Under the shadow of a big plane tree: Why Platanus orientalis should be considered an archaeophyte in Italy

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Published online: 22 Jan 2015.


To link to this article: http://dx.doi.org/10.1080/11263504.2014.998312

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ORIGINAL ARTICLE

Under the shadow of a big plane tree: Why *Platanus orientalis* should be considered an archaeophyte in Italy

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Abstract

In Italy, *Platanus orientalis* L. is judged as an endangered species by some authors and non-native by others: these contrasting assessments can mislead the prioritization of management actions to preserve the species and the riparian vegetation that is its host. Based on a multidisciplinary approach, including palaeobotanical and ecological information, we assessed its status in Italy including the ecological and conservation value of the riparian plant communities hosting it in the Cilento National Park (S-Italy). Palaeobotanical data showed that *P. orientalis* in Italy should be considered an archaeophyte. According to the ecological assessment of the riparian plant communities hosting *P. orientalis*, the presence of the species can be interpreted as an indicator of an unfavourable state for the conservation of riparian vegetation. Knowing the status of a species remains one of the first steps to take to correctly propose scientifically based solutions for the conservation of plant diversity. However, there are no absolute criteria for conservation because all conservation objectives can be considered as cultural values. In this context, *P. orientalis* should be protected as a symbolic tree, an archaeophyte testifying an ancient common Mediterranean cultural heritage, worthy of preservation but outside of natural habitats.

Keywords: Habitats Directive, naturalness, palaeobotany, riparian vegetation

Introduction

At present, Platanaceae is a small family showing a relict distribution in the warm-temperate zone of the Northern Hemisphere, with only one genus and seven species (Friis et al. 2011). All the taxa are wind-pollinated and wind-dispersed.

In the Northern Hemisphere, fossils are conspicuous in several Mid and Late Cretaceous sediments and, until the Early Cenozoic, the family was much more diverse displaying highly distinct morphologies in vegetative and reproductive organs (Tschan et al. 2008; Friis et al. 2011).

*Platanus orientalis* L. (plane tree), a SE European and SW Asiatic floristic element of warm riparian forests, is the only species of Platanaceae which survived in the Old World (e.g. Tutin et al. 1993; Zhiyun et al. 2003). In Italy, at the westernmost limit of its distribution (Conti et al. 2005; Peruzzi & Uzunov 2007; Caruso et al. 2008), *P. orientalis* is considered native in the southern regions (Campania, Calabria, Apulia and Sicily) and alien in all the other regions. In the inventory of Italian non-native flora (Celesti et al. 2009), the species is not listed, confirming that it is appraised as an indigenous element and not as an archaeophyte. In addition, in Italy, it is considered as a species of conservation concern and reported as “Endangered” in the recent National Red list (Rossi et al. 2014).

To confirm the importance given to this species at the European level, the habitat hosting *P. orientalis* has been inserted in the Habitats Directive (92C0 Platanus orientalis and Liquidambar orientalis woods) and a specific subtype has been recognized in Italy (44.713 – Sicilian plane tree canyons), characterized by either relict *P. orientalis*-dominated or *P. orientalis*-rich galleries. More recently, in the Italian Manual for habitat interpretation (Biondi et al. 2009), the habitat is reported to be in Calabria and Campania; moreover, the habitat has been proposed as being of...
special interest due to the risk of extinction by anthropogenic pressure.

Nevertheless, the Global IUCN Red list of assessment does not list P. orientalis as indigenous to Italy (World Conservation Monitoring Centre 1998) and several authors in the past have pointed out that the species is doubtfully native to Europe, outside of Eastern Mediterranean regions (e.g. Marchi et al. 2013).

In the Mediterranean area, the presence of P. orientalis is linked not only to ecological and phytogeographical issues but also to an ancient human interest, as attested by classical historical sources of Greek and Roman literature. For example, in Crete the plane tree was related to the Great Mother’s cult and to the myth of Europe (Theophrastus, Historia plantarum, I 9, 5); in Lidia (East Turkey) it was a holy tree (Herodotus, Historiae 7, 31); in the Iliad it has a prophetic role (Iliad II, 307). Moreover, Greek authors often mention the plane tree as a hallowed tree for its pleasant shadow (e.g. the Aesop’s fable “The Travellers and the Plane-Tree”). Plato describes the tree along the Ilisso River (near Athens), under which Phaedrus leads Socrates to discuss an essay (Phaedrus 229–230), thus inventing the prototype of the philosophical scene for the following centuries (Roselli 2012). Athenian philosophers, writers and artists loved to talk under the plane trees along the walk of the Academy (Pliny the Elder, Naturalis Historia 12, 9).

