

Restoration and protection actions of the Priority Habitat 9370* “Palm groves of Phoenix” in Crete - LIFE PHOENIX

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Abstract. Endemic palm groves of the *Phoenix* genus in Europe form vital natural and semi-natural ecosystems with exceptional ecological and socio-economic significance. These unique habitats are found only in Spain (*Phoenix canariensis*) and Greece (*P. theophrasti*). Their rarity has led to their inclusion in Annex I of the EU Directive 92/43 and their designation as Priority Habitat 9370*, “Palm groves of Phoenix,” with just 53 Natura 2000 (N2K) sites allocated for their conservation at the EU level.

Both species, face similar conservation challenges. Key threats include the impacts of climate change, pest infestations, and Invasive Alien Species (IAS). Additionally, region-specific issues arise from human activities: in Gran Canaria, past poor practices have led to hybridization with *P. dactylifera*, while in Crete, overgrazing and tourism pressures are primary concerns. Hybridization and pest control in Crete are currently managed with a precautionary approach.

The overarching goal of the LIFE Phoenix project is to enhance the conservation status of Priority Habitat 9370* in by implementing a comprehensive strategy. This includes mitigating major threats such as droughts, wildfires, overgrazing, visitor pressure, and hybridization; restoring natural palm groves through proper management techniques; preventing and controlling pests and IAS; promoting reforestation; and fostering environmental governance and awareness.

Keywords: Endemic palm groves, *Phoenix canariensis*, *Phoenix theophrasti*, Priority Habitat 9370*.

1. Introduction

In Greece, habitat 9370* is restricted to the island of Crete, where it predominantly occurs in ravines, along small perennial streams, and at river estuaries on alluvial and sandy substrates, within thermophilous zones of the island. The habitat is characterized by the presence of thermophilous plant taxa such as *Arisarum vulgare*, *Aristolochia cretica*, species of *Arum*, *Ceratonia siliqua*, *Olea europaea*, *Pistacia lentiscus*, *Dracunculus*

vulgaris, species of *Juncus*, and *Nerium oleander*. Nevertheless, its principal diagnostic feature is the presence of the endemic palm *P. theophrasti*, which is capable of forming nearly monospecific stands, particularly in the Vai region in northeastern Crete.

In other localities, such as the palm grove at Souda Plakias, *P. theophrasti* coexists with cultivated land and livestock facilities, growing adjacent to a small permanent watercourse. In these areas, increased competition for water resources exacerbates drought stress in the palm populations, thereby rendering them more vulnerable to insect infestations. All these habitats are distributed alongside the island as presented below to all four Regional Units of Crete.



Figure 1. Habitat 9370* in Crete

Martsalo Gorge (GR4310004). A small site with naturally occurring palms in difficult-to-access terrain, with strong erosion problems. **Agios Nikitas Palm Forest (GR4310005).** Hosts one of the densest and most isolated palm colonies, providing a unique, less-disturbed ecosystem. **Vai Palm Forest (GR4320006)** The largest and most iconic palm grove in Crete. *P. theophrasti* forms dense, expansive populations. **Preveli Palm Forest (GR4330003).** A popular tourist destination, where palms grow in dense clusters along a riverbed, creating a lush, semi-aquatic environment. **Souda Plakias (GR4340012).** A transitional landscape, where palms coexist with olive groves and human

settlements, reflecting both natural and anthropogenic influences. **Aspri Limni (GR4340015)** Located near Chrysoska-litissa Monastery, this site is in its ecologic boundaries and marks the westernmost population.

2. Major threads

Regardless of the protection Natura 2000 areas provide, this priority habitat still faces the following threats, which are considered as the most important:

Overgrazing: Unregulated and poorly managed livestock grazing in Crete has caused significant damage to the palm groves of *P. theophrasti* and other associated endemic plant species, necessitating the establishment of a monitoring system, to prevent severe degradation.

Visitors pressure: Tourism poses a significant threat to the palm groves, particularly in the two most prominent areas, Vai and Preveli, which attract over 100,000 visitors annually that strongly affect natural regeneration. None of these sites have a visitor management plan, leaving them vulnerable to the impacts of unregulated and expanding tourism.

Pests and invasive alien species (IAS): The *Rhynchophorus ferrugineus* beetle has caused widespread damage to palm trees across Europe and is particularly harmful due to the difficulty of detecting infestations in their early stages. Recently it is detected to affect *P. theophrasti* too.

Climate change: A serious problem in Crete is the occurrence of intended fires as a grazing method and the wildfires. Additionally, reduced rainfalls lead to the drop of groundwater availability and repeated, more frequent and longer droughts. Rainfall phenomena are much more severe, resulting in landslides and soil drift.

3. Restoration and protection actions

Reduction of direct anthropic impacts. These threats will be addressed through the installation of new fencing to protect palm stands from grazing and anthropogenic pressures, particularly from tourism. In parallel, efforts will be made to raise public awareness regarding the ecological importance of the species.

Climate Change. Its mitigation is based on increasing soil moisture, improving soil condition and preventing forest fires. In this sense, the following concrete actions are proposed: a) Removal of dead wood and invasive vegetation, as they constitute fire propagation corridors along ravines and b) Preventive grazing, in coordination with local farmers and shepherds.

Hybridization control. Despite the absence of hybridization in the populations analyzed, there are significant anthropogenic pressures that pose a potential threat to the genetic integrity. In almost all areas, high tourism activity and overgrazing exert considerable environmental stress. Likewise, many hotels in the region plant non-native *Phoenix* species, as ornamental plants. Moreover, a plant nursery located near the largest palm forest actively cultivates these non-native *Phoenix* species, increasing the likelihood of future hybridization.

Pest control and eradication (*Rhynchophorus ferrugineus*). Until 2024, no infestations of *Phoenix theophrasti* by the red palm weevil (*R. ferrugineus*) had been reported. The first major outbreak occurred that year in Vai. In response, the Lasithi Forest Service implemented an Integrated Pest Management (IPM) plan including: a) Isolation and Monitoring of the Forest; 10 km exclusion zone, monitoring of nearby nurseries, removal of other *Phoenix* species, b) Suppression of the Weevil Population Within the Forest, c) 5 Km buffer zone with Pheromone Traps, d) Systematic Inspection and Surveillance for new infestation sites and e) Public Awareness and Community Engagement.

Control and eradication of invasive vegetation. Complete removal of the invasive species *Eucalyptus sp.*, as major competitors to *P. Theophrasti*, especially in water absorption.

Erosion control. Construction of dry-stone walls and gabion structures will be implemented to mitigate streambed erosion and enhance habitat stability.

Vital space enhancement. Removal of surrounding vegetation within a 4m radius will be carried out to facilitate *P. theophrasti* regeneration, as resprouting via root suckers and basal shoots is a key component of its natural reproduction.

Ex-situ conservation. Establishment of seed banks and production of 2,500 seedlings in Public Nurseries will support future reforestation efforts and habitat enhancement initiatives.

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