English Abstracts

The study of *Pinus brutia* x *Pinus halepensis* hybrids in Israel's planted forests and their implications for forest regeneration

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Pinus halepensis (Aleppo pine) is a native Israeli species and was the main species used for afforestation in the country from the end of the British Mandate until the 1970s. Since then, it has gradually been replaced with *Pinus brutia* (the Turkish pine) due to the latter's resistance to the Israeli pine bast scale insect (*Matsucoccus josephi*). When the two species grow side by side, natural hybrids are formed between them; however, the scope of this phenomenon and its impact on forests in Israel have not yet been thoroughly studied.

The proportion of hybrids in planted stands of Turkish pine (the first forest generation) ranges from 2.5% to 9%, and the trees display more vigorous growth compared to neighboring Turkish pines, especially in semi-arid regions.

The proportion of hybrids was also studied in naturally regenerating Turkish pine stands. About 5% of the seeds from mother trees were found to be hybrids. In seedlings at the end of their first winter after germination, the proportion of hybrids was about 8%, and among those that survived their first summer it increased to about 22%. This increase suggests a survival advantage compared to Turkish pine seedlings.

To test this hypothesis, controlled experiments were conducted comparing morphological and anatomical traits, and water-balance indicators in seedlings of Turkish pine, Aleppo pine, and their hybrids. The results showed that hybrids express combined characteristics of both parents, which may grant them certain advantages in growth rate and survival.

This study demonstrated that hybridization in Israel's coniferous forests is a significant phenomenon, with the potential to increase diversity and possibly even improve forest resilience. Furthermore, reciprocal hybridization across successive generations may enable bidirectional gene flow, thereby enriching genetic variability and contributing to the forest's resilience to the impacts of climate change.

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Ancient agriculture in the Negev: Identification, mapping, and development of tools for conservation and restoration

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Ancient agricultural systems, evidenced by thousands of remnants such as terraces and other types of water management structures, are prevalent across the Negev desert, dating primarily to the Roman and Byzantine periods. These

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ancient systems played a crucial role in mitigating desertification and preserving biodiversity. However, these valuable archaeological resources are facing accelerated degradation due to both natural processes and human activities, including infrastructure development, overgrazing, and vandalism. This degradation exacerbates soil erosion and threatens the ecological balance. Acknowledging the impracticality of declaring all terrace sites to be protected antiquities due to their extensive distribution, this study focuses on developing a comprehensive protocol for their conservation and restoration. The study's core objectives are: 1) mapping ancient agricultural activity centers; 2) developing terrace conservation tools; and 3) developing terrace restoration tools. Mapping efforts identified approximately 120,700 dunams of agricultural systems, of which 58% are in unprotected areas. These unprotected areas were prioritized and ranked (high, medium, low priority) for restoration based on diverse cultural and ecological criteria. Existing conservation and restoration practices of organizations such as KKL-JNF, the Israel Antiquities Authority and the Nature and Parks Authority were analyzed to enable the formulation of practical guidelines and recommendations applicable to both public and private projects, ultimately aiming to raise public awareness and minimize further damage to these crucial historical and ecological assets.

Investigating changes in food webs and their importance for open-space management in an era of climate change

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Climate change affects the stability and functioning of ecosystems worldwide, driving substantial shifts in the composition and dynamics of food webs. Extreme events, such as droughts and heat waves, may cause the extinction of keystone species, alter biotic interactions, and promote the establishment of invasive species, processes that directly influence ecosystem functioning.

This article combines empirical research with theoretical considerations and highlights practical implications. The empirical component focuses on the impacts of climate change on food webs in desert open spaces. This was examined through extended monitoring of keystone species populations, climate trend analysis, and assessments of food web changes. Studies conducted between 1973 and 2020 demonstrated that the extinction of the desert keystone species, the desert isopod *Hemilepustus reaumuri*, led to a significant decline in the population density of its main predator, the scorpion *Scorpio maurus palmatus* and facilitated the invasion of the Israeli scorpion *Buthus occitanus israelis*.

These findings support theoretical models suggesting that climate change reshapes food webs through three main mechanisms: (1) direct species extinctions, (2) secondary extinctions of populations dependent on the lost species, and (3) rewiring of food-web interactions following the establishment of new species.

The implications of this study for open-space management point to the need for early identification of ecological drought sensitive key species in the food web, monitoring of different population across trophic levels, and the use of food-web-based approaches in ecological management. Understanding food web dynamics in desert open spaces which are simpler than those of more mesic ecosystem can guide the development of management strategies to confront climate change modulation of food webs and prevent functional collapse of open spaces and other ecosystems.

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