the 2014 and 1975 spills, yet the 44 years old spill seems to still influence the arthropod community.

## **PARALLEL SESSION: CONSERVATION PLANNING**

### **A fast-moving target: the challenge of achieving marine conservation goals with MPAs under climate change**

Gil Rilov and 15 other colleagues

National Institute of Oceanography, Israel Oceanographic and Limnological Research (IOLR)

Current and global climate change impacts, even under the most optimistic IPCC scenarios, pose a tremendous challenge to marine conservation. Species pools are shifting rapidly in many regions due to warming, heat waves cause mass mortalities, and thermophilic aliens more easily establish in warming waters. All these can lead to major ecological shifts and even collapse of entire ecosystems. Under this scenario, preserving intact or recovering degraded marine ecosystems and local biodiversity is an increasingly difficult challenge for both policymakers and conservation managers. We reviewed the current state of implementation of key European conservation-oriented marine directives (marine special plans for MSP and program of measures for MSFD) and found that so far, climate change has been very superficially addressed or not considered at all. Clearly, even the largest and best managed marine protected area (MPA) cannot be expected to achieve their conservation goals, especially in global change hotspots such as the southeastern Mediterranean coast. In such regions, even inside MPAs, native biodiversity is or will be severely altered, thermophilic non-indigenous species will thrive and may shift the ecological balance, native commercial stocks will either collapse or be replaced with alternative stocks, and food-webs will re-shuffle, either maintaining or drastically shifting their ecosystem functions. It is thus necessary that we shift our expectations and perhaps our indicators for what is considered “good environmental status” under a fast-changing ocean climate. In climate-change hotspots, we can focus, for example, more on protection of functional diversity and ecosystem functions, rather than on native species.

## **Detecting biodiversity refugia using remotely sensed data (General topic – Protected areas)**

Vladislav Dubinin, Tal Svoray, Michael Dorman, AviPerevolotsky

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### Context

Habitats characterized by improved soil moisture availability can function as microrefugia (hereafter referred to as “refugia”) for the persistence of rare plant species in dry environments. Such areas are dominated by Mediterranean woody vegetation (shrubland and woodland). An analysis of these refugia elucidates their spatial distribution at the landscape scale.

### Objectives

Explore whether potential refugia, detected using the upper quantile of the normalized difference vegetation index (NDVI), are related, in space and time, with the survivability of rare species in dry environments.

### Methods

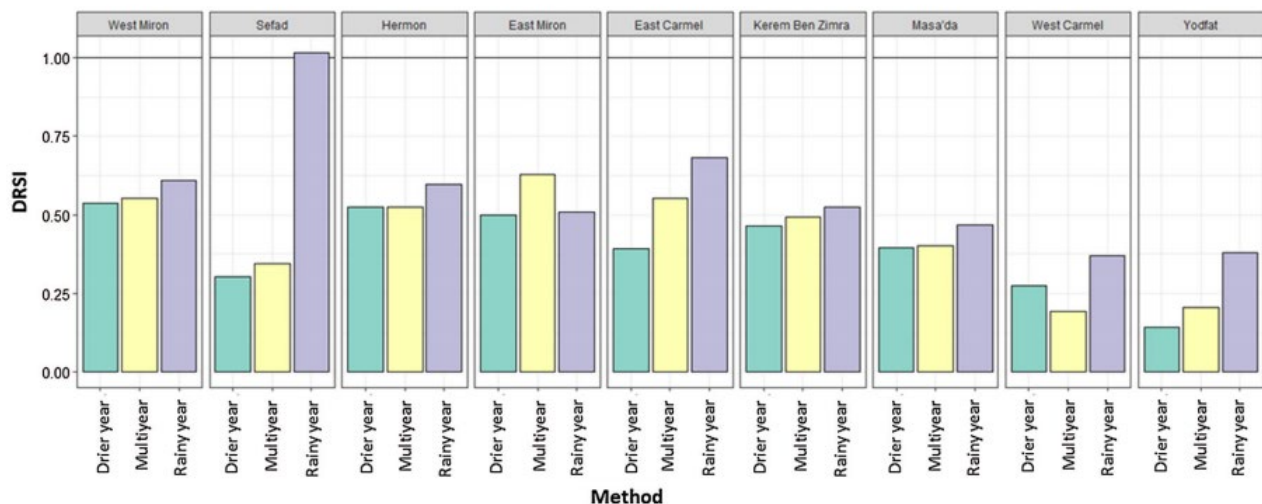
We used upper NDVI quantile (25%) values to predict potential refugia in nine selected areas in northern parts of Israel from 1992 to 2011. Next, we developed an index based on the ratio of density (number of observations per area) of rare species in non-refugia versus refugia patches, per site (density of rare species index, DRSI). Finally, we examined the temporal stability of the DRSI using ANOVA and Augmented Dickey–Fuller (ADF) tests.

### Results



Refugia classifications and DRSI values for all areas were stable over time (1992–2011). The DRSI values were significantly lower than 1; that is, the density of rare species in the predicted refugia areas was higher than in non-refugia areas.

DRSI values for nine areas using three refugia prediction methods (dry-year NDVI image, rainy-year NDVI image, and multiyear NDVI average image); the DRSI expresses the concentration of rare species in the estimated refugia areas (low value = high concentration).



## Conclusions

We assumed that patches of dense woody vegetation, determined by the upper 25% quantile of the NDVI, could be used to identify potential biodiversity refugia in dry environments. This assumption was validated by the DRSI results; it confirms that the local conditions in refugia support rare species.

## Contribution to conservation in Israel

1. Our method shows that humid sites (the potential refugia) in the Mediterranean climate zone can indeed protect many rare species from extinction and could help them to survive in the face of forecasted climate change.
2. The presented method for identifying refugia can be used for nature conservation of rare species in dry environments, by providing guidelines for selecting locations for new protected areas. Setting aside protected areas is one of the most effective measures to conserve endangered species, as well as the habitats and ecosystems required for their survival.

## **Regional scale ecological landscape evaluation: A comparison between GIS layer stacking and an optimization algorithm**

Idan Talmon, Liran Ben-Altabet, Amir Perlberg, Aviv Avisar, Gal Kagan & Uri Ramon

Open Landscape Institute, National Center for Biodiversity Studies, Steinhardt Museum of Natural History, Tel Aviv University, Tel Aviv, Israel

In the small and densely populated Israel, there is a constant conflict between development and conservation. This emphasizes the need for proper planning and knowledgeable prioritization of conservation efforts. This study compares between two methods of Ecological landscape evaluation in the recently surveyed Alonim hills and Northern Nazareth ridge in the lower Galilee region. The traditional method used by Open Landscape Institute (OLI) is based on the integration of ecological data collected in field surveys and national databases, combined with Landscape continuity analysis model, and INPA's (Israel Nature & Parks Authority) protected areas and ecological corridors layer. This method was compared to a model built in MARXAN software based on similar data. MARXAN uses an optimization algorithm to prioritize spatial conservation while accounting for the representation of all ecological features as defined by a set of conservation targets. MARXAN frequency of selection was normalized into 5 valence categories –as in the traditional method. The results of the two methods were significantly positively correlated ( $R^2=0.45$ ,  $p<0.001$ ), with ~60% of the pixels scoring the same. On mountain agricultural lands, planted forests and some natural areas, the traditional method scored higher, whereas in valley agricultural lands on heavy soils and areas important to landscape connectivity, MARXAN scored higher. MARXAN results emphasize the importance of agricultural lands while assuring that all ecological properties are conserved. These differences are a result of efficient area selection by MARXAN while giving up habitats that are adequately preserved by the selected areas with a lower ecological cost.

## Defining Red Lines for Ecosystem Health and Biodiversity Conservation in Israel

Tsalyuk Miri<sup>1</sup>, Uri Ramon<sup>2</sup>, Aviv Avisar<sup>2</sup>, Eran Feitelson<sup>3</sup>

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<sup>2</sup> Landscape Survey and Evaluation Department, Deshe Institute

<sup>3</sup> Department of Geography, Hebrew University of Jerusalem

'Israel 100' is a strategic plan aiming to predict and address the economic, social, and environmental changes awaiting Israel by 2048. As part of this plan, 'red lines' define the boundaries of unwanted states that policies should prevent. The purpose of our work is to define red lines for the ecological state of Israel that will guide policy. Red lines are states of discontinuity – crossing a tipping point will lead to irreversible degradation. We conducted an expansive review of scientific and grey literature to specify red lines that will quantify three main categories: indicator species for biodiversity, ecological health, and ecological complexity. Next, we conducted consultation round table with leading ecologists from the academia, government, and NGOs to further characterize these lines. Examples of such red lines include minimum viable population of keystone species, number of trophic levels in a food chain, percent protected areas in each ecosystem type, and width of ecological corridors. Examples of red line for ecological health include water flow rate that allows fish migration, and rates of organic matter breakdown. Some red lines have been already transgressed in Israel and we might aspire to restore them, such as the extinctions of apex predators and loss of pristine wilderness. For each red line we review examples of its international use, propose practical and measurable indicators, and illustrate its advantages and disadvantages. We believe these red lines will guide sustainable development and spatial planning, and inform policies for protecting natural resources and natural habitats in Israel.

## Projecting into the past to restore the future

By Keren Gila Raiter, Rick Management Ecology Lab, Department of Ecology, Evolution and Behavior, Hebrew University of Jerusalem.

General topics (based on list provided at <http://www.israeliconservation.com/abstract-submission.html>):

- Conservation planning
- Habitat/landscape/ecosystem conservation
- Endangered species

Habitat conservation and restoration is a central focus of threatened species conservation, but it is not always clear exactly where potentially suitable habitats lie. In highly modified landscapes historical baselines may be lacking, and instead, conservation practitioners must rely on modelled species distributions. Species distribution models (SDMs) are widely used in conservation but can be heavily compromised by inadequacies and uncertainties in the underlying data. For example, absence data caused by cryptic impacts of anthropogenic development and imperfect detection may produce false indications of habitat unsuitability. Furthermore, presence data with inaccurate location (e.g. collected without GPS nor accurate mapping) may identify suitable habitats inaccurately. Such uncertainties can comprise major hurdles in identifying potential areas for habitat restoration.

For two critically endangered lizards, *Acanthodactylus beershebensis* and *A. schreiberi*\* (\*taxonomy under debate), we adapted SDM methods to account for multiple uncertainties. We accounted for a) 'questionable absences', where observed absences in suitable habitat are caused by development impacts; and b) positional uncertainty, rife in historical data (including from natural history and museum collections). We used environmental factors to categorise 'questionable absences' and emerging spatial-statistical tools to identify records where spatial uncertainty is likely to reduce model prediction accuracy. We created ensembles of multiple model-sets reflecting different data combinations and weighted by model precision to deliver enhanced SDMs to identify which areas could be targeted for restoration, as well as inform priorities for other species recovery actions. Such models can inform decisions to be made by the relevant conservation authorities and land-management agencies.

