Vascular Plants of Oiti and Parnassos National Parks of Greece, as Important Components of Biodiversity and Touring Experiences

Abstract. National Parks represent natural ecosystems whose biodiversity endows them not only with spectacular ecological and scientific value but also with a rich aesthetic and cultural value. Other apparent benefits of National Parks are in their potential for biodiversity conservation and in their appeal to visitors and tourism, and particularly the kind that is concerned with learning about nature and the environment. In this paper, we present the work being done for the AdVENt project, which focuses on researching a particular region of the Parnassos and Oiti National Parks in Greece, with a remarkably diverse endemic flora, and in developing innovative applications in order to enhance the tourism experience in protected areas of particular environmental interest. AdVENt aims to provide technologically advanced multimedia solutions and high quality content, highlighting the natural beauty of the region.

Keywords: Vascular plants, National Parks, Natura 2000, Augmented Reality, Mobile Apps.

1 Introduction

Mediterranean Basin is one of the 18 biodiversity hotspots worldwide and presents a high geomorphological and climatic heterogeneity (Blondel and Aronson, 1999). Its flora includes approx. 25000 plant species or nearly 30000 species and subspecies (Medail, 2008), a fact that renders it the richest among the regions hosting Mediterranean ecosystems. Mediterranean mountains are specifically known for their vast plant diversity and endemism, ideal for biogeographical and biodiversity studies. Greece is an important region of the Mediterranean Basin, being the actual meeting point of three continents, Europe, Asia and Africa (Sainz Ollero, Moreno Saiz 2002; Martin-Brano et al., 2010). It is characterized by a typical Mediterranean climate with mild, humid winters and hot, dry summers. However, differences in natural environment and climate can be found regionally or locally, due to the diverse topography of the country (Hobbs et al., 1995). A large variety of Mediterranean habitats included in the reference list of the Natura 2000 initiative exist in Greece. They host a spectacular biodiversity, fortunately well protected, within a large network of protected areas that includes, among others, the Greek National Parks. The latter are natural areas that usually present a vast amount of ecological, aesthetic, cultural, educational and scientific values. Their potential for conservation is significant and they attract a large number of visitors who want to experience nature.
The vascular flora of Greece includes 5758 species and 1970 subspecies (native and naturalized), representing 6620 taxa, belonging to 1073 genera and 185 families (Dimopoulos et al., 2013, 2016). The endemic vascular flora of Greece includes 1459 taxa (22% of the total number of taxa in Greece), which correspond to 1274 endemic

species (22,1% of the total number of Greek species) and 450 endemic subspecies (22,8 % of the total number of Greek subspecies) (Dimopoulos et al., 2013, 2016).

Recently, a project titled "Augmented Visitor Experience in National Parks" (AdVENt), co-funded by the European Union and the Greek National Funds, begun in 2018 for a 3-year period, involving partners from the academia and SMEs, aiming at creating a more direct and representative experience of nature for visitors of the Oiti (or Oeta or Oite) and Parnassos (or Parnassus) National Parks. In the following sections, AdVENt is being briefly described, with a focus mainly on the research work of collecting the data and creating the database for the vascular plants of the region.

2 Study area of AdVENt

The AdVENt project covers certain mountainous areas of the geographic region of central Stereá Elláda (or Continental/Central Greece), i.e., the National Parks of Oiti and Parnassos (Figs. 1, 2). In these National Parks, visitors can find ample natural and cultural treasures and options for various outdoors activities: hiking trails, dense fir forests, endemic and rare plant species, landscapes of special natural beauty and of course, historical and archaeological sites (Delphi) and popular winter sport destinations (Parnassos ski resort).

More specifically, Mt Oiti known as the mountain of flowers and of the legendary hero Hercules, is a mountain of unique beauty, with vast fir forests, rare, as well as impressive, plant species and rich fauna, with waters being abundant and flowing ceaselessly throughout the seasons, through steep and beautiful gorges. It is the fifth highest mountain in Central Greece and its highest peak is Pyrgos (2152 m) (Management Body of Oiti National Park, Sperchios Valley and Maliakos Gulf, 2019).

Also, Mt. Parnassos presents spectacular geomorphological structures, steep cliffs, rocky areas and caves. Its main element, limestone (76.6%), aided in creating particularly impressive formations, such as the sinkhole of Lilaia and the Corycian Cave, renowned for their beauty. Parnassos National Park together with the National Park of Olympus are the two oldest National Parks in Greece. Parnassos is characterized by the great wealth of flora, i.e. rare black pines and cedars, wild peonies and mountain tea, and fauna, such as grey wolves, wild boars, ferrets, foxes, vultures, hawks and reptiles. Special mention should be made to the enormous cultural-historical value of the place, where the Sanctuary of Apollo and the Oracle of Delphi are situated, unique ancient archaeological sites (Management Body of Parnassos National Park 2019).