Roman authors (e.g. Ovid, Virgil, Martial, Pliny the Elder, Cicero and Petronius) appreciated this tree for the useful shade provided in gardens but also venerated it as a sort of “genius loci” (Curbera & Galaz 1995). Martial (9.61) reported that Caesar planted a plane tree in Corduba (Spain), imitating Agamemnon and Menelaus when they planted some plane trees before leaving for Troy. After Caesar’s death, the tree was worshipped, which explains the watering with wine described by Martial and also reported by others as Macrobius (Saturnalia 3.13), Ovidio (Remedia amoris 141) and Pliny the Elder (Naturalis Historia 12, 6). Interestingly, Pliny the Elder reported that plane tree was introduced in Italy from a foreign country only for its shade: the tree arrived across the Ionian Sea, around 390 BC, at first in the Tremiti islands at the tomb of Diomedes, then imported to Sicily by Dionysius the Elder (432–367 BC), tyrant of Syracuse (Naturalis Historia 12, 3–7) and in the city of Regin (Reggio Calabria, Italy). Later, the plane tree has been spread to present-day Belgium, where it was subjected to taxation, so that Pliny sarcastically observes that people had to pay a fee for the shadow too.

Within this controversial phytogeographical and cultural framework, we considered it was important for biological conservation to disentangle the status of P. orientalis in Italy using a multidisciplinary approach based on palaeobotanical data which is one of the most reliable method for determining the native status of a species in a given location (Decocq et al. 2004; Preston et al. 2004; van Leeuwen et al. 2005; Froyd & Willis 2008).

The aims of the paper are to understand: (i) whether P. orientalis has to be considered a native species in southern Italy; and (ii) the ecological and conservational value of the riparian plant communities hosting P. orientalis, in order to discuss the rationale for conserving non-native species and the plant communities in which they live.

The contrasting evaluation of the status of the species in Italy, being judged as an endangered species by some authors and non-native by others, can lead to a different evaluation of the conservational value of the relative riparian habitats and consequently can influence the prioritization of management actions. Indeed, in the framework of conservation biology, it is considered crucial to furnish appropriate scientific information to the managers of protected areas so that they may efficiently allocate the scarce resources for conservation and habitat restoration.

Material and methods

Study area

The Cilento National Park (Campania) is one of the widest Italian National Parks, with an area of 178,172 ha. Altitudes range from sea level to Mt. Cervati (1898 m). Two bioclimatic zones are present: the Mediterranean along the coast and hills, and the Temperate zones prevailing in the mountain and inner areas. Precipitation varies from 730 to 1700 mm year$^{-1}$, depending on altitude, with a peak in winter and a period of aridity in summer. Limestone and silicoclastic substrata of “Flysch of the Cilento” dominate, in the latter the main river basins (Alento, Calore, Mingardo and Bussento) are established. Olive orchards and sclerophyllous Mediterranean vegetation prevail along the coast, whereas forest landscapes dominate in the inner area (mainly represented by Quercus cerris or Fagus sylvatica woods) with a non-negligible amount of riparian forest dominated by Salix alba, Populus nigra, P. alba and Alnus glutinosa. Detaile analyses of forest vegetation can be found in Corbetta et al. (2004), Rosati et al. (2010) and Fasce et al. (2013).

Palaeobotanical data

Among the data concerning the presence of Platanus in Europe in the past, the focus is on the presence of and past distribution of P. orientalis in the Mediterra-
nean basin and in Italy (e.g. Bertini & Martinetto 2008; Tschan et al. 2008; Moser et al. 2013). We also used The European Pollen Database (www.europeanpollendatabase.net) to check sporadic plane pollen.