## **Optimal planning to mitigate the impacts of roads on multiple species**

Tal Polak, | Emily Nicholson, Clara Grilo, Joseph R. Bennett, and Hugh P. Possingham

Roads have significant impacts on wildlife worldwide and there are a variety of actions that can mitigate their negative effects. Using decision theory combined with a meta population model we determined the most cost-effective actions to mitigate the effects of roads on multiple species. We tested the cost-effectiveness of three management options: no mitigation, erecting fences with wildlife crossings and erecting fences without wildlife crossings on hypothetical road layouts for a suite of European and Australian fauna. We explored the trade-off between population probability of persistence and mitigation cost of the following planning strategies: 1) a single species, 2) two types of focal species based on different life history traits, and 3) comprehensive multispecies planning. The multispecies strategy was the most robust and cost-effective, while all single-species strategies were inefficient. Basing decisions on the species with the largest home range can provide reasonably cost-effective results, but should be considered only when there is insufficient time or money to perform a multispecies analysis. The method presented here can be adapted to other road systems or species combination, thus helping practitioners to make informed decision based on cost-effective information. This is also an important step towards assimilation of multispecies planning within the field of road ecology.

**PARALLEL SESSION: AGROECOLOGICAL****The effect of honeybees on wild pollinator activity in apple orchards**

O. Avrech\*, Y. Mandelik

Department of Entomology, The Hebrew University of Jerusalem,

[omri.avrech@mail.huji.ac.il](mailto:omri.avrech@mail.huji.ac.il)**Abstract**

The Mediterranean ecosystem of Israel is rich in wild pollinators, that can provide substantial crop pollination services. However, the introduction of commercial pollinators, mainly honeybees, in large numbers to agricultural fields and orchards, can affect the activity level and composition of wild pollinators. Understanding these effects is key for optimal pollination management in agricultural fields and orchards. Here we studied the effect of distance from honeybee hives on pollinator activity level, pollinator composition and pollination services (fruit yield and quality). We used apple as our model crop, since it requires high pollination services and in recent years the combined activity of both commercial and wild pollinators is promoted in apple orchards. However, the interactions between honey bees and wild pollinators and their effect on the yield and fruit quality are poorly known. The study was conducted in 17 Pink-Lady apple orchards in the upper Galilee; wild pollinators and honey bee visitation activity to apple flowers at distances of fifteen and a hundred meter from honey bee hives was examined. Wild pollinators visitation rate was significantly higher and their composition was significantly altered at large compared to short distances from honeybee hives, regardless of the distance from surrounding natural area. Importantly, fruit set and fruit quality were not affected by distance from honeybee hives. We conclude that high level of honeybee activity affects the activity level of wild pollinators, but this doesn't affect yield and fruit quality. Wild pollinators can provide a safety net for events of decreased honey bee activity, expected mostly at larger distances from honeybee hives.

## **The effect of agriculture on resident birds' community structure in three habitats along Israel's precipitation gradient**

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In the past century Israel has undergone major development resulting in a reduction of natural landscapes. In central and northern Israel, a high percentage of land cover was transformed to agriculture. Birds are considered sensitive to changes in vegetation structure and composition, and can be used as indicators for biodiversity loss in altered habitats. In order to evaluate the effects of agriculture on resident birds' community structure, we analyzed bird point count data collected by Hamaarag – Israel's Long Term Biodiversity Monitoring Program. Data collection was carried out in three habitats, 3-5 sites per habitat, and at 6 points per site. A sum of 18 sites revisited 3-1 times between 2012-2018, a sum of 281 point counts. We compared bird community structure between points on the edge of agriculture (up to 100m) and points distant from agriculture (500-2000m) in each habitat, and accounted for life history trait differences between bird communities. We found significant differences in community structure between the distant points and the points on the edge of agriculture in all three habitats. All three habitats show similar effects of agriculture on the local bird community structure, suggesting that expansion of agriculture impacts local bird species in all habitats. Arid and open habitat specialists, ground and ground cavity nesters, and invertebrate predators were negatively affected by agriculture. Agricultural areas also draw Mediterranean maquis and forest species, and also invasive and commensal species. We suggest four alternative hypotheses that may explain our results and suggest future research that can explore them.



## Dominant parasitoids respond differently to weed management practices in vineyards in Israel

Gabriella Möller<sup>1</sup>, Tamar Keasar<sup>2</sup>, and Michal Segoli<sup>1</sup>

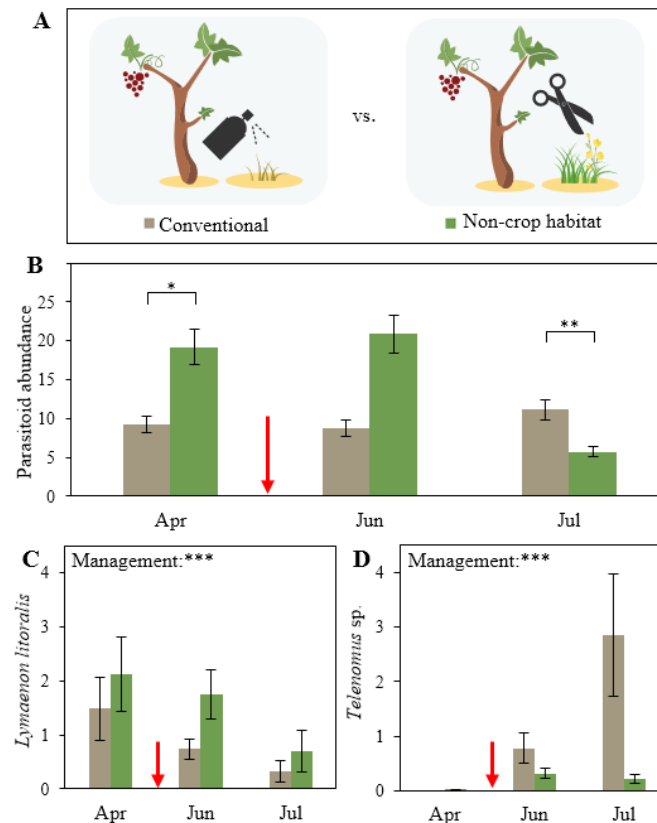
<sup>1</sup>Mitrani Department of Desert Ecology, Ben-Gurion University of the Negev, Israel

<sup>2</sup>Department of Biology and Environment, University of Haifa-Oranim, Israel

Maintaining natural vegetation within crop fields to support natural enemies is one strategy of conservation biological control. Natural vegetation may provide shelter and alternative prey for natural enemies, increasing their abundance and enhancing pest control. Farming practices aimed to manage non-crop vegetation may thus indirectly affect natural enemies. Our study compared the effects of two such practices on the parasitoid community in vineyards in northern Israel.

We selected vineyards of similar age, grape variety, and insecticide application, but with different weed managements ("conventional", repeatedly spraying herbicide throughout the vineyard vs. "non-crop habitat," trimming the herbaceous vegetation that grows between the vine rows after the flowering season). We suction-sampled arthropods and compared parasitoid abundance and diversity between managements during the 2016-2017 grape-growing seasons.

We collected 19,970 arthropods, 2943 of which were parasitoids. The interaction between management and season significantly affected the parasitoids' total abundance ( $p < 0.001$ ); parasitoids were more abundant in the "non-crop habitat" plots before trimming, but became more abundant in the "conventional" plots towards the end of the season. Likely, the different responses of the dominant parasitoids to management explain this pattern; *Lymaenon litoralis* (16.8% of total parasitoids), an early-season leafhopper parasitoid was more abundant in "non-crop habitat" plots, while the late-season Lepidoptera parasitoid *Telenomus* sp. (10% of total) was more abundant in the "conventional" plots. Our results suggest that the effectiveness of the management implemented in the vineyard is timing-dependent and highly influenced by the identity of dominant species. This knowledge can contribute to improving management decisions in vineyards.



**Figure 1.** Effect of “Conventional” (spraying herbicides throughout the vineyard) vs. the “Non-crop vegetation” (letting natural vegetation grow between vine rows, trimming it after the flowering season) managements (A) on: total parasitoid abundance (B) and abundance of dominant species *Lymanon litoralis* (C) and *Telenomus* sp. (D) (mean  $\pm$  SE). Red arrows indicate trimming events. Significance codes: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

### Contribution of this research to biodiversity conservation in Israel

Wine production is a growing industry in Israel with over 200 wineries spanning across 12,000 acres of vineyards<sup>1</sup>. Currently, the conventional management approach is to maintain “clean vineyards” by regularly applying herbicides to prevent weed germination and to maintain a bare soil<sup>2</sup>. While herbicides contribute to weed control, their use jeopardizes both human and environmental health. Preserving non-crop habitats within a crop may support the abundance of natural enemies, enhancing their activity as biological control agents<sup>3</sup>. However, the effectiveness of this approach on Israeli vineyards is limited to few studies<sup>4</sup>. Our study of the potential of this management option showed that natural vegetation within vineyards can enhance the abundance of some parasitoids such as *Lymanon litoralis*, an early-season parasitoid of leafhoppers (a common vineyard pest). These results can help steer the current agricultural practices towards a more sustainable approach, contributing to the conservation of native plants and associated communities.

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## Comparing costs-effectiveness of conserving non-crop habitats in agricultural landscapes at multiple scales

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<sup>1</sup>Faculty of Architecture and Town Planning, Technion-Israel Institute of Technology, Israel.

<sup>2</sup>Faculty of Civil and Environmental Engineering, Technion-Israel Institute of Technology, Israel.