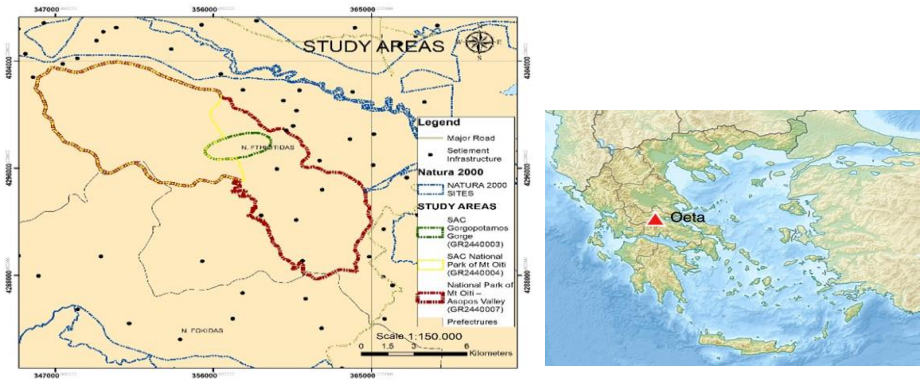

Figure 1. Map of Oiti (Oeta) National Park.

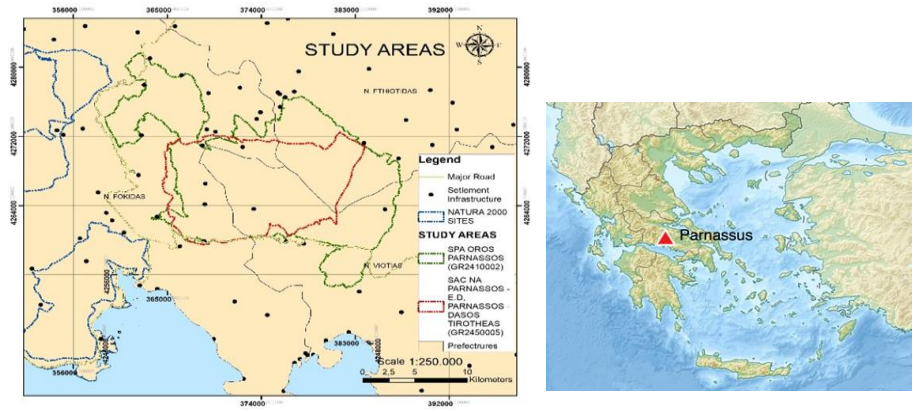

Figure 2. Map of Parnassos (Parnassus) National Park.

Furthermore, the two sites, i.e. Mt Oiti and Mt Parnassos belong to the Sub-Humid (SH) and Humid (H) climatic zones, respectively, according to Climatic Zone Classification of UNEP (1992), which is based on the Thornthwaite's Aridity Index, AI (Thornthwaite, 1948, Thornthwaite and Mather, 1955). More specifically, in Mt Oiti the available data from Agathonos Monastery meteorological station (38º 52' 2'' N, 22º 12' 16'' E, alt. 533 m), established by the Institute of Mediterranean & Forest Ecosystems, covering the time period 1994-2004 indicate that the annual average air temperature is 13.7ºC, with seasonally variation between 5.5ºC in winter and 23.5ºC in summer, presenting intermediate values during the transitional seasons of spring and autumn (11.4 and 14.3ºC, respectively). The annual precipitation is 790.2mm, occurring mainly in winter (336.1mm) and spring (201.9mm) and presenting diminished values in summer (59.0mm). From the long term available data of the nearby, though altitudinal lower meteorological station of Lamia (38.9º N, 22.4º E, alt. 144 m), established by the Hellenic National Meteorological Service (HNMS), Tsiros et al. (2020) estimated the values of the AI since the beginning of the century

and found a value of 0.64 (SH climate zone) for the latest climatic period (1960-1997), while the previous periods the AI values were increased, i.e. 0.75 for the climatic period 1930-1960 (H climate) and 0.69 for the climatic period 1900-1930 (H climate), indicating that the climate in the region became drier during the last decades. In Mt. Parnassos, the nearest meteorological station was installed in Arachova (38.47° N, 22.57° E, alt. 950 m) by the HNMS. From the available data of the period 1976-1997, the annual average temperature in the region is 13.2°C, seasonally ranging from 5.0°C in winter to 22.3°C in summer. The annual precipitation is 501mm, unevenly distributed among seasons, occurring mainly in winter (191mm) and autumn (150mm) and less in spring (114mm) and summer (45mm). The AI values is 0.66 (Tsiros et al., 2020), corresponding to the H climate zone (UNEP, 1992).