Current species and habitat distribution in Campania

To describe qualitative and quantitative features of *P. orientalis* vegetation in the Cilento region, we referred to a large database regarding the vegetation of Cilento National Park (Rosati et al. 2012) that contains approximately 2300 phytosociological relevés that are now migrating to the on-line database VEGITALY (Gigante et al. 2012). Current *P. orientalis* distribution in Cilento National Park was inferred from data collected for the project “Riparian vegetation analyses and mapping” (Lapenna et al. 2014), funded by Cilento National Park. Habitats were identified according to the Italian Manual for habitat interpretation (Biondi et al. 2009). The taxonomic nomenclature follows Conti et al. (2005); alien taxa status (except *P. orientalis*) refers to Celesti et al. (2009); attribution of species to syntaxa and vegetation classification are according to Rivas-Martinez et al. (2002) and more recent specific literature (e.g. Poldini et al. 2011).

Data analyses

Limited to actual habitat and species distribution of Cilento National Park, we evaluated the conservation value of *P. orientalis* stands compared to the other riparian vegetation forests found in the Cilento region. This data-set was stratified according to land units, identified using an ecological land classification approach (Blasi et al. 2000). Vegetation classification of riparian forests was performed using the modified divisive method TWINSPAN; we set four pseudo-species cut levels (0%, 5%, 25% and 50%) and total inertia as measures of heterogeneity. The analyses were implemented in JUICE 7.0 (Tichy 2002).

To assess the ecological and conservational value of the riparian plant communities hosting *P. orientalis*, we calculated at plot level and at community level six indicators: species richness, number of species of conservation concern (C), number of alien species (A), number of riparian forest species (R), number of nitrophilous/ruderal species (N) and evenness. The use of these indicators complies with the approach used for the ecological and environmental evaluation of habitat quality in the framework of Natura 2000 network (e.g. Poldini et al. 2007; Aguiar & Ferreira 2013). To sum up the results in a single index, we used a combination of the indicators, according to the following formula

\[ \text{IN} = (C + R) - (A + N) \]

that can be considered as an index of naturalness. Differences among main types of riparian forest communities were tested by means of ANOVA and Tukey contrasts.

Results

Palaeobotanical data: An overview of the past presence of *Platanus* in Europe

The Platanaceae family has an excellent fossil record dating back to the Early Cretaceous in Europe. The most ancient *Platanus* fossils (leaf and reproductive structure) were discovered in Germany (Tschan et al. 2008). Macrofossils belonging to several species of *Platanus* were found in the Tertiary of several European countries, e.g. *P. neptuni* from the Palaeocene/Eocene of Scotland, from Eocene of Germany and Czech Republic and from the Oligocene of Germany (Kvaček 2010), Serbia (Djordjević-Milutinović & Dulić 2009) and Greece (Velitzelos & Gregor 1990; Velitzelos et al. 2014); *P. schimperi* from the Palaeocene of France and England (Kvaček 2010); *P. leucophylla* from upper Miocene and Pliocene of Italy (Martinetto et al. 2007; Bertini & Martinetto 2008) and Greece (Velitzelos et al. 2014); and *P. academicae* from upper Miocene and Pliocene of Greece (Velitzelos et al. 2014).

In the Pleistocene, once the glacial/interglacial cycles became established, thermophilous taxa, very sensitive to abrupt temperature decreases, appear only in the warm interglacial and interstadial periods, showing a discontinuous record in central Europe. In the Mediterranean Europe, various thermophilous taxa still occurred in the Upper Pleistocene. In the Iberian Peninsula (Postigo Mijarra et al. 2007, 2008, 2010), for example, an important group of taxa including *Castanea*, *Carpinus*, *Celtis*, *Fagus*, *Juglans*, and *Platanus* was found, persisting throughout the whole Quaternary, resisting the cold and dry climates of the Lower and Middle Pleistocene. Pollen of *Platanus*, in particular, disappeared only in very recent times reaching, residually, the Holocene. In France, plane pollen was found only sporadically in small quantities in either Pliocene or Early Pleistocene sediments (Gauthier 1992; Argant 2004). Sporadic grains of plane tree were found also in three marine cores in the sediments of the Upper Pleistocene and the first part of the Holocene of the Gulf of Lions (Beaudouin et al. 2005).