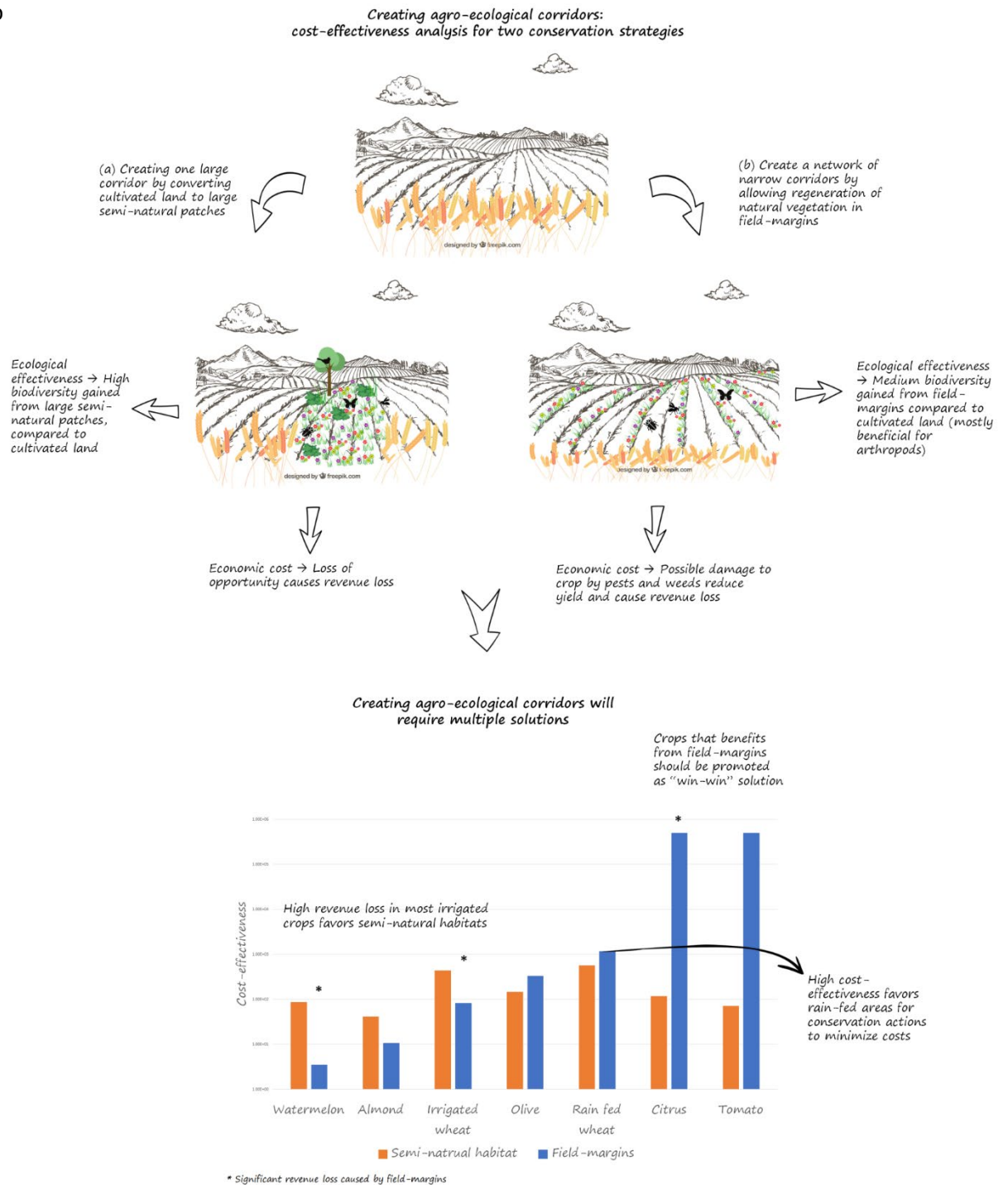
Wildlife-friendly farming is a common tool to enhance biodiversity and ecosystem-services in agricultural landscapes, but it incurs costs to farmers, hence careful consideration of the cost-effectiveness of wildlife-friendly practices is key to promoting agro-ecological policies. While numerous studies assess the benefits of wildlife-friendly farming, few studies simultaneously evaluate the economic costs of these practices. We assessed costs and benefits of maintaining uncultivated field-margins compared to conserving large semi-natural patches, at a large spatial scale over multiple seasons and crops in Israel. We estimated economic costs in terms of increased production costs and revenue loss, and ecological benefits in terms of increased potential biological pest-control and above-ground biodiversity of plants, birds and arthropods. Uncultivated field-margins increased above-ground biodiversity by 64% compared to cultivated-land, and accounted for 78% of the biodiversity recorded in semi-natural patches. Yet, their ecological-effectiveness varied across seasons and taxa, and was lowest for bird and plant diversity, with 42-46% less species than semi-natural patches. Uncultivated field-margins increased potential biological pest-control, but benefits were not translated to higher yields; field-margins were associated with reduced yield in some irrigated crops, leading to low cost-effectiveness compared to sparing semi-natural patches. However, field-margins were more cost-effective in orchards and extensive rain-fed crops. This suggests that there is no 'one-size-fits-all solution'; generally, restoring large semi-natural patches was more cost-effective than uncultivated field-margins. Yet for some crops, uncultivated field-margins mutually benefited farmers and biodiversity and can therefore be used to minimize costs for farmers, preferably where sparing semi-natural patches is not possible.

### Significance to biodiversity conservation in Israel

The conflict between biodiversity and food-production is of high-priority in conservation-policy, but there is a controversy between those supporting large-scale sparing of natural habitats and those in favor of wildlife-friendly agriculture. Choosing the best policy relies on effective solutions at affordable costs, but we deeply lack knowledge about the second. This could lead to poor conservation policies, e.g. high investments in measures with lower conservation value. Israel recently began to promote new agro-environmental policies, but conservation resources are limited and we need to choose the most cost-effective actions. In this case-study, we assessed the cost-effectiveness of two conservation actions for multiple taxa, crops and seasons in an intensive

agricultural region in Israel. We identified 'win-win' cases which should be targeted, alongside cases which require high economic investments. We emphasize that tailoring local solutions will increase the success of environmental policies.

**Figure 1:** The cost-effectiveness framework and case-study results. The flowchart shows the ecological benefits and economic costs resulting from creating (a) large natural habitats compared to (b) uncultivated field-margins. The chart shows the cost-effectiveness of both actions for several commo



## Social marketing of agricultural practices supporting biodiversity

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Encouraging the implementation of conservation practices is social challenge. As two thirds of the Red species list are affected by agriculture, the behavior of farmers is of vital importance for successful conservation. Social marketing is a strategic marketing scheme set for promoting social values using commercial marketing tools. The aim of the study at hand: to assess social marketing factors encouraging the use of agricultural practices supporting biodiversity conservation in Israel. We used mixed model of qualitative and quantitative methods, in 3 stages: (1) Content analysis for mapping the social marketing environment: The farmers, The agricultural practices, and the training tool itself. (2) Development of an online training tool. (3) A field research to evaluate the training tool, together with a farmer association. Stage 1 identified that farmers lack practical knowledge on biodiversity in agriculture, they lack normative information and interpersonal communication on the subject. Stage 2 was able to create an online training tool. Stage 3 identified that farmers consume training content on diverse characteristics and not only scientific knowledge. They are much more attracted to normative information, and value interpersonal communication when choosing new practices. Therefore, we concluded that when perusing the assimilation of new agricultural practices supporting biodiversity conservation, conservation projects should work on multiple communication channels, emphasizing normative messages about the social acceptances of conservation measures in agriculture. The methodology developed in this research can be adopted to other type of conservation efforts, suggesting methods for assessing, analyzing the engaging various social influence effecting successful conservation.

## **A quantitative evaluation of the effectiveness of human-wildlife conflict management in a major stopover and wintering site**

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Effective non-lethal reduction of human-wildlife conflict is vital for protection of important stop-over and wintering sites with mixed use. To alleviate the conflict between conservation and agriculture in sites used by large, grazing migratory birds, various combinations of active management techniques are implemented. To quantitatively evaluate the effectiveness of these methods, detailed information on management levels, combined with an understanding of the behavioural response of the birds, are needed.

We used high-resolution movement data of 30 Eurasian cranes (*Grus grus*), combined with detailed information regarding sensitivity level of agricultural fields. Detailed movement data of the disturbance teams guarding the sensitive fields and food amounts provided by the diversionary feeding were also recorded.

We show that diversionary feeding significantly reduced the core activity area and time spent at sensitive crops of most of the tagged cranes, but this depended on the amount of food provided at the feeding station. Nevertheless, 17% of the cranes did not change their space use after the feeding station began operating, due to their much more restricted use of it. When cranes were present at sensitive crops, crane-disturbance teams interactions ended in cranes returning, mostly within one hour, to the same field in 34% of cases

Our results suggest that a combination of sufficient diversionary feeding and repeated disturbance is essential to effectively prevent crop damage. Moreover, establishment of refuge areas, where the cranes can forage undisturbed, is important to decrease their presence at sensitive crops once they are not at the feeding station.

**PARALLEL SESSION: IMPACTS OF HUMAN ACTIVITIES ON BIODIVERSITY CONSERVATION 2**

**Eucalypts inhibit pedogenesis (soil formation) and change community compositions in a sandy habitat**

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Only approximately 17% of the Israeli coastal dunes possess reasonable ecological value. Over the years, substantial efforts have been made to stabilize coastal dunes using exotic species. However, the influence of the widely used Australian genus *Eucalyptus* on ecosystem dynamics in afforested sand dunes ecosystems, has been poorly studied.

Our study compares the effects of (a) *Eucalyptus camaldulensis*, (b) Carob tree (*Ceratonia siliqua*), and (c) White broom (*Retama raetam*) upon their underlying soil profile and adjacent ecosystem. For these three environments we analyzed the pedological and chemical soil profile and calculated yearly decomposition rate using litterbags. Then, we analyzed several key groups of organisms, namely vascular plants, ground-dwelling arthropods, and reptiles, sampled in *Eucalyptus* and dune (populated by Carob and white broom) plots between 2016-2018.

Pedogenesis was found to be absent beneath *Eucalyptus*. O and A horizons, composed mostly from undecomposed organic matter were four times thicker than beneath Carob trees. Litter bag tests indicate a significantly slower decomposition rate of *Eucalyptus* litter compared to Carobs and White broom litter. Dune plots were richer in Plant, Arthropods and reptiles species compared with *Eucalyptus* plots, and composed significantly higher numbers of psammophile and endemic species. *Eucalyptus* plots however, host more invasive and foreign plant species. The fauna was dominated by generalist creatures that usually inhabit high moisture and high organic matter habitats.

To summarize, the slow decomposition rate of *Eucalyptus* litter leads to rapid accumulation of a thick moist layer of undecomposed organic matter at germination depth. This process rapidly transforms the natural sandy habitat into an unsuitable for psammophile species.



## Tree rings reveal the adverse effect of water confiscation on protected riparian *Platanus orientalis* tree growth

Amit Bachar - Plant and environmental sciences, Weizmann institute of sciences

### Abstract (General topic - Protected areas)

Tree-rings provide natural records of the tree growth and thus can be used as a powerful tool to study *in situ* tree response to changes in their environment, including climate change. Mature trees (>50 years) are ideal for using a dendrological approach i.e., measuring annual tree-rings. Additionally, stable isotope carbon composition ( $\delta^{13}C$ ) of wood material is a good proxy for tree drought stress, completing the tree growth data. We compared the two tree growth parameters to meteorological data and looked for patterns in tree response to changes in climatic conditions (temperature, precipitation and increasing atmospheric CO<sub>2</sub> concentration). Surprisingly, our results from Nachal Kziv nature reserve in the northern Galilee show that riparian *Platanus orientalis* tree growth did not respond to climatic conditions. Instead, *Platanus* growth correlated with the continuous pumping from the stream that was performed for human water-use. In 1976-1991, under excessive water pumping, tree growth was reduced by 50-85% compared to the years that preceded and followed. Furthermore,  $\delta^{13}C$  analyses suggest that the trees suffered from drought stress in this period. Fortunately, the trees recovered when the pumping stopped completely in 2006. Our study pinpoints the adverse effects of water confiscation on protected *Platanus* tree growth, and can be used as a good case study against anthropogenic interventions in natural reserves in the future.