3 Objectives of AdVENt

As stated in the previous sections, the National Parks of Oiti and Parnassos are the regions of interest in project AdVENt, since they host a remarkably diverse flora, fauna and landscapes.

The main objectives of AdVENt are: (a) the research on the flora of the region and the creation of a vascular plant database of the Oiti and Parnassos National Parks, available to the scientific community and the general public, which is expected to promote research in the relevant fields of botany, ecology etc.; (b) the digitization in 2D, 3D and 360o of selected natural and cultural treasures of the region to create stunning new digital content for the presentation and promotion of the region; (c) the development of an integrated Augmented Reality (AR) mobile application to enrich the tourist experience, particularly customized for the accommodation of mountaineering & hiking; (d) the research and development of a sophisticated technology and mobile application for the visual recognition/identification of plant species of the region of interest. Overall, AdVENt aims at promoting enriching and generally enhancing the visibility and competitiveness of the local tourism product (Fig. 3).

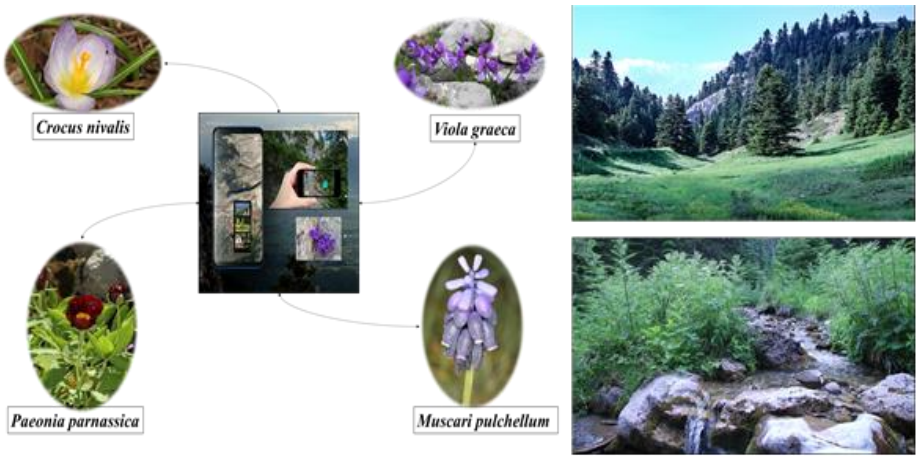

Figure 3. Visual identification of vascular plant species.

4 Database of vascular plant of the Oiti and Parnassos National Parks

The vascular plant database of the Oiti and Parnassos National Parks was mainly created for touristic purposes, but its educational and scientific use has also been taken into consideration. Plants growing along the main pathways of the two National Parks have been mainly targeted, supplemented by the vast majority of plant species distributed above 1000 m. Species distribution data in the study areas were extracted from Strid, (1986), Strid & Tan (1991, 1997, 2003), and Karetsos (2002). Plant nomenclature follows Dimopoulos et al. (2016).

The database includes 819 plant taxa (species and subspecies); 673 taxa are distributed in Parnassos National Park and 586 in Oiti. The most diverse plant families are Asteraceae (85 taxa) and Fabaceae (74). The endemic floristic element is represented by 109 taxa, among them several rare and threatened species, as well as seven local endemics. The flora of the area also includes numerous socio-economically important plants, like medicinal plants and crop wild relatives, introducing the visitors to the high value of the native flora as highly significant phytogenetic resources.

In more detail, the plant database contains the following information of plants species:

Field name	Field description
Group	Group name of plant
Genus	Genus name of plant
Family	Family name of plant
Taxon	Species/subspecies name of plant
Author's name	Authors referencing the plant
Scientific name	Scientific name of the plant
Common name	Common name of the plant
National extinction risk	National extinction risk for the plant
Global extinction risk	Global extinction risk for the plant
Status	Status of the plant (range-restricted/alien)
Endemic	Range-restricted characterization of plant
Crop wild relative	Crop wild relative of plant
Medicinal	Medicinal use of the plant
Floristic regions of Greece	Floristic regions of Greece where the plant can be found
Life-form categories	Life-form categories of plant
Habitat categories	Habitat categories of plant
Range-restricted taxa and native and non-native (alien) taxa	Range-restricted taxa and native and non-native (alien) taxa of plant
Blossom	Blossom period starting and ending
Description of ecology	General description of plant
Folklore-historical information-uses	Folklore-historical information-uses of plant
References	Bibliography for plant

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