

What's new in a deciduous oak forest? The path of biodiversity in the Balkan Botanic Garden of Kroussia, N Greece

Krigas N.* & Vergou A.** , Maloupa E.

Balkan Botanic Garden of Kroussia, National Agriculture Research Foundation,
Thermi, Greece

* Departement of Botany, Aristotle University of Thessaloniki, Greece

** Royal Botanic Gardens, Kew, UK

Introduction

The Balkan Botanic Garden of Kroussia (BBGK), N Greece is situated near the mountain village Pontokerasia (Kilkis Prefecture), at 600m of altitude (Mt Mavrovouni), c. 70km from the Thessaloniki, the second bigger city of Greece (Fig. 1). BBGK was founded in 2001 as an initiative of the National Agricultural Research Foundation of Greece (NAGREF) and covers an area of 31 ha. Nowadays is an active member in Botanic Garden Conservation International (BGCI), and leads the efforts towards the establishment of a national network of botanic gardens in Greece.

In BBGK, an area of 16ha is dedicated to the *ex situ* conservation of rare, threatened and/or endemic plants collected from the wild in Greece, while 15ha are dedicated to the *in situ* conservation of the wild growing plants of a deciduous oak forest dominated by *Quercus frainetto* and *Q. pubescens* (Fig. 1).

BBGK's environmental activities are planned in order to: (i) present and acquaint the people with the wild growing native plants of Greece and/or the Balkans in organized thematic displays, (ii) promote the ecological knowledge about different plant species, their properties and significance, (iii) develop observation skills of the visitors and understanding for the identification of different groups of plants, and (iv) help in the raising of environmental awareness.

Methodology

A curved path of c. 500m has been created in the natural deciduous oak forest of BBGK (Fig. 5), covering a walking distance from the main entrance of the garden till the semi-natural pond rest area (Fig. 1). Along this path (i) different habitat types have been identified and (ii) populations of different plant species have been localized and numerous herbarium specimens have been collected.

All plant specimens have been taxonomically identified according to Tutin et al. (1968-1980, 1993). Labeling of plant populations have been made evident with plastic or metal identity tags. Each tag included information on plant family, scientific and common name(s) and plant's distribution area (Fig. 2, 7).

Along the path of biodiversity, a number of spots characterized by easy access, openness, relative safety and vicinity to areas of special interest have been selected for field work activities. In these spots plant identification sheets (scanned plant individuals, with notes) have been organized for the spring flowering species.

Regarding the environmental activities organized along the path, experiential conservation actions, environmental games, environmental trail and field work have been selected as main educational techniques, with an emphasis in cooperative and empirical learning (Willison & Greene 1994, Georgopoulos & Tsaliki

2002); such techniques are currently used in programs of Environmental Education Centres of Greece (Flogaiti & Vasala 2003, Stylianiou 2005).

Results and discussion

The taxonomic identification of the herbarium specimens revealed the occurrence of 198 plant taxa (species and subspecies) along the path of biodiversity, including 12 trees, 11 shrubs and 175 perennial and/or annual herbs. All distinctive populations with numerous plant individuals were selected and labeled, while isolated plant individuals were not. In total,