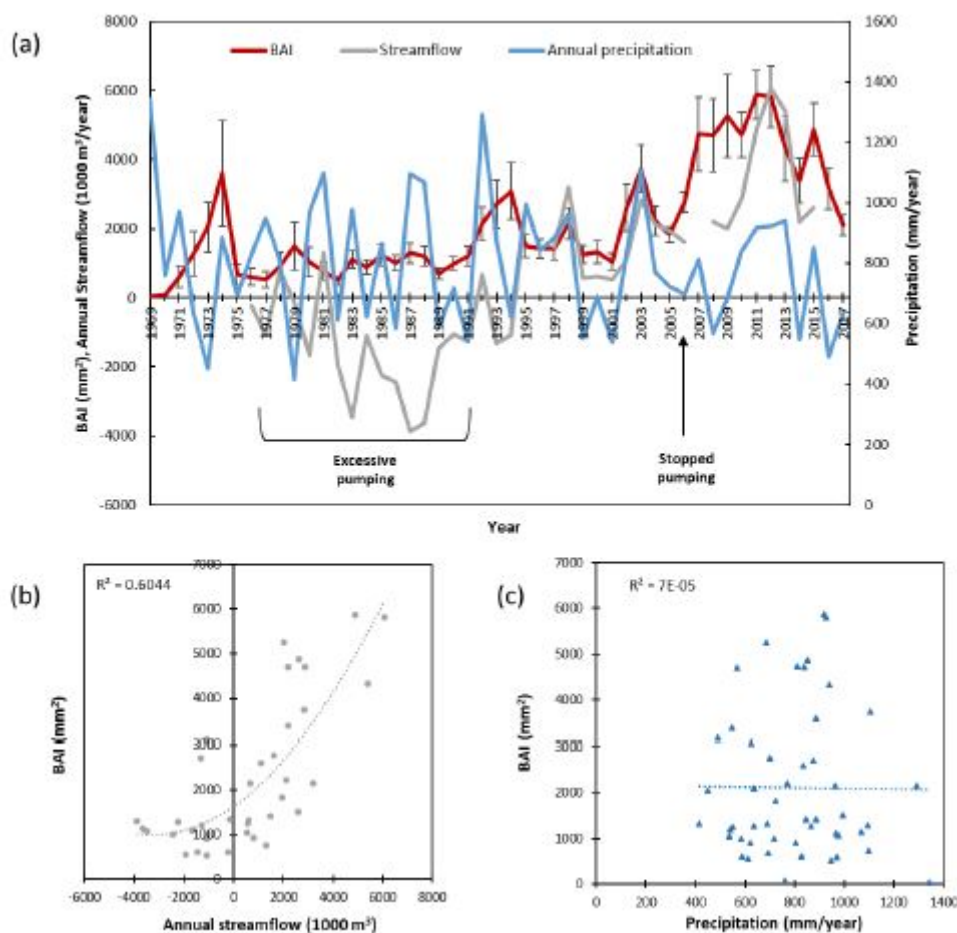


Figure 1—(a) 1969 to 2017 mean $\pm$ SE Basal Area Increment (BAI) of *Platanus* trees at Kziv stream, Annual streamflow and Precipitation. Streamflow is calculated as the water volume in Ein ziv subtracting the volume of water pumped from the spring. Negative stream flow values indicate that excessive pumping was performed. (b-c) the correlation between mean BAI and (b) Annual streamflow and (c) Precipitation.

**The significance of my research for biodiversity conservation in Israel:**

As water availability in Israel is extremely low, water confiscation has been performed to this day, and is likely to occur also in the future. Since *Platanus* trees in Israel are often riparian, namely, found next to a river or a stream, excessive water confiscation could irreversibly damage the main ecosystem where these trees grow. This might result in a slow decay of *Platanus* species from our local landscape, thus damaging the biodiversity conservation in Israel.

## **Coastal dune conservation: Can we restore mobile dune biodiversity in the face of shrub encroachment in the coastal dunes of Israel?**

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Keywords: restoration, biodiversity, conservation, destabilisation, coastal dune management, long-term data, multiple-taxa, Israel

### **Abstract:**

Coastal management projects often seek to stabilize and re-vegetate dunes, however recent evidence suggests that dune stabilization can be detrimental to these naturally dynamic coastal systems and their highly adapted biodiversity. We sought to restore the habitat heterogeneity in Nizzanim Dunes Natural Reserve by actively removing perennial vegetation, to provide suitable habitat for mobile dune species. Two experimental methods were tested on fixed and semi-fixed dunes, and opportunistic disturbance by off-road vehicles was also assessed, giving three different forms of vegetation removal.

We examined the responses to treatment for plants, arthropods, reptiles & rodents, from 2004-2018 as part of the Long-Term Ecological Research (LTER) program. This is the largest experimental habitat-manipulation experiment in Israel, in the largest remaining intact dune system along the Israeli Mediterranean coast. In addition, no previous studies have considered temporal effects of coastal dune restoration on composition.

Treatment effects depended on the removal type and taxon. Overall, disturbed dunes had most similar composition to dynamic mobile dunes for faunal taxa, while annuals were absent. On semi-fixed dunes a small but desired shift towards the mobile-dune composition was seen across all taxa, particularly rodents. Most notably, a temporal trend was detected for all faunal taxa both in composition and for indicator species, suggesting that restoration success may be achieved over a long period. Fixed dune removal had little impact on composition even after more than a decade. Conservation management plans for the reserve should consider the specific targets and conservation priorities at both local and national scales.

## **Analyzing the impacts of dryland agriculture on environmental systems in the Arava Valley**

**Amir Lewin, Effi Tripler, and Takuya Iwamura:**

Agriculture is one of the most significant forms of human land use associated with biodiversity decline, particularly in fragile desert regions due to habitat loss, groundwater overuse and soil salinization. The Arava Valley is a hyperarid region comprising unique desert ecosystems and species threatened by intensive dryland agriculture. It is further divided into two distinct land-tenure systems - Kibbutzim and Moshavim, which vary in terms of their social dynamics and agricultural practices. The Arava Valley therefore provides an ideal model system for evaluating the interrelationships between social and ecological processes underlying agricultural landscape structural changes. Here, we use GIS tools to classify 2 m resolution aerial images of agricultural settlements into categories of land use over the past 15 years. These landscape maps are then used to quantify temporal and spatial configurations of agricultural land area and connectivity, which show contrasting land use patterns between Kibbutzim and Moshavim. Finally, we integrate these patterns of land use changes with environmental and ecological indicators. For example, environmental impact quotient methods show higher nitrogen fertilizer water loads associated with bell peppers grown under structures of Moshavim. Additionally, species occurrence data of invasive Golden Jackals show their clustering in proximity to open fields and orchards of Kibbutzim, which may aid as corridors (along with hedgerows) for their dispersal. However, implications from this study suggest that recent and future land use trends such as conversion to date production, solar panel fields, and water policy scenarios are likely to result in alternate environmental outcomes.

## Ecological continuity under pressure: A study case from the Shilo River Reserve

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Realization of the significance of ecological corridors is growing rapidly in recent years, as natural ecosystems continually shrink and fragment. During 2017, the Israel Nature and Parks Authority initiated a regional framework, aiming to establish a statutory plan to determine outlines for ecological corridors in central Israel. The framework defines three levels of land use within a corridor: core, open agro-lands and bottlenecks. The Shilo River Reserve, within Israel international borders, is part of this framework, and includes both core and bottleneck corridors. All terrestrial animals in the reserve depend on two narrow passages, connecting the reserve with another core corridor to the south. One of these passages is currently under the Ela'd city expansion plans. The objectives of the study were to quantify the presence of medium to large mammalian species in the reserve, and their use of the reserve as a potential corridor. A grid of trail cameras that was laid in the reserve for 28 days during May-June 2018, revealed that with 85% of total observations, the endangered mountain gazelle was by far the most common out of seven mammalian species. Golden jackals and red foxes followed, with only seven and five percent respectively. Gazelle observation frequencies increased with distance from built-up areas, and the two passages were used with relatively low frequencies. Our results highlight the importance of the reserve's continuity, both as prime gazelle habitat and as ecological corridor, and emphasizes the necessity of its protection from further development.

## **The efficacy of protected areas during and post-war in Sri Lanka**

**Joseph J Erinjery<sup>1</sup>, Eyal Goldstein<sup>1</sup>, Gerardo Martin<sup>2</sup>, Kris Murray<sup>2</sup> and Takuya Iwamura<sup>1</sup>**

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**<sup>2</sup>Grantham Institute-Climate Change and Environment, Imperial College, London**

Civil conflicts can have either positive, negative or neutral impacts on forest cover. Such impacts are often scale dependent due to the varied spatial and temporal responses to events related to conflict at different spatial scales. However, studies exploring the efficacy of protected areas during and post-war at multiple spatial and temporal scales are scarce. We explored the temporal and spatial impacts of civil conflict on forest cover at national, regional and local scale in Sri Lanka and analyzed the efficacy of protected areas during and post-war. We used a combination of remote sensing and socio-ecological data to analyze land use changes at different spatial scales. At the national scale, we found a decline in forest cover (4.7%) and observed protected areas to be more efficient in protecting forest cover than non-protected areas. However, at the regional scale we observed that forests were more protected only in protected areas in civil war regions and not in non-civil war regions. We observed a drastic decline of forest in refugee camps during war and resettlement areas after the war. Overall, land use changes were disparate across different spatial and temporal scales. Such efficacy studies are critical from a forest management and conservation perspective.

### PARALLEL SESSION: ANIMAL CONSERVATION

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Landscape

Oral

#### **What threats the migratory Blackcap in Africa? Estimating the degree of climate and land cover changes within the estimated African wintering habitats**

Tal Raz<sup>1\*</sup>, Gidon Perlman<sup>2</sup>, Yosef Kiat<sup>3</sup>, Kevin Kardynal<sup>4</sup>, Keith Hobson<sup>4</sup>, Takuya Iwamura<sup>1</sup>

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Every year, billions of migratory passerines fly through Israel between Europe and Africa. Long-distance migrants, which winter in sub-Sahara Africa, are found declining in comparison with their short-distance counterparts. Many suggest this is due to the environmental changes of their wintering habitats in Africa. However, there is a severe lack of knowledge regarding these potential wintering ranges, and therefore we do not know what kind of threats these birds are facing. In this research, we identified the African wintering habitats of the Blackcap (*Sylvia atricapilla*) that migrate through Israel and analyzed the threats to their survival in these regions. For this purpose, at the Jerusalem Bird Observatory (JBO), we collected molt feathers, which grew during their wintering periods. Since these feathers contain an isotopic signature of their growth area, we can identify the wintering habitats statistically. Combined with species distribution model, we successfully narrowed down the potential habitat range for the Blackcap caught at the JBO. Finally, we calculated the habitat loss rate as well as the degree of climatic changes within the wintering habitats between the years 2005, 2009, 2016 by using land cover maps. We found out that the Blackcap population, which migrate through the JBO, are most threatened by the land cover changes, recording 20.5% habitat loss between 2005 and 2016 due to an expansion of cropland.

## Breeding success and survival of terns nesting in Israel

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### Abstract

Ground-nesting colonial seabirds, such as terns, are highly vulnerable to habitat loss and human disturbance at breeding sites. The Little and Common terns (*Sternula albifrons* and *Sterna hirundo*) are migratory seabirds nesting in Israel, which are listed as endangered due to large reduction in available breeding sites. Conservation of these species require long-term monitoring and examination of the associated risks. Our goal is to study the breeding success and survival of both tern species in Israel, and the factors influencing it. During the breeding season, we observed the tern colonies and documented breeding biology parameters and predators' presence. In addition, terns ringing data was collected since 2010, allowing for long-term monitoring of nesting individuals. We controlled the vegetation on Pigeon Island, resulting in full occupancy of the new breeding grounds, and an increased number of breeding pairs. Overall, we observed an increase in the number of breeding pairs in Israel over the last years, with a peak in 2018. However, we found low breeding success and poor chick survival for both tern species, with predation being the main factor negatively influencing breeding success in all colonies in 2017. We documented two previously-unknown predator species of tern chicks in Israel. Consequently, anti-predator management was implemented, and as a result, Little tern chick survival in Atlit was significantly higher during 2018, and the productivity of the colony resembled other colonies worldwide. Based on our findings, more effective management of breeding sites will be implemented to reduce predation, and improve breeding success.