In Greece, the presence of plane tree is seen since the Oligocene with *Platanus neptuni* in Evros (NE Greece; Velitzelos, Kvaček, et al. 2002). Some species of *Platanus* dating back to the Upper Miocene were found in Macedonia/Thrace (N Greece) and on Island of Corfu. *Platanus* was also found in several
sites of Pliocene age (Velitzelos & Gregor 1990). Its presence was confirmed by the finding, on the Island of Rhodes, of Pleistocene macrofossils attributed to Platanus lineariloba (syn. P. academicae, Velitzelos, Teodoridis, et al. 2002, 2014) and of Middle Pleistocene pollen in the Tsampika pollen record (Kouli, pers. comm.).

In Italy Platanus leucophylla (Unger), Knobloch leaves occur frequently in the Messinian evaporits (Martinetto et al. 2007; Bertini & Martinetto 2008). This taxon is always accompanied by the same deciduous (e.g. Acer, Alnus, Fagus, Liquidambar, Populus, Pterocarya, Quercus, Salix and Zelkova) and evergreen (e.g. Lauraceae, Engelhardia, Smilax and Trigonobalanopsis) broad-leaved taxa associated with several conifers (Tetraclinis, Taxodium, Sequoia and Pinus). Regarding the Messinian age, pollen ascribed to Platanus was frequently found in Italian sediments (Ghetti et al. 2002; Bertini 2006). It was also frequent in Pliocene sediments, for example, at Stirone in Northern Apennines (Bertini 2001), at Poggio Rosso in the Upper Valdarno basin (Bertini et al. 2010) and at Fosso Bianco in the Tiberino Basin (Pontini & Bertini 2000). Surprisingly, Pleistocene fossils of Platanus are very rare. No traces of plane pollen have been found in the Pleistocene sequences of central Italy, while in southern Italy the presence of plane pollen seems to have been reported only in the Early Pleistocene sites of Saticula (Sant’Agata de’ Goti, Benevento; Russo Ermolli et al. 2010) and Semaforo section (Crotone; Combourieu-Nebout 1995). The plane pollen does not appear in the pollen sequences of the Middle Pleistocene of Italy, even in the sequences from the regions where plane trees currently live (Figure 1). For the Upper Pleistocene, its presence is indicated by Renault-Miskovsky et al. (1984) in Northern Italy (Liguria and Veneto).

Pollen grains of Platanus were never recorded in the Holocene records of Basilicata (Mercuri et al. 2010; Florenzano & Mercuri 2012), Calabria (Canolo Nuovo, Schneider 1985; Lago di Trifoglietti, Joannin et al. 2012) and Sicily (Lago Preola, Calò et al. 2012; Gorgo Basso, Tinner et al. 2009; Lago di Pergusa, Sadori & Narcisi 2001, Sadori et al. 2008, 2013; Biviere di Gela, Noti et al. 2009). The origin of some sporadic founds in Middle Bronze age sites in Northern Italy is under investigation because the plane pollen may be attributable to long-distance transport (Mercuri in verbis).

Figure 1. Current distribution of P. orientalis in Italy and its presence/absence in palaeobotanical records (pollen and macroremains). Main Greek colonies in the study area are shown.
The only recent finds are of Roman age, with findings in Campania concentrated in the area of Naples. Many historical sites show the sporadic but quite continuous presence of *Platanus*. At the Greco-Roman harbour of Neapolis (Russo Ermolli et al. 2014), rare plane pollen has been found since the 1st century BC. The sediments of Lago d’Averno record an important expansion of plane in the Roman age, present, even if sporadic, until 8th century AD (Grüger & Thulin 1998; Grüger et al. 2002). All other finds are from the Vesuvian area, from sites destroyed by the eruption of 79 AD. Charcoals of *P. orientalis* have been recently found by Moser et al. (2013) in the soil of the northern garden of the Villa of Poppea at Oplontis where, previously, Jashemski (1979) had found root cavities, while pollen has often been found in the gardens of the Vesuvian Roman villas (Mariotti Lippi & Mori Secchi 1997; Mariotti Lippi 2000; Mariotti Lippi & Bellini 2006).

The available data from sites covering the Roman age, in sites located north of Naples, did not report plane remains (e.g. Mercuri et al. 2002, 2013). In particular, the Roman harbours of Rome and Pisa, investigated under the archaeobotanical point of view, did not provide any trace of *Platanus* (Mariotti Lippi et al. 2007; Sadori et al. 2010, 2014; Pepe et al. 2013; Goiran et al. 2014).