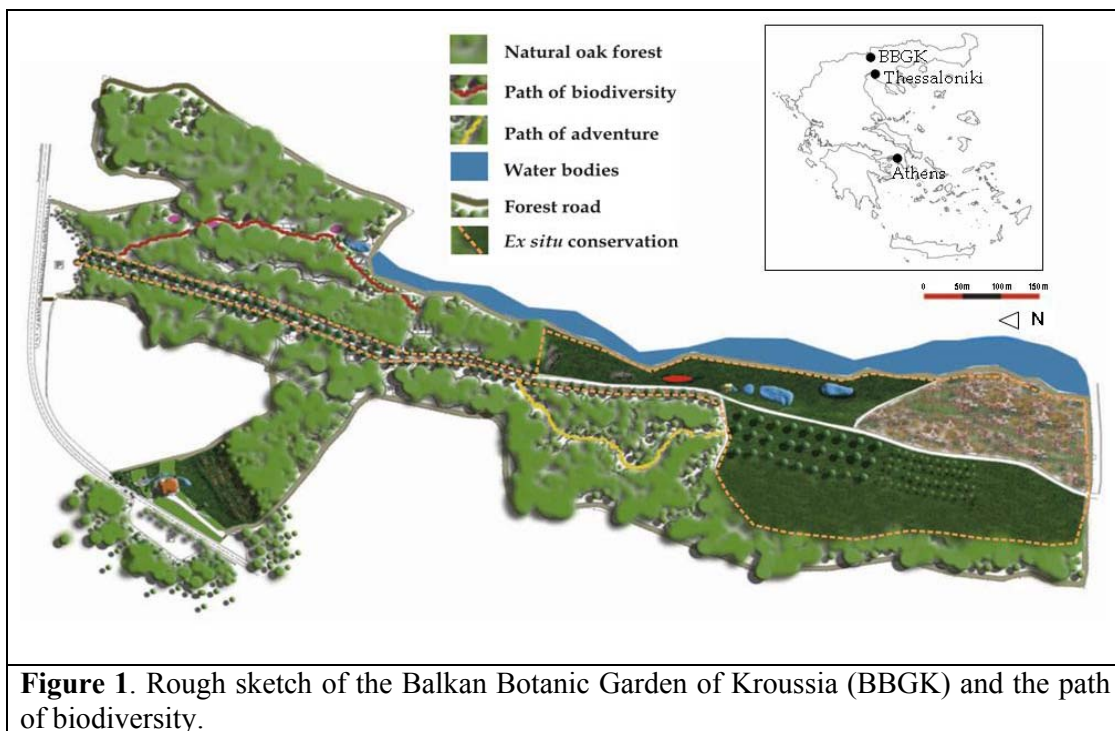


Figure 1. Rough sketch of the Balkan Botanic Garden of Kroussia (BBGK) and the path of biodiversity.

populations of 126 wild growing plant taxa have been labeled with about 500 identity tags (Fig. 2, 7), including four main categories of plants: (i) medicinal plants (e.g. *Anthemis tinctoria*, *Achillea chrysocoma*, *Cistus creticus*, *Crataegus monogyna*, *Juniperus oxycedrus*, *Lysimachia vulgaris*, *Salix alba*, *Teucrium chamaedrys*, *Tussilago farfara*, *Vitex agnus-castus*, etc.), (ii) woodland species (e.g. *Brachypodium sylvaticum*, *Fraxinus ornus*, *Lathyrus laxiflorus*, *Lonicera etrusca*, *L. caprifolium*, *Ruscus aculeatus*, *Veronica chamaedrys* etc.), (iii) Greek and/or Balkan endemic plants, e.g. *Centaurea pallidior*, *Campanula scutellata*, *Dianthus corymbosus* (Fig. 2), *Digitalis lanata*, *Genista carinalis*, *Jasione heldreichii*, *Knautia macedonica*, etc.), and (iv) orchids protected by national and/or international legislation (e.g. *Cephalanthera longifolia*, *Dactylorhiza sambucina*, *Epipactis helleborine*, *Ophrys sphegodes*, *Orchis morio*, *O. papilionacea*, *Serapias vomeracea*, *Spiranthes spiralis*, etc.).



Figure 2. Identity tag of the Greek endemic *Dianthus corymbosus* in BBGK.

The path of biodiversity (Fig. 5) consists of a trail that meets different habitat types of the oak forest (deciduous oak forest, openings in oak forest, grasslands, rocky places, streams with seasonal flow, semi-natural pond, and forest roads). The path of biodiversity looks differently according to seasonal changes. With the peak flowering in spring, it provides the visitor with the opportunity to realize the changes of biodiversity in time as well as in space.

The environmental activities organized along the path of biodiversity of BBGK include:



Figure 3. Delimitation of wild populations of rare, threatened and/or endemic plant species in BBGK.

A. Experiential conservation actions: During a pilot program with students of primary education of the Kilkis and Thessaloniki Prefectures, several populations of orchids and/or endemic plant species have been demarcated with wood timbers of c. 50cm high. The populations were delimited *in situ*, wood timbers were tied around with red ribbons, and on white ribbons the scientific and common name of the plants was indicated (Fig. 3). All wild orchid populations were demarcated by students in order to protect them from trampling of ignorant visitors resulting in plant biomass damages. All delimited conservation areas have been mapped (20 areas).



Figure 4. Scene from the blind guess environmental game sensing flower shape and arrangement of *Dactylorhiza sambucina* at BBGK.

B. Environmental Games. *Food-chains and webs in the oak forest:* the students representing different organisms of the forest interconnected in chains and webs and the instructor trying to threaten or move one or many of them. *Plant mix cocktail:* identification and distinction of different plant smells. *Blind guess:* in groups of students, sensing of plant habits, texture and shape of leaves, fruits and/or flowers with covered eyes, verification and finding of the same plant with open eyes (Fig. 4). *Orchestra of the oak forest:* distinction and identification of different sounds in the forest, in groups of students with closed eyes.

C. Environmental Trail: a scenario to follow, among selected spots of interest, with maps, equipment, guidelines, questions to be addressed e.g. *age and height estimation of trees* (Fig. 6, 7), *identification of different plant species or plant traits in different spots* (Fig. 9), and clues to discover in order to reach the hidden treasure (*identification and localization of the hidden treasure*, Fig. 8).