## Differential scale-related nest predation by foxes and ravens in relation to human activity in a desert area

Yonatan Zohar\*, Yotam Orchan\* and Ran Nathan\*

\*Movement ecology Lab, Hebrew university in Jerusalem

### Abstract:

Predation of ground nest can be enhanced by human activities attracting predators to the vicinity of the nests, yet the spatial scale of this potential effect is largely unknown. Filling this gap is of particular importance in desert areas, where ground nesting constitutes the most common nest type in the local breeding avifauna. Towards this end, we monitored predation of 83 artificial nests placed at different distances (0 to 2km) from human activity hotspots ("large-scale" effect) in the Judean desert, with and without addition of transient food (a snack leftover; small-scale effect), during a period of 14 days in February-June 2018.

Red foxes (*Vulpes vulpes*) were the most common predator (79%), followed by brown-necked ravens (*Corvus ruficollis*; 6%) and Golden spiny mice (*Acomys russatus*; 3%). Surprisingly, fan-tailed ravens (*Corvus rhipidurus*) were not observed predating on any of the nests despite their abundance in the study area, and data from GPS tracks indicating cases of close proximity to the nests. The distance from human activity hotspot had no effect on predation rate, but predation rate was significantly higher when a snack was left near the nest.

We therefore conclude that human activities can enhance predation of ground nests primarily through short-scale attraction of some common mammal and bird species. Consequently, outreach, education and management enforcement activities should highlight the detrimental effects of occasional anthropogenic food leftovers, which can threaten many breeding bird species in desert ecosystems by attracting nest predators.

**Location-aware alert system for wildlife poisoning using GPS tagged vultures**

Gal Vine, Ohad Hatzofe

Israel Nature and Parks Authority

Despite considerable effort and partial success, the Griffon Vulture (*Gyps fulvus*) population in Israel has dropped from hundreds of nesting pairs to only ca. 50 pairs in 60 years. The main causes for this decline are poisonings caused by illegal use of pesticides, veterinary drugs and intoxication by lead. In most cases, poisoning events are discovered only after intoxicated animals are found. Thus, it is too late to save them and also to detect criminals in order to prosecute and to create preventive deterrence. It is almost impossible to perform early detection and to prevent the exposure of vultures to poison baits laid out in the environment. In response to the critical status of the Griffon vulture population, we have built a location-aware alert system that integrates with modern GPS-satellite transmitters that allow tracking of vulture movements over long time periods in near real-time, sampling location, body temperature and speed. The system produces automated individual stress or death alerts for each transmitter-carrying individual by analyzing information of body temperature, site topography (cliff landings) and group size. The alerts are directed to the relevant regional rangers according to the individual location, this allows a fast on-ground response to preventing potential poisonings. This project demonstrates the potential of tracking technology for management of endangered species populations. Future developments will allow generalizing this technological solution for early warning of wildlife poisoning.

## **Movement and feeding behavior of three raven species in the Judean Desert suggest high extinction risk for the most abundant species**

Yotam Orchan\* and Ran Nathan\*

\*Movement ecology Lab, Hebrew university in Jerusalem

Synanthropic species, as ravens, utilize anthropogenic resources for food and nesting, thereby increase their local abundance. In desert ecosystems, high abundance of such predators (or competitors) might risk other animals. Motivated by observations suggesting high abundance of ravens in the Dead Sea area, we examined population size, movement (GPS tracking) and feeding behavior of three raven species in this area. The fan-tailed raven (*Corvus rhipiduros*; FTR) is the most abundant raven species in the study area, yet higher numbers were reported in the past; today, occurs mostly or solely in the study area, reported as declining throughout its geographical range. The brown-necked raven (*C. ruficollis*; BNR) is less common near the Dead Sea but abundant in other parts of the desert. The common raven (*C. corax*; CR) appears in low numbers. FTRs roosted mostly in one site and foraged mostly near the Dead Sea, BNRs roosted and foraged all over the Judean Desert, and CRs moved well beyond the study area. All species fed on anthropogenic resources, but differ in the level of human presence in their feeding locations (high, intermediate and low levels, respectively). FTRs were inferior to both BNRs and CRs in access to food, approaching food only when outnumber other species.

Altogether, we suggest that FTRs are concentrated in a restricted area to maintain sufficiently high numbers allowing access to food given their inferior competitive abilities. This further elevates extinction risk of this locally abundant yet declining population. We call for active management of this endangered species.

## **Life is hard: the rekindling the Arabian Oryx (*Oryx leucoryx*) reintroductions in Israel**

**Noam Leader, Tal Polak, Asaf Tsoar, Eran Hyams, Zohar Ben-Shitrit and Ronny King**

Israeli Nature and Parks Authority

The Arabian oryx reintroduction program in Israel started in 1978 with the arrival of eight individuals to Hai-Bar Yotvata. Between 1997-2014, the Israeli Nature and Parks Authority (INPA) reintroduced 129 individuals into the wild.

The INPA used a soft-release method, where the animals are placed in an enclosure at the release site for a period of time (1-3 months). This common method provides a better affinity to the release site and a high post-release survival rate. However, it requires extensive funding and resources. While, in hard-releases the animals are released immediately, without an adjustment period. Hard-release, consumes less time and to require less resources than soft-release. The cost-benefit of such releases is still debatable.

We performed three hard-releases, at different locations known for their high oryx activity. Each release had two to three individuals, equipped with GPS collars. For the first month the collars transmitted a location every 30-minutes, later, three times a day, giving us an indication on their survival and home-range selection post-release.

Out of the eight individuals, five survived and one was confirmed as having joined a local herd. Their post-release movement behaviour varied, some remained close to the release site for a few weeks, while others ranged out in just a few days. One individual, seem to have started homing back towards Hai-Bar Yotvata but didn't survived.

Due to the high survival rate (62%), the INPA decided to continue with additional hard-releases in the upcoming years and release an additional 40 individuals to achieve a viable population in the wild.

**PARALLEL SESSION: BIODIVERSITY CONSERVATION**

**Israeli Butterfly Monitoring Scheme: challenges and lessons from the first BMS on the borders of the desert**

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2 –Helmholtz Centre for Environmental Research (UFZ), Germany

3 –German Centre for Integrative Biodiversity Research (iDiv), Halle-Jena-Leipzig, Germany

**Abstract**

Butterfly Monitoring Schemes (BMSs) are an excellent avenue for engaging the public in biodiversity monitoring and conservation and for the acquisition of spatially and temporally broad datasets. Most existing BMSs are in temperate climates, with Israel as a notable exception. The country's climatic and biogeographic diversity poses unique challenges both in BMS-establishment and expansion and in data-analysis, and our experience in coping with them offers valuable insights for establishing new BMSs, especially in non-temperate climates. We tested the applicability of the Regional Generalized Additive Model (Regional GAM) methodology, so far used for deriving butterfly flight season and abundance, and assessed the potential of Israel's unique Community Model of BMS, in which volunteers are grouped in Monitoring Communities and receive continuous guidance and support. We found that Regional GAM's reliability rises with the number of observations, so it should be applied with great caution for species with complex flight phenology. Expert knowledge of species' natural history and ecology is crucial for model application and interpretation, especially for species with complex flight seasonality. Observers grouped in a Monitoring Community show a rapid increase in the reported taxonomic resolution. Volunteer persistence was lower among members of the Monitoring Community in the second and third years to its establishment, but during the fourth year it reached a similar level depicted by ungrouped volunteers. We discuss remaining challenges in establishing BMSs into scarcely-populated areas, as well as remaining methodological challenges and potentials residing in expanding BMSs for analysis of data where butterflies are active year-round.

## **The National Red List of the Invertebrates of Israel; Challenges, goals and advantages**

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Concern about rapid biodiversity losses due to anthropogenic disturbance is evident both globally and in Israel, and many efforts are invested in assessing and conserving plant and vertebrate species. However, arthropods are frequently neglected, despite the accumulating evidence that they are highly threatened and declining at alarming rates in recent years.

Invertebrates comprise approximately 80% of described species globally and are often the first to become extinct in response to habitat loss and disturbance, due to their high sensitivity to changes in resource availability and other environmental factors. National & Regional Red List assessments provide an important tool to scientifically assess the risk of species extinction, but invertebrates are the most poorly assessed group. Classifying threatened invertebrates is therefore critical to biodiversity conservation and can help to assess changes in habitat quality to inform conservation planning.

Over 60 National Assessments of invertebrates have been conducted worldwide, most using the IUCN Red List methodology. While some information is sparse compared with vertebrate species, many insects depend entirely on one host plant or animal, allowing risk assessments at a high level of detail under IUCN Red List Criteria A & B. For example, several Ground beetles exclusively inhabit coastal sand dunes, whose continued loss is well documented. The distributions of many aquatic insects are well recorded and the causes and rates of the habitat loss are well known. We present the challenges and goals for applying the IUCN Red List protocol to the National Red List Assessment of invertebrates in Israel.

## **From "landscape improvement" to landscape conservation: Biodiversity loss due to Afforestation of natural landscapes in Israel, calls for a change of policy**

Alon Rothschild - Society for the protection of nature in Israel

Scarce tree cover characterizes the natural landscape of vast areas in Israel. Ecosystems like grasslands, loess plains and Batha are under-represented in nature reserves, thus being under threat. A substantial portion of these landscapes is designated as "Forest" in outline plans or is subject to "land – preservation" afforestation by the land Authority.

100,000 hectares have already been planted in Israel in past decades. In the year 2019, what is the ecological cost of transforming natural landscapes into a planted forest? What is the public benefit of afforestation?

We have reviewed data from peer-reviewed papers, as well as "gray" literature, regarding afforestation's impact on biodiversity and ecosystem services in five natural ecosystems and a variety of taxonomic groups in Israel, as well as from other countries.

Our results show that afforestation in natural landscapes in which trees are naturally absent cause Biodiversity loss, especially of "specialist" species. Community change, as specialist species are being replaced by generalist or forest species, was documented across Israel, from the Mediterranean area to the desert, and was shown in birds, reptiles, arthropods and annual plants.

Negative impacts are not restricted to the forest, as "edge effect" influences adjacent natural areas.

A change of policy is needed: Afforestation of natural ecosystems should generally cease, and natural succession should be managed, if needed, with a grazing regime. Only limited and carefully selected afforestation actions should be allowed, where a clear justification is presented.

We recommend relevant changes in the outline plans. natural landscapes should be designated as nature reserves, managed by the iNPA.

## **Cattle and Spears: damages of an uninvited guest to the Mediterranean herpetofauna**

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While studying the effect of grazing on the Mediterranean ecosystem using reptiles as an indicator, we accidentally encountered the potency of a relatively new predator in the system – the Cattle Egret (*Bubulcus ibis*). Therefore, we explored the impact of this eruptive waterfowl, which often escort cattle, on the lizard assemblages in Northern Israeli woodlands.

We integrated data on predator functioning and its effect on prey species abundances by: (1) mapping the distribution of egret nesting colonies; (2) exploring egret food menu during nesting seasons using vomit analyses in 10 large nesting colonies near woodlands; (3) sampling lizard assemblages using direct observations in sites along a distance gradient from these colonies; and (4) monitoring egret activity in study sites using direct observation and camera traps.

