

performances at Neot Kedumim remained high all year, indicating winter acclimation. This suggests that the effect of low temperature on the photosynthesis acclimation and stomatal conductance was greater than that of water shortage.

We conclude that *Ziziphus spina-christi* is potentially adapted to semi-arid climate conditions, but is inhibited by its mild sensitivity to drought. Therefore, it is more suitable for planting in "Limans" that provide the plant with an adequate water supply for photosynthesis and growth. In the "Shihim", characterized by severe salinity conditions, the physiological performance of *Ziziphus* is poor relative to other forest trees and it barely survives and is therefore not suitable for this type of afforestation.

## Acacia Trees in the Arava – Policy Paper

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This document is based on a comprehensive survey commissioned by KKL–JNF and conducted in 2011–2012. The results of the survey were published in "Survey of Acacias in the Arava" (Perlberg, 2013).

The survey was conducted along the Arava Valley, which covers an area of roughly 1500 square kilometers and mapped some 65,000 acacias using remote sensing methods.

The survey included all the ecosystem components interacting with acacia trees and a section with conclusions and recommendations for the future.

The policy paper regarding the Arava acacia trees gives these conclusions and recommendations spatial dimensions and maps them in a series of subject plans, which express both the work done in the acacia survey, as well as GIS data and planning aspects.

The recommendations were grouped into four main areas:

Statutory protection recommendations: recommendations based on the analysis of protected areas vs. areas of value and identification of areas requiring increased statutory protection. The main areas requiring additional statutory protection are areas of high value with few conflicts with contradicting area designations.

Recommendations for physical protection: recommendations based on the analysis of physical elements that allow acacias to exist on one hand and disturbances and abuses of the area on the other. Physical protection should be promoted mainly in areas in which acacia trees cannot be protected by statutory means.

Principles for community and tourist development: the principles were determined in relation to existing and future tourist and community initiatives, the tourism and recreational potential of the area and existing population concentrations. Acacias and other sites adjacent to communities were identified as having potential for community development, whereas more distant areas of interest were defined as recreational complexes and sites for tourism development.

Management, administrative and supervisory principles were evaluated from a holistic perspective of the area, the type of management desired and the ability to control activity in the area. Recommendations included preparation of a comprehensive management program for the area together with all the interested parties involved in it, which would serve as a basis for management and supervision efforts of each body.

## The Conflict between the State of Israel and the Negev Bedouin

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The conflict between the State of Israel and the Negev Bedouin over land is not new; State vs. nomadic land ownership is an on-going dispute originating as early as the Ottoman Empire. Illegal construction and land use are its prevalent expressions, making it difficult for the State to supply basic needs to its citizens.

The implications for the Bedouin society, which is the poorest population in Israel, are severe. They include, among others, difficulties in providing full services provided to other citizens in Israel. The current situation also hinders development of the Negev for the benefit of all its inhabitants. This article will explore the roots of the dispute, review key milestones in its development, and describe its implications throughout the Negev region.

## Juniperus in Israel – Identification, Habitat Characterization and Demographics

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Israel has one isolated juniper population in Mt. Shfanim, known for many years.

Until recently, the trees in this population were considered as prickly juniper (*Juniperus oxycedrus* L.), which has four distinct sub-species. The eastern Mediterranean population belongs to sub-species *oxycedrus*. Phenotypic differences exist between sub-species, including tree crown shape, stomatal bands, leaf base shape and scale cone tips.

New research shows that the eastern Mediterranean population of the sub-species *oxycedrus*, including the population of Mt. Shfanim, belongs to a different species named *Juniperus deltooides* (Map 1).

Phenotypic characterization that we conducted in mature trees of Mt. Shfanim indicated that this population consists of *Juniperus deltooides*.

In order to monitor the dynamics and spatial distribution of this unique population, 409 trees were mapped and measured (Map 2), and a bedrock-soil-vegetation survey was conducted to characterize the specific habitat of this juniper.

We recommend establishing an 'ex situ' plantation from seeds collected from selected trees on Mt. Shfanim in order to preserve the rare and unique juniper population.

## The Effect of Seed Source and Habitat Conditions on the Growth Rate of *Pinus canariensis* in Planted Forests in Israel

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*Pinus canariensis* is a species endemic to the Canary Islands. Its suitability to different ecological conditions and its relatively high resistance to fire, aroused interest in the species in Israel and it was planted in various forests. The purpose of this study was to examine the fitness of different *P. canariensis* seed sources, from the Canary Islands and Israel, 18 years after planting (in 1998), in the Biriya, En Dor and Ben Shemen forests. In addition, we examined the effect of different habitats on the long-term development of *P. canariensis* in 300 forest stands throughout Israel.

The seed sources from Israel exhibited better survival rates than the Canary Islands sources. In addition, the best growth rates of *P. canariensis* were found on dark rendzina soil in areas with average annual precipitation >450 mm. In light rendzina soil *P. canariensis* trees occasionally exhibit chlorosis.

Based on these results, we recommend avoiding planting *P. canariensis* in light rendzina soils. In semi-arid areas, planting is preferable in high quality niches (e.g. northern aspects and sites benefitting from run-off contribution). For future plantations, we recommend collecting seeds (for nursery cultivation) from the Ma'ale HaHamisha, Har Horshan and Nir Etsiyon forests, which had the best survival and growth rates.