**The ecological value of the riparian plant communities hosting *P. orientalis* in Cilento region**

Among 87 selected relevés of riparian forest vegetation in the Cilento database, we found 10 relevés with *P. orientalis*, surveyed from 1999 to 2011: the distribution of these stands is limited to two river tributaries of the Alento River (Badolato and Palistro) close to the Greek colonies of Elea (Figure 1).

In the same land unit and river morphology where *P. orientalis* is present, vegetation classification of riparian forests identified three main types: *Salix alba–Populus nigra* community (cf. Rubo ulmifolii–Salicetum albae Allegrezza et al. 2006), lowland *Alnus glutinosa* community (Hyperico hircini–Alnetum glutinosae Gafta & Pedrotti 1995) and montane *Alnus glutinosa* community (Euphorbio corallioidis–Alnetum glutinosae Barbagallo et al. 1982).

According to this vegetation classification, a specific *P. orientalis* type of riparian vegetation based on floristic composition was not identified: most of *P. orientalis* stands are interspersed within the cluster of lowland *Alnus glutinosa* riparian forests (Hyperico hircini–Alnetum glutinosae). This is in contrast with Corbetta et al. (2004) that recognized a specific community for *P. orientalis* stands of Cilento (Petasiti hybridi–Platanetum orientalis). Hence, to allow a comparison of the riparian communities hosting *P. orientalis*, we artificially separated two types of forests: *P. orientalis* riparian forests, where the species is present but not dominant, and *P. orientalis*-dominated riparian forests, where the species cover is more than 50%.

The comparison of indices shows that *P. orientalis* stands have the lower number of characteristic species of riparian forests and the higher number of aliens, nitrophilous and ruderal species. They also have the lower mean values of richness and evenness (Table 1). *Salix alba–Populus nigra* community (S) showed the lowest number of species of conservational concern.

There is a trend of decreasing ecological conservation values from montane *Alnus glutinosa* community (A) to *Salix alba* vegetation (S): the index of naturalness synthesizes it, showing that *P. orientalis* stands have a lower value compared to the others communities, except for *Salix alba* stands. Moreover, the *P. orientalis*-dominated stands show a lower value, suggesting that the more the *P. orientalis*, the worse the ecological value of the stand (Figure 2). However, based on the results of ANOVA and Tukey test, only a few pairwise comparisons were statistically significant (Table 1): the amount of alien species is higher in *P. orientalis* stands than in any other riparian community.

**Discussion and conclusions**

Palaeobotanical data indicate that different species of *Platanus* were present in Europe, relatively widespread in the Pliocene and Pleistocene records of central Europe, Greece, France and Italy. These populations persisted in Spain and France until the early Holocene.

Pollen records of the Near East and Balkan regions show, instead, in recent times, a spreading of *Platanus* from Near East to Greece. In fact, in the former Lake Hula (Israel), *Platanus* pollen is observed during the last glacial period, dating back 20,000 years BP (van Zeist et al. 2009). At Lake Van, in Turkey, traces of plane trees are found dating back about 12,500 years BP (Wick et al. 2003), while the oldest macroremains, dated back to at about 9300 cal. BP, are from the Neolithic site of Çatalhöyük East (Asouti & Hather 2001).

In Greece, after having disappeared hundreds of thousands of years before the Middle Pleistocene, plane tree pollen is present in the pollen diagrams since about 8000 BP, becoming very common since about 4500 BP. The late Holocene spread of *Platanus* in Greece and in its islands has been interpreted as an effect of human action (Bottema & Sarpaky 2003), which is in agreement with classical literature sources.

*Figure 1* 
- Under the shadow of a big plane tree
The palaeobotanical data show the common presence of *Platanus* in Southern Italy only since the Roman period, confirming its introduction for ornamental use as reported by Pliny the Elder, suggested also by representations on wall paintings and mosaics (Jashemski et al. 2002), by leaf impressions (in Stabiae, Jashemski 1979), by pollen (Vesuvian area, e.g. Mariotti Lippi & Bellini 2006).