We found that: (1) nesting colonies are widespread; (2) lizards composed ~ 20% of egret diet; (3) sites in proximity to egret colonies had species-poor lizard communities; and (4) egrets were more abundant in grazed sites in proximity to colonies (<7 Km).

Our study demonstrated the wide spread distributions of Cattle Egrets in the Israeli Mediterranean ecosystem, and their direct impact on lizard communities, distinctly in cattle grazed woodlands. In context of the ongoing debate on the role of grazing, our results highlight a trade-off between the maintenance of habitat heterogeneity by this traditional land use practice, and the increased risk of predation to wildlife caused by the subsequent egret infestation.



**Bioclimate correlates with richness of amphibian skin microbiomes at the global scale**

R.G. Bina Perl - School of Marine Sciences, Ruppin Academic Center, Mikhmoret, Israel

Microbial symbionts are integral to host health in many ways. Among others, they play important roles in gastrointestinal tracts, regulate epithelial development and influence innate immunity. Unlike e.g. mammals or reptiles, amphibians have a soft and sensitive skin and cutaneous microbes are their first line of defence against skin pathogens. Their skin, which can be sampled non-destructively, has advanced to a leading model system to investigate host-associated microbial community structure. Previous research on local scales has shown that amphibian skin microbial diversity varies temporally and is reduced when hosts are exposed to habitat destruction or microclimate shifts, yet it remains poorly understood how key biotic and abiotic factors shape host-associated microbial communities at the global scale. We used cutaneous microbiome data from 2,349 post-metamorphic amphibians representing 205 species across a broad biogeographic range to investigate global patterns in amphibian skin bacterial communities, and applied multiple statistical approaches to investigate how biotic and abiotic factors correlate with these communities. We found that global amphibian skin bacterial richness was consistently correlated with temperature-associated factors. Furthermore, skin microbiomes were more diverse in environments with colder winters and less stable thermal conditions. We conclude that temporal and spatial characteristics of the host's macro-environment mediate microbial diversity. In the face of rapid environmental change around the globe, climatic changes may alter host microbiomes, which, in turn, could have consequences on maintenance of host health and selection and evolution of amphibians.

## Introducing the *bdverse*: an ensemble of R packages for biodiversity big-data

Tomer Gueta<sup>1</sup>, Vijay Barve<sup>2</sup>, PovilasGibas<sup>3</sup>, Thiloshon Nagarajah<sup>4</sup>, Ashwin Agrawal<sup>5</sup> and Yohay Carmel<sup>1</sup>

The recent availability of species occurrence data from numerous sources (e.g., scientific research, citizen-science, and natural history collections), standardized and connected within a single portal has the potential to answer a staggering variety of research questions. Yet, biodiversity big-data are prone to various data quality issues and biases, which may invalidate its usage in research. Furthermore, complex technical and analytical skills are increasingly required for handling biodiversity big-data.

The *bdverse* is a collection of packages that form a general framework for facilitating biodiversity science in R. Hopefully it will serve as a sustainable and agile infrastructure that enhances the value of biodiversity data by allowing users to conveniently employ R, for data exploration, quality assessment, data cleaning, and standardization. The *bdverse* supports users with- and without programming capabilities. It comprised of six unique packages in a hierarchal structure — representing different functionality levels. Major features of three core packages will be highlighted and demonstrated: (i) *bdDwC* standardizes field names and forces recommended Darwin Core vocabulary; (ii) *bdchecks* provides functionality of data checks coupled with essential metadata and unique support functions for managing vast amount of checks; (iii) *bdclean* a user-friendly data cleaning Shiny app for the inexperienced R user, which uses elements from all other *bdverse* packages. An official release of the *bdverse* is expected in March 2019.

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## POSTER SESSIONS

### Landscape architecture of future nature reserves and conservation management in Israel

Anna Argoetti, Faculty of Architecture and Town Planning, Technion, Haifa, Israel

By 2048, the Israeli population is expected to double itself. The growth is predicted to reach 15 million people. As a result, the demand for built areas and more infrastructure will naturally grow, thus slowly reducing the open landscapes in Israel and harming the sensitive protected areas and their ecological systems.

Despite the advanced ecological knowledge gained in the last decades, the nature conservation system in Israel still addresses very small and limited areas as nature reserves, without considering the connections between them or the areas surrounding. Therefore, the nature reserves in Israel are threatened by the decrease of the open unprotected landscapes; among them agriculture fields, stream areas, parks and the seashore.

I am suggesting a widespread solution to protect the open landscapes continuity hoping to promise the protection of the diversity in Israeli nature. The project examines the coastal plain streams as symbiotic ecosystems; each stream area functions as a system that has to be protected as whole. In addition, the connectivity between the streams has to be preserved as open landscape to enable migration. This grid of open landscape enables flexibility for the ecosystem in a response to environmental changes.

Poleg stream serves as case study through which I have begun to further examine the issue. The stream contains six small sporadic nature reserve and a national park and surrounded by municipalities. In this area I examine the types of open landscapes and their contribution to the ecosystem and suggest a detailed plan for truisms sidelong nature conservation.



## **Preventing the Invasion of Pests and Pathogens into the Israeli Wild Flora through Regulated Importation of Plant Products**

Arik Shammai, Camal Sherf, Dana Ichelczik, Daniella Cafri, Doron Bar-Bornshtein, Edna Levy, Eitan Recht, Genya Elkind, Liat Gidron-Heinemann, Merav Maor, Moshe Vaknin, Ofra Evron, Refael Greenberger, Shahar Samra, Valeriya Seplyarsky, Yael Meller Harel

**Plant Protection and Inspection Services, Ministry of Agriculture and Rural Development, Bet Dagan, Israel**

### **Abstract**

The Israeli Plant Protection and Inspection Services (PPIS) are an Israeli regulatory authority operating within the framework of plant protection laws and regulations, for the purposes of maintaining plant health and promoting agricultural export. In order to safeguard the health of plants in agricultural and natural environments, PPIS ensures the import of plant material free of harmful organisms, and continuously monitors the status of potential new pests to prevent their entry and establishment in Israel. The Plant Quarantine Department within PPIS is the operational arm which regulates the import of plant products into Israel. This activity is facilitated by the PPIS Plant Pest Diagnosis Department, who are responsible for the detection and identification of harmful organisms, including fungi, oomycetes, bacteria, viruses, viroids, nematodes, noxious weeds, snails, insects and mites.

Between the years 2015-2018, over 97800 shipments of agricultural produce were imported into Israel through Haifa and Ashdod sea ports and Ben Gurion Airport cargo terminal. Out of these, 443 shipments were rejected due to the interception of quarantine pests. Commodities intercepted included wood products infested with quarantine beetles such as the weevil *Hylobius abietis*, plant products infested with fungi, such as apples infested with *Neofabrea* sp., and vegetable seed lots containing seeds of noxious weeds such as the Broad-Leaved Dock *Rumex obtusifolius*. Such quarantine pests, if not intercepted upon arrival could become established in Israel and might cause severe damage to Israel's agriculture and natural flora, as well as cause problems in the export of agricultural products from Israel.

## Drivers of Community Assembly of Insectivorous Bat Communities in Pine Plantations in Israel

Claudia Allegrini – MDDE, Ben Gurion University of the Negev, Sde Boker Campus, Israel

Pine plantations are usually characterized by simply-structured coniferous monocultures. Lacking plant species diversity and structural heterogeneity, they are considered poor in diversity of animal species. In Israel, forest management has been focused on increasing the heterogeneity and complexity of forest structure in order to increase biodiversity. Furthermore, recent studies on insectivorous bats show that species richness in pine plantations in northern Israel doesn't differ from species richness in natural woodlands. Thus, these plantations are likely to be important for diversity and conservation of bat species. The main purpose of this research was the identification of factors driving community assembly in forest-dwelling bats. Using the ESLTP analysis, an extension of the RLQ approach, we aimed to identify potential environmental filters in species' traits, considering phylogenetic context, spatial distribution of pine plantations and habitat features in the surrounding landscape. Preliminary results show that 22 out of the 32 insectivorous bat species found in Israel, use pine plantations as foraging sites. All of them, except two, are categorized as endangered species. The highest species richness was found in the northern study sites. Nonetheless, central and southern pine forests resulted to be important as well for bat diversity. The ESLTP analysis shows that environmental filtering has a role in shaping communities of bats in pine plantations in Israel. This result can be used to predict responses of bat species to environmental changes and disturbance.

## **Giant clam growth in the Gulf of Aqaba is accelerated compared to fossil populations: The role of nitrate aerosol fertilization**

Daniel Killam<sub>1</sub>, Tariq Al-Najjar<sub>2</sub>, and Matthew Clapham<sub>3</sub>

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2. University of Jordan, Aqaba Branch
3. University of California, Santa Cruz; Department of Earth and Planetary Sciences

The giant clams are reef-dwelling bivalves which use the same photosymbiotic partnership characteristic of reef-building corals. But while the declining health of corals in the face of climate change and human pollution are the topic of intensive research, comparatively little work has been dedicated to understanding trends in the health of giant clams in relation to environmental change. We have collected fossil and modern specimens of three species of *Tridacna* from reefs fringing the Gulf of Aqaba. After calibrating the daily/twice-daily growth bands from the outer shell layer, we have determined that all three species are growing more quickly in the modern day compared to fossil specimens from Holocene and Pleistocene reefs. We found that giant clam shell organic  $\delta^{15}\text{N}$  of modern specimens show a 4.5‰ lower average value compared to fossil specimens, an offset which we propose is most likely attributable to increased deposition of isotopically light nitrate aerosols in the modern era. As nitrate is a known accelerant of giant clam growth, it may play a role in the faster growth seen in modern populations. We found that that growth is positively correlated to temperature as measured by oxygen isotope paleo thermometry of their shell carbonate, and discuss how lower winter cold temperatures in the past may have depressed giant clam growth compared to the relatively small seasonal availability seen today. Giant clams can serve as isotopic and physiological sentinels of reef environmental change, both to determine their own comparative health and that of the coral reefs they inhabit.

**Arrival time to stopover site, accumulation of fuel and stopover duration during fall migration of juvenile Red backed Shrikes (*Lanius collurio*) in the Hula Valley, Israel**

Daniela Zinssmeister and Nir Sapir<sup>1</sup>

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The timing of long-distance migration is critically important to animal fitness and population dynamics of migratory animals. Understanding how internal and external factors affect migration timing is a major challenge in the study of bird migration, and base to provide recommendations for bird conservation advancement during stopover. The goal of this research was to enhance the understanding of factors affecting bird migratory departure timing and fuel deposition during autumnal stopover at an edge of a wide ecological barrier by studying a long-distance migrant, the Red backed Shrike (*Lanius collurio*). We combined ATLAS (Advanced Tracking and Localization of Animals in real-life System) with repeated recording of bird body mass by field-deployed measuring scales in the Hula Valley, 200 km north of a wide ecological barrier, the Sahara Desert. We investigated following questions: 1) How long do juvenile Red Backed Shrikes need to refuel during stopover until they can proceed with their migration? 2) Do different arrival body masses of birds influence their refueling pattern? 3) Does arrival time in the season to the stopover site has an impact on refueling and stopover duration? Our results suggest that arrival body mass at a stopover site might be a predictor for the individual's stopover strategy, fueling period and stopover duration. Gained information about habitat use can help to advance bird conservation in agro-ecological systems.

