

# Predicting Woody Plant Diversity as Key Component of Ecosystems: A Case Study in Central Greece

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## ABSTRACT

The Mediterranean basin is a global hotspot of biodiversity. Woody plants are key components of ecosystems. This article explores the environmental impacts on woody plant species richness and diversity in maquis and abandoned olive groves in an important ecological area of central Greece. The results showed that woody plant species richness and diversity had increasing values in maquis compared to abandoned olive groves. According to Principal Component Analysis, woody plant species richness and diversity (Shannon diversity index) were positively correlated with soil organic matter, plant litter, N, P, K, slope and precipitation in maquis. Also, positive correlations among woody plant species richness and diversity, and soil organic matter, and slope were detected in abandoned olive groves. Conclusively, the present study is the first in the area and the results it will be utilized as a decision support tool for sustainability assessment of ecosystems with the help of the information systems.

## KEYWORDS

Abandoned Olive Groves, Biodiversity, Canoco, Distribution Pattern, Environment, Information Systems, Maquis, Principal Component Analysis

## 1. INTRODUCTION

The Mediterranean basin region is a global hotspot of biodiversity and presents a wide diversity of habitats and ecosystems. Biodiversity is a widely used term in ecology and natural resource management, and it is a key item in nature conservation (Do et al., 2015; Feroz et al., 2016).

Greece is distinguished for its rich flora. The country is geographically located in SE Europe and occupies the southern tip of the Balkan Peninsula (the farthest east of the three peninsulas of Europe), which, unlike the other two, doesn't have the very high mountains separating it from the rest of Europe. It is an inland country with a large number of islands and is close to Asia and Africa. Also, it contains a variety of climatic conditions (29 climatic classes according to the Thornwaite classification scheme), a fact attributable to its geographic location, terrain ruggedness and the presence

DOI: 10.4018/IJAEIS.2019010101

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of the sea. The vascular plants of Greece include 5758 species and 1970 subspecies, representing 6620 taxa, belonging to 1073 genera and 185 families. Many of these plant species are endemic, as a result to the location and the particular climatic, geological and topographical conditions (Dimopoulos et al., 2013).

Land abandonment constitutes a characteristic element of people's dynamic relationship with natural ecosystems. In the Mediterranean region, which has undergone anthropogenic intervention for thousands of years (Kosmas et al., 2000), there has been dramatic abandonment of traditional land uses, agriculture and livestock farming over the past decades. Land abandonment may be due to natural causes or socio-economic factors (Lambin & Meyfroidt, 2010). Due to the dramatic decline in land productivity over the last decades, areas that have been introduced into cultivation in the past century are increasingly being abandoned (Karakosta, 2012; Kosmas et al., 2000).

According to Lambin & Meyfroidt (2010), socio-economic causes seem to be the most important cause of land abandonment. Naveh & Kutiel (1989), Lepart & Debussche (1992) and Cramer et al. (2007) refer that the environmental and socio-economic changes of recent decades have led to dramatic abandonment of the countryside resulting in the abandonment of cultivated land throughout the world. The abandonment of land is due to socio-economic factors that force the rural population to move from the countryside to large urban centers (Macdonald et al., 2000; Bonet & Pausas, 2004; Papanastasis, 2008; Karakosta, 2012).

MacDonald et al. (2000) report that the abandonment of agricultural land is due to a lack of profit in agricultural activity, the inability to adapt to new farming practices due to the small agricultural pieces of land and the natural aging of the active agricultural population. Several studies (Lavorel et al., 1998; Lavorel et al., 1999; McIntyre et al., 1999) point out that the estimation of the effects of external factors on vegetation, such as abandonment, can be investigated with the assistance of plant functional groups.

Woody plant species are among the most important components of terrestrial ecosystems (e.g. maquis and abandoned olive groves) and affect the overall composition of their communities and environment (Paganová & Jureková, 2012; Solomou & Sfougaris, 2015). Especially, they offer food such as leaves, flowers, pollen, nectar, seeds, and fruit which are important for the wildlife diets (Solomou & Sfougaris, 2015). In addition, woody plant species diversity is fundamental to the overall natural ecosystems biodiversity, because woody plants provide habitats for almost all other species (Feroz et al., 2016). Also, structural diversity measured as variation across a vertical stand profile appears to be a good ecological indicator of the conservation of woody species diversity (Feroz et al., 2016; Neumann & Starlinger, 2001).

The main aims of the present study are to provide primary information on: a) woody plant composition and diversity in maquis and abandoned olive groves, an important area with high conservation value and b) environmental impacts on woody plant species richness and diversity (Shannon diversity index) so as to generate data that would be used in the future management of these ecosystems.

## **2. MATERIALS AND METHODS**

### **2.1. Study Area**

The study was conducted in 2009 on 10 maquis (M1-M10), a shrubland biome in the Mediterranean region, and 10 abandoned olive groves (A1-A10) in western Magnesia Prefecture of Central Greece (Figure 1). The Magnesia Prefecture is located in the south-eastern part of Thessaly and consists of a continental section, the islands of Northern Sporades, as well as some uninhabited smaller islands and rocky islets. It has a total area of 2.638 km<sup>2</sup>. Bordering from the south with the Fthiotida Prefecture, NW with the Larissa Prefecture, east with the Aegean Sea and SE with the Pagasitic Gulf. A large part of the county is mountainous (45%).

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