### Table I. Number of species and diversity indexes of riparian vegetation in Cilento region.

<table>
<thead>
<tr>
<th>Vegetation types</th>
<th>Overall Cilento riparian forests</th>
<th>Montane <em>A. glutinosa</em> forests (A)</th>
<th>Lowland <em>A. glutinosa</em> forests (H)</th>
<th><em>P. orientalis</em> riparian forests (P)</th>
<th><em>P. orientalis</em> dominated riparian forests (Pd)</th>
<th><em>Salix alba</em> forests (S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of plots</td>
<td>87</td>
<td>44</td>
<td>25</td>
<td>6</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Species of conservation concern</td>
<td>Mean 1.74 a</td>
<td>2.63 b</td>
<td>1.04 a</td>
<td>1.00 ab</td>
<td>0.50 ab</td>
<td>0.25 a</td>
</tr>
<tr>
<td>SD</td>
<td>1.64</td>
<td>1.68</td>
<td>1.09</td>
<td>0.63</td>
<td>1.00</td>
<td>0.46</td>
</tr>
<tr>
<td>Species typical of riparian forests</td>
<td>Mean 16.13 a</td>
<td>20.93 c</td>
<td>11.2 b</td>
<td>15.33 abc</td>
<td>8.25 ab</td>
<td>9.75 ab</td>
</tr>
<tr>
<td>SD</td>
<td>7.31</td>
<td>4.61</td>
<td>6.73</td>
<td>5.12</td>
<td>4.99</td>
<td>5.20</td>
</tr>
<tr>
<td>Nitrophilous/ruderal species</td>
<td>Mean 3.44 a</td>
<td>2.93 a</td>
<td>3.24 a</td>
<td>6.17 a</td>
<td>3.25 a</td>
<td>4.87 a</td>
</tr>
<tr>
<td>SD</td>
<td>3.35</td>
<td>1.97</td>
<td>3.14</td>
<td>4.58</td>
<td>4.03</td>
<td>6.93</td>
</tr>
<tr>
<td>Alien species</td>
<td>Mean 0.72 ab</td>
<td>0.34 a</td>
<td>0.60 ab</td>
<td>2.83 c</td>
<td>0.25 ab</td>
<td>1.87 bc</td>
</tr>
<tr>
<td>SD</td>
<td>1.45</td>
<td>0.60</td>
<td>1.00</td>
<td>3.19</td>
<td>0.50</td>
<td>2.53</td>
</tr>
<tr>
<td>Richness</td>
<td>Mean 34.06 a</td>
<td>38.18 a</td>
<td>29.96 a</td>
<td>37.00 a</td>
<td>21.50 a</td>
<td>24.87 a</td>
</tr>
<tr>
<td>SD</td>
<td>13.46</td>
<td>8.29</td>
<td>13.99</td>
<td>18.60</td>
<td>13.89</td>
<td>20.21</td>
</tr>
<tr>
<td>Evenness</td>
<td>Mean 0.73 a</td>
<td>0.74 a</td>
<td>0.69 b</td>
<td>0.76 a</td>
<td>0.71 ab</td>
<td>0.76 a</td>
</tr>
<tr>
<td>SD</td>
<td>0.06</td>
<td>0.03</td>
<td>0.07</td>
<td>0.04</td>
<td>0.01</td>
<td>0.09</td>
</tr>
<tr>
<td>Index of naturalness</td>
<td>Mean 13.72 a</td>
<td>20.29 c</td>
<td>8.40 b</td>
<td>7.33 ab</td>
<td>5.25 ab</td>
<td>3.25 b</td>
</tr>
<tr>
<td>SD</td>
<td>8.86</td>
<td>5.53</td>
<td>5.81</td>
<td>6.83</td>
<td>2.75</td>
<td>7</td>
</tr>
</tbody>
</table>

Notes: The lowest value for each index is shown in bold. Letters (a, b, c) show the differences in pairwise tests in ANOVA analyses.

![Figure 2](image.png)  
Figure 2. Box plot of the index of naturalness of main riparian plant communities of Cilento National Park. A: Montane *A. glutinosa* forests; H: Lowland *A. glutinosa* forests; P: *P. orientalis* riparian forests; Pd: *P. orientalis*-dominated riparian forests; S: *S. alba* forests.
and by charcoals and root cavities (Oplontis, Moser et al. 2013).

Furthermore, the striking coincidence between the present distribution sites of plane trees and the locations of some cities of Magna Grecia (e.g. Elea-Velia in