## Global warming and the structure of marine fish communities in the eastern Mediterranean

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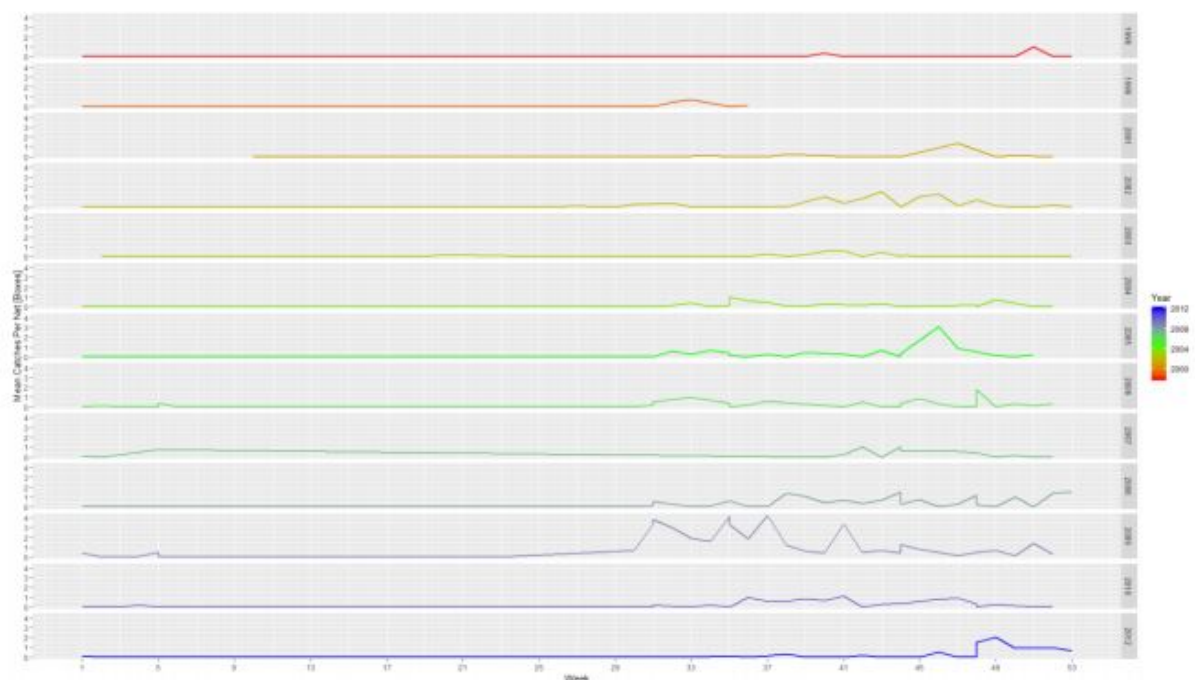
### Abstract

Accumulative evidence suggests warming may substantially impact natural communities, e.g., by driving seasonal changes in timing of migrations and reproduction or by causing an increase of thermophilic species and decrease of psychrophilic species. However, although the Mediterranean Sea is rapidly warming the paucity of base-line data means we do not know how species composition or the phenology of Mediterranean fishes respond to warming.

Here, we use long term and high resolution data based on fish caught along the Israeli coast between 1981 and 2018, extracted from the log books of over 16,000 fishing hauls with nearly daily reports on trawling location and catch composition.

Preliminary results suggest changes in the timing of peak catch in several species, suggesting fish arrive earlier in the spring and depart later in the fall. We also calculated the Mean Temperature of the Catch (MTC), an index, proposed by Cheung et al., 2013, that calculated from average inferred temperature preference of exploited species, weighted by their annual catch. We found both for indigenous and invasive species MTC increases through time indicating shifts in community composition towards more thermophilic species.

Those results suggest the warming Eastern Mediterranean has already impacting both species phenology and species composition. The results could help us predict future changes resulting from additional temperature increases.





Alteration in the peak catch time of *Scomberomorus commerson* from 1987-2013. The Y axis shows the weekly mean catch per net [in boxes] of *Scomberomorus commerson*. The X axis shows week in the year. Each line is one year. There is shift in the peak time for these species.

**Significance:**

This study adds to the mounting evidence suggesting climate change is substantially impacting natural communities. This study also can be used to target local conservation efforts. Changes in phenology usually occur before changes in distribution or populations sizes. Hence, species with marked shifts in phenology may be those most sensitive to warming and may warrant targeted conservation efforts. Fish management often includes fishing limitations during the reproduction season. If the reproduction season is expected to change in correlation to sea warming, the fishing limitations need to be updated and modified to reflect the seasons in which species actually breed.

**Keywords:**

Phenology, Climate Change, Reproduction Season, Fish Community, MTC, Mediterranean Sea.

## The physiology of endangered fruit tree species in Israel and their potential for improving orchard drought resistance

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A world biodiversity hub, Israel is home to many crop plant ancestors, including fruit trees of the family *Rosaceae*: pear, plum, and almond. Small populations of these wild varieties still exist in cool, montane sites, but are under threat due to warming and drying. Climate change already negatively affects water availability, both locally and globally.

Our research compared mechanisms underlying drought resistance in cultivated fruit trees and their locally available, protected, wild relatives: Syrian pear (*Pyrus syriaca*), Bear's plum (*Prunus ursina*), and the Ramon almond (*Amygdalus ramonensis*).

We conducted a field experiment in cultivated orchards and a nearby native Syrian pear site in the Upper Galilee. We tested the effect of drought stress on transpiration, hydraulic conductivity and plasma membrane water channels (aquaporin PIPs) mRNA levels, xylem embolism and anatomy, photosynthesis, and non-structural carbohydrates.

Despite a more negative water potential, the wild pear's hydraulic conductivity was similar to that of the cultivated species. The similar embolism level corresponded to the wild pear's narrower conduits. Wild pear maintained its photosynthesis rate, with subsequently lower transpiration rate, and showed more efficient water-use under drought compared to the cultivated species. Specific PIP genes showed upregulated transcription following drought, indicating their role in the adaptation to drought.

Our study shows that Syrian pear is more resistant to drought than its cultivated relative, and is better-suited to survive under the current climate change. The results highlight the potential of using wild relatives of fruit tree species to prepare key crops to a drier, hotter future.

### Long-term genetic consequences of a reintroduction - the Asiatic wild ass *Equus hemionus* in Israel

Lilly Zecherle , School of Natural Science and Psychology, Liverpool John Moores University, Liverpool, UK

Species reintroductions are a powerful conservation tool, yet they are often characterized by low success rates. Commonly reintroductions are evaluated by population growth and census size, however, a populations long-term persistence strongly depends on its genetic makeup. Few founding individuals and population bottle necks can lead to low genetic diversity and high levels of inbreeding in the established population, ultimately increasing its risk of extinction. In the special case of the reintroduced Asiatic wild ass *Equus hemionus* in Israel, the founding population consisted of few individuals from two different subspecies. To better understand the current state and predict future chances of persistence of this population, the genetic aspects of this reintroduction were investigated.

DNA samples from individuals prior and post release and samples of the original subspecies were analysed using next generation sequencing methods. An extensive SNP dataset was created and applied to investigate subspecies admixture, genetic diversity and effective population size.

Admixture levels were high prior and post release as identified by individual hybrid indices ( $\text{Median}_{\text{Founding}}=0.43$ ,  $\text{Median}_{\text{Wild}}=0.43$ ). There was a small significant decrease in heterozygosity in the course of the reintroduction ( $\text{Ho}_{\text{Founding}}=0.25$ ,  $\text{Ho}_{\text{Wild}}=0.22$ ; Wilcoxon test,  $p<0.001$ ) and estimates of effective population size were low (variance and inbreeding effective size,  $N_{\text{ev}}=17.1$  and  $N_{\text{ef}}=26.7$ , respectively).

The results indicate successful admixture which likely reduced loss of genetic diversity during reintroduction. Nevertheless, effective population sizes are small and to secure long-term persistence adequate management is crucial to facilitate gene flow and maximize the number of breeders.

## Image-Based 3-Dimensional (3D) Modeling for Depiction of Coral Reef Community Structure

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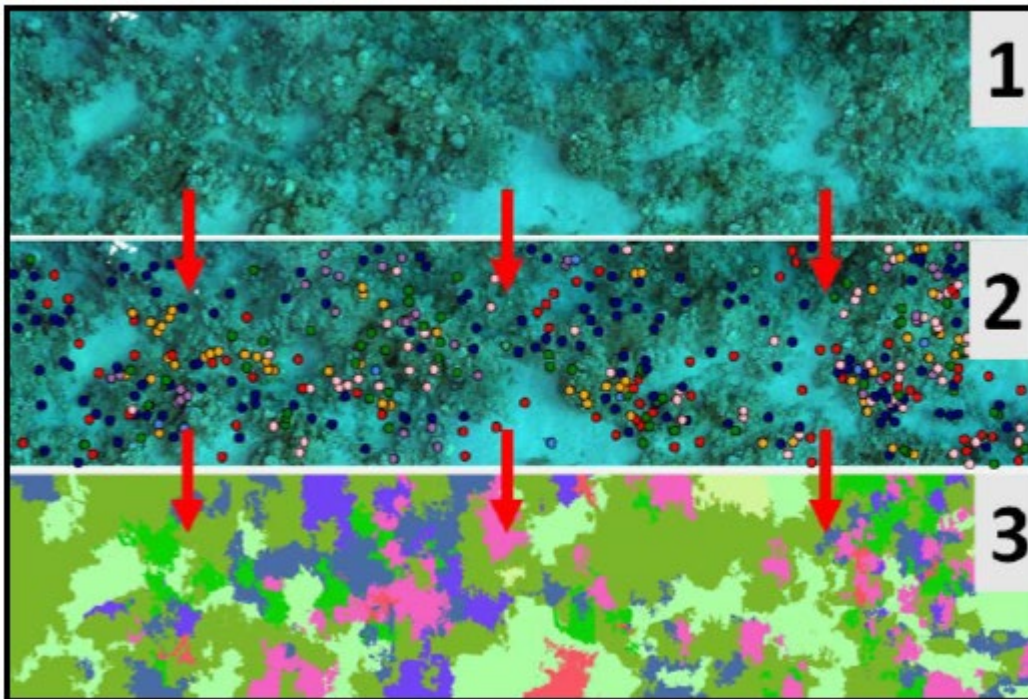
Coral reefs are the most complex and diverse ecosystems in the marine environment. These epic structures are built mainly by colonial organisms of the phylum Cnidaria; Scleractinian Corals. While many studies have focused on the biology of these holobionts, much remains to be learned of their spatial distribution and community structure dynamics, a research frontier which is confined by the available technological tools. My research can be divided, in two fields; development of computer vision tools, and their application in research and monitoring; primarily of coral reefs. Underwater photography and image-based modeling is utilized to create wide-scale (km), high resolution (genus specific), true color and texture 3D maps of the shallow and mesophotic coral reefs of Eilat. These maps are automatically analyzed using semantic segmentation, a machine learning task that provides information regarding every pixel in the image-based map. Highly detailed map models provide both the fine scale topography of the benthos (terrain complexity), and the distribution of key sessile groups which are automatically detected and segmented through computer-vision and deep-learning. The multivariate spatial data is used to examine phenomena in benthic ecology such as the neighbor relations, size frequency distribution, and depth-related zonation of sessile invertebrates. Furthermore, it enables to test specific hypotheses such as the relation between terrain complexity (rugosity) and biodiversity through an automated framework. The replacement of traditional methods for rapid underwater ecological assessment with accurately derived metrics from image-based 3D map models represents a paradigm shift soon to be actualized in underwater research and monitoring.