D. Field work–Introduction to the methodological approach (Fig. 9). *Research question:* Does the opening of the path have an impact on plant diversity of the forest? *Hypotheses to test:* Along the path in comparison to the area surrounding it, occur (i) fewer plant species, (ii) more plant species, (iii) different plant species, (iv) differences in the abundance of certain species. *Research area:* The path, and the area surrounding it. *Variables to investigate:* Numbers, composition and abundance of plant species. *Material and methods:* Map, selection of spots, plant identification sheets, data collection sheets, recording quadrats, abundance classes. *Data processing-Results:* Comparison tables of plant species and abundances for different spots. *Discussion-Conclusions:* Verification or rejection of the hypotheses tested with the method selected.



Figure 5. The path of biodiversity (Fig. 5) consists of a trail that meets different habitat types of the oak forest

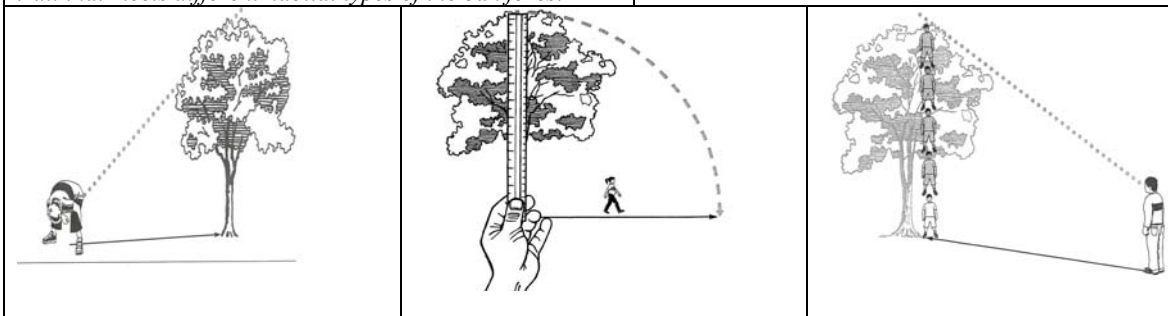


Figure 6. Different ways of height estimation of trees used in environmental activities of BBGK.



Figure 7. Age estimation of tree trunks in BBGK.



Figure 8. Identity tag of a hidden treasure (*Juniperus ocycedrus*).



Figure 9. Autumn field work on the assessment of the diversity of plant species in 1m² quadrats with identification sheets at BBGK

Up till now, about 3,000 people, including c. 500 students of primary and secondary education, have walked and/or experienced environmental activities along the path of biodiversity in the oak forest of BBGK. The environmental activities organized by BBGK along the path of biodiversity have taken into account: (i) the aims and scopes of the environmental education (Georgopoulos & Tsaliki 2002, Pirovetsi 2004), (ii) the current pedagogic approaches (Kalaitzidis & Ouzounis 2000) and (iii) the guidelines of environmental education strategic development in botanic gardens (Willison & Greene 1994). At the same time the environmental activities of BBGK aim to incorporating new ideas of experiencing the nature in the wild as an arcadia, a resource, and a lifeworld (van Koppen 2000).

References

- Georgopoulos, A. & Tsaliki, E. 2002. Environmental Education: principles, philosophy, methodology, games and activities. Publ. Gutenberg, Athens (in Greek).
- Kalaitzidis, D. & Ouzounis, K. 2000. Environmental education: theory and application. Publ. Spanidi, Xanthi (in Greek).
- Pyrovetsi, M. 2004. Principles and targets at the design and the development of educational material for the environmental education. *For the Environmental Education* 32: 5-8 (in Greek).
- Stylianou, L. 2005. Program of environmental education for children of preschool age "The achievements of a dewdrop". 2nd Panhellenic Symposium of the Greek Society-Board of Environmental Education & University of Piraeus "Inspiration, contemplation and fantasy in environmental education, Peireus (in Greek, proceedings in CD).
- Tutin, T.G., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A. (eds.). 1968-1980. *Flora Europaea* 2-5. Cambridge.
- Tutin, T.G., Burges, N.A., Chuter, A.O., Edmonson, J.R., Heywood, V.H., Moore, D.M., Walters, S.M. & Webb, D.A. (eds.). 1993. *Flora Europaea*, ed. 2nd, 1. Cambridge.
- Flogaiti, E. & Vasala, P., 2003. "The world of sea": a package of environmental educational material. Proceedings of the Panhellenic Symposium of the Greek society for the protection of nature and cultural heritage & University of Piraeus "Design and production of educational material for the environmental education": 201-214. Publ. Livani, Athens (in Greek).
- Van Koppen, C. S. A., 2000. Resource, arcadia and lifeworld: nature concepts in environmental sociology. *Sociologia Ruralis* 40(3): 300-318.
- Willison, J. & Greene, J., 1994. Environmental Education in Botanic Gardens: guidelines for developing individual strategies. BGCI, Surrey.