# Abstracts

For figures, tables and bibliography – see in the Hebrew text

## Evolution of Israeli Forestry from Pure Even-Aged Pine Plantations to Sustainable Uneven-Aged Mixed Forests. Part C: Practical Implications for Forest Tending

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The main goal of tending operations implemented in planted forests in Israel is to promote the development of sustainable and resilient forests. Increasing species and age diversity and decreasing stand density in accordance with site carrying capacity through selective thinning, are the major measures that were taken to achieve this goal. Since KKL–JNF formulated its new forestry policy in 1990, there has been a gradual decrease in the stand density recommended for different site qualities and age (Table 1). In addition, mixed forests were planted since then in new and regenerated plantations which now comprise about 40% of the total forest area in Israel.

Thinning and pruning operations followed by removal and treatment of the slash, particularly in fuel breaks, are important measures to reduce the spread of forest fires, which cause the greatest damage to forests in Israel (Figure 1). Other detrimental agents, that require regeneration of the damaged stands are *Matssucocus josephi* infestations (specific to *Pinus halepensis*) (Table 2), prolonged droughts (Pictures 7 & 8, Table 3), snowstorms, and bark beetle attacks (Picture 9).

Tending stands, particularly of Aleppo pine, which are more than 50-years-old, have low species diversity and that grew too densely at the young developmental stage, aims to extend the rotation age as much as possible through light thinning. But in stands where many of the trees are gradually leaning sideways and falling (Picture 10), clearcutting, in which outstanding individual and clusters of Aleppo pine trees, as well as individual trees and patches of other conifers and native broadleaves are left as a basis for mixed, uneven-aged, multi-layered second-generation forest (Picture 11), is recommended. In recent years, aging and decline of such first generation stands, have become a significant reason for forest regeneration in Israel.

## The Function of the Ecological Services of Planted Forests Bordering on Farmlands in Minimizing Pesticide Leakage

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Intensive agriculture includes, among other things, an increased use of pesticides. These are chemicals used in the field for controlling pests, including insects, weeds, fungi and rodents. Due to their widespread use, pesticides pollute water, air, soil and environment and pose a health risk for humans.

The aim of this study was to examine the role that forests or tree belts planted by KKL–JNF near conventional intensive farmlands fulfill as wind barriers, reducing the transport of atmospheric dust particles containing pesticides. We hypothesized that pesticides transported from agricultural fields and orchards accumulate on the trees and the soil beneath them. The study examined the importance of buffer zones

created by commonly planted forest trees (*Eucalyptus* spp., *Pinus halepensis* and *Ceratonia siliqua*). The methods included analyzing the quantity and the chemical composition of pesticides, carried by atmospheric dust particles, at different distances from the intensive agricultural fields where pesticides were applied. The findings of the study included seventeen chemical compounds used as insecticides, fungicides and herbicides, found both in the agricultural fields and in the adjacent tree belts. The findings highlight an important function of trees, which has not yet been taken into consideration in planting and afforestation policies. From a management perspective, particularly in cases of agricultural fields and orchards that are adjacent to populated areas, planting tree belts should be positively considered as a means of reducing pesticide leakage from airborne dust.

## The Effect of Environmental Conditions on Annual Growth and Development of *Ziziphus spina-christi* in a Natural Habitat in a Mediterranean Climate and in Planted Forests in a Semi-Arid Climate

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*Ziziphus spina-christi* (Rhamnaceae) distribution is limited to areas characterized by mild winter temperatures and a small number of frost events. As a thermophilic tree, *Ziziphus* is adapted to dry hot climates and can tolerate high temperatures. Presumably, this could make it suitable for cultivation in an environment characterized by increasing degradation of land and water resources. The research goal was to study the main environmental factors affecting establishment and “abundance” of *Ziziphus spina-christi* in order to formulate guidelines for planners of future afforestation.

The ecophysiology of *Ziziphus spina-christi* was studied in natural habitats and planted forests, with the natural forest serving as a reference habitat. The natural habitat, Neot Kedumim, is a landscape reserve located near Modi'in and characterized by a Mediterranean climate with annual precipitation of 520 mm/year. The planted forest, Ambassadors Forest, is located north of Be'er Sheva and characterized by a semi-arid climate with annual precipitation of 229 mm/year. KKL–JNF has been planting *Ziziphus spina-christi* in that forest quite extensively since 2005. The afforestation in Ambassadors Forest is characterized by two different arid planting methods. The first is “Limans” which are artificial micro-catchments used to collect floodwater by damming a desert wadi. The second planting method is “Shihim” which are large artificial soil embankments built on the hillsides, which allows surface runoff to collect preventing soil erosion. The effect of seasonal change in soil moisture, stem water potential, photosynthesis rates and stomatal conductance were followed at Neot Kedumim and Ambassadors Forest by monthly measurements throughout the year.

The results showed that the seasonal stem water potential (SWP) range in Ambassadors Forest was –0.8 to –1.2 MPa during the wet period (November to April) and –1.4 to –1.6 MPa during the dry period (May to October) – indicating that the trees did not suffer severe water shortage. Relatively high stomatal conductance was observed throughout the summer (0.3 mol m<sup>-2</sup> s<sup>-1</sup>) and dropped during the winter (~0.073 mol m<sup>-2</sup> s<sup>-1</sup>). The stem water potential at Neot Kedumim was higher compared to Ambassadors Forest during the wet season (September), but dropped to low values during the end of the summer. Photosynthetic