### Significance:

By employing Artificial Intelligence (AI); specifically computer vision and semantic image segmentation, for the benefit of coral reef research and conservation, we aim to replace humans in the laborious task of benthic image labeling and enable wider scale surveys which are not possible today due to the gargantuan size of image libraries which are generated in expansive visual surveys of the seabed.

We are developing a powerful tool and an automated approach which is adaptive, cost-efficient, and scalable, with serious time-saving implications and never before seen level of detail in wide-scale coral reef mapping. The ability to fully segment km scale photomosaics of the seabed and provide semantic detail for every pixel of the image is invaluable for research in coral reef ecology, conservation, and monitoring.

Figure 1:



Example of our workflow for label propagation: a wide-scale (15X3 m<sup>2</sup>) photo-mosaic (1) is labeled (2), labels are propagated for full terrain depiction (3) .

### **Floral diversity, honeybee activity, and pollination network structure**

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Habitat disturbance and the simplification of plant communities are considered major threats to wild pollinators. These, as well as spillover of managed pollinators, may be reflected in the pollination networks of affected habitats. We hypothesized that low floral diversity and honeybee activity lead to simpler and less stable pollination networks. We surveyed and constructed pollination networks for 16 sites in the Judean Foothills, classified as harboring high or low floral diversity (mean Shannon index:  $1.88 \pm 0.11$  and  $0.53 \pm 0.14$ , respectively). Both habitat types spanned a range of honeybee activity levels. We found greater interspecific sharing of floral resources by bees in low floral diversity sites. Network connectivity and complexity were negatively related with honeybee activity, but only in high floral diversity sites. Thus, low floral diversity and honeybee activity may increase pollinator communities' vulnerability to extinction and susceptibility to interspecific pathogen transmission.

## The monitoring and conservation of Near Eastern Fire Salamander populations in Haifa

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### Abstract

Amphibians are undergoing population declines worldwide, with >41% of the species being globally threatened with extinction. The Near Eastern Fire Salamander (*Salamandra infraimmaculata*) is listed as endangered in Israel, mostly due to severe habitat loss, aquatic pollution and accidental roadkill. It inhabits a wide range of aquatic habitats in the Middle East, with Mount Carmel in Israel being the southern tip of its worldwide distribution range. The city of Haifa is located on Mount Carmel, with wadis constituting much of its urban nature, but are under little management and suffer from various threats, such as infrastructure development and pollution. Nevertheless, some of them may provide suitable habitat for amphibians. We conducted a survey of Near Eastern Fire Salamander adults in four locations inside Haifa, using a capture-recapture method based on recognition of individuals by dorsal spot patterns. We also collected physiological measurements and GPS locations of the adults and documented abiotic conditions. We investigated potential breeding sites and checked for presence of salamander larvae. The data were collected by conducting citizen science. We characterized two populations of the Near Eastern Fire Salamander in Haifa, one of which is potentially larger than some well-known populations in nature reserves. We also found two breeding sites containing salamander larvae in urban habitats. Based on these results, we initiated a salamander conservation project in Haifa, aiming to conserve the wadis as suitable habitats for amphibians, expand research on the salamander populations and involve decision makers and the public in urban nature conservation.

### **A citizen science project - Back Yard Birds Count in Israel**

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The public Back Yard Birds Count is a citizen science project, held in Israel once a year, since 2006. Its aim is to monitor the bird populations for protecting the birds and the biodiversity as well as for public outreach to the birds and nature. According to citizen science principles, research methods and results are presented to the public: guidelines for the count and bird's information are found in the internet site in three languages: Hebrew, Arabic and English. The count focuses on the most common birds although people are asked to report other species if identified. The report is in the Hebrew version of eBird application. The site contains educational lesson plans and all educational institutes that participate receive an award certificate. Summary of the count appears in a dynamic map and in a short text compared to previous years. All raw data is open to the public. The results show that each year there is a growth in invasive species reports mainly of the Myna and Monk Parakeet, yet the percentage of reports of other species is stable. The five birds reported the most are Crow, Sparrow, Laughing Dove, Pigeon and Bulbul. At the 2018 count, the Myna reached fifth place together with the Bulbul. We found that the count provides good data on the status of birds and shows positive correlation between a variety of birds and bird-environment components. Participation of schoolchildren in the count improved their environmental literacy in relation to students who did not participate.



### **Back Yard Birds Count in Israel**

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The public Back Yard Birds Count is held once a year in Israel, starting in 2006. The count occurs each year –at the end of January and early February. The results show that each year there is a growth in invasive species reports mainly of the Myna and Monk Parakeet, yet the percentage of reports of other species is stable. The five birds reported the most are Crow, Sparrow, Laughing Dove, Pigeon and Bulbul. At the 2018 count, the Myna reached fifth place together with the Bulbul.

The aim of the project is to monitor the bird populations for protecting the birds and the biodiversity as well as for public outreach to the birds and nature.

Guidelines for the count and pages containing forms and birds information are found in the internet site in three languages: Hebrew, Arabic and English. The count focuses on the most common birds although people are asked to report other species if identified. The report is in the Hebrew version of eBird application.

All educational institutes that participate receive an award certificate.

Summary of the count appears in a dynamic map and in a short text compared to previous years. There is also an extensive summary contains information about the participants.

A study done at Porter School of Tel Aviv University found that the information of the count provides good data on the status of birds and shows positive correlation between a variety of birds and bird-environment components. This strengthens the idea that birds can be biodiversity indicators. Participation of schoolchildren in the count improved their environmental literacy in relation to students who did not participate.

## **Germination analysis of natural and ecologically-restored sites in phosphate mining fields in Zin valley, Israel**

Tom Zylberberg - Department of Life Sciences, Ben Gurion University of the Negev, Beer-Sheva, Israel

Ecological systems have been severely disturbed and damaged through the anthropogenic procedure of mining. Ecological restoration practices attempting to rectify the damage require in-depth understanding. Phosphate open-pit mining fields cover over 200km<sup>2</sup> of the northeastern Negev desert. However, the effects of the mining process and the ongoing restoration efforts on the ecosystem have not been studied. Plants and their seed banks have major role in ecosystem processes and hence call for main consideration in studying ecological restoration. In my study, I focus on three mining sites, restored in different years, along Zin river valley and compare the plant community of restored plots within these areas to adjacent natural plots. I ask whether germination potential differs between the restored plots and the adjacent natural plots within a similar mining site. I test the hypotheses that: (1) there is a lack of seed bank in the restored plots; (2) the soil composition at the restored plots depresses germination. I use soil samples collected from the different mining sites and set up a greenhouse experiment. Some samples are treated with enriched soil or with vermiculite. Results indicate that lack of seed bank is the major limiting factor of restoring the plant community. The younger sites differ significantly from their natural areas, while the oldest site shows no significant difference. My findings shed light on the constraints of vegetation growth and lead to new sets of experiments that test prospective practices for restoration of the phosphate mining fields to be implemented in the future.

### **Establishing a Refuge Botanical Garden for the endangered plant *Hormuzakia negevensis***

Udi Columbus 1 , Margareta Walczak 1 , Merav Lebel 1 , Alon Singer 2 , Tomer Faraj 2 , Ravit Eshed 3 , Einav Mayzlish Gati 2 , Sima Kagan 3

1 INPA – Israel Nature and Parks Authority

2 IGB – Israel Gene Bank

3 Volcani center - agricultural research organization

*H. negevensis* is an herbaceous perennial from the Boraginaceae family. It is extremely rare and is endemic to Israel. This species was discovered in the 1990s in the sandy Yamin plane at the Negev desert by A. Danin and the entire known global population of it (estimated to comprise of a few dozen individuals) currently is found solely on one single ridge. This site is at risk of destruction because it is in a military zone, and is also on the planned path of the train-rails to Eilat. Hence, this species is included on the Israel Red List and is defined as 'in danger of extinction'. The INPA in cooperation with the IGB (Israel Gene bank) decided to establish a population of *H. negevensis* at an alternate protected site. The selected site, at Mamshit National Park is protected from animals, off-road vehicles and hikers. In total, 58 cuttings were taken from 17 wild individuals. Approximately one year later, in January 2015 these cuttings were planted in a sandy plot at Mamshit National Park in three separate channels. At the end of the initial acclimatization year, all plants survived and were thriving, and some have matured and released seeds. To date (January 2019) there is 59% survival rate, all surviving plants are producing seeds, and most importantly, there are more than 150 seedlings scattered in the garden plot. This successful project is part of the ex-situ conservation strategies applied by the INPA and the IGB in order to protect and conserve the endangered, near threatened and very rare (ENtR) plants of Israel.

## The dead support life: cemeteries and other urban sacred sites have an important conservation role

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### Abstract

Urbanization is a rapidly-growing radical process of habitat alteration worldwide, driving extreme biodiversity changes such as species loss, species interchanges, and community homogenizations. Urban 'green' spaces are often considered as local conservation hubs. Among these, cemeteries and other urban sacred 'green' sites (e.g., churchyards, temple gardens, etc.; USS hereafter) might be especially important for conservation because they are less disturbed than e.g., city parks, and in the case of graveyards also enjoy highly fertile soil due to the decomposing bodies.

We investigated, at a global level, three questions: 1. are USS species-richer than other urban and non-urban adjacent sites? 2. Do USS serve as shelters for rare or endangered species? 3. Do USS harbor higher proportions of native species than other urban and non-urban adjacent sites? We further examined how several potential drivers of biodiversity in USS (site type, religious affiliation, site age, ownership) affect the patterns. We analyzed plant and animal data from the literature for hundreds of sites representing 24 countries from all continents, and diverse cultural backgrounds. Generally, USS are not richer than other urban sites for most taxonomic groups, though anthropogenic-cultural variation exists. USS do tend, however, to host rare and endangered species. The proportion of non-natives is lower than other sites for animals, but not for plants.

In conclusion, USS offer important conservation opportunities, serving as urban biodiversity sanctuaries. Considering their conservation potential and the scarcity of information currently available for many taxa (e.g., reptiles, amphibians, fish), further investigations are fundamentally required.

**Collective outreach to protect Rehovot vernal pool and its endangered species**

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Vernal pools (rain-fed winter pools) are diverse and unique ecosystems under severe threat. Among the important pools in the Israeli coastal plain, Rehovot vernal pool is under transition into becoming a national park, but is still sensitive. Illegal deployment of construction waste, harming agricultural activities and new city plans are posing an immediate danger.

Driven by local enthusiasts, a workshop held at the Weizmann Institute of Science has recently ignited a collaboration between scientists, environmentalists and educators, to raise public awareness and protect the pool.

Within a few months, a series of ecology-oriented education activities were formed, stressing the importance of the vernal pool and its conservation as a habitat for endangered species. Among these activities, we established (1) an ecology workshop for high school students; (2) an ecology program for elementary school pupils; and (3) diverse social media platforms.

Accompanied by an exceptionally large flooding area, thanks to heavy rains this year, the activities led to a surge of public interest in the pool. The forgotten vernal pool became a local attraction and a source of pride to the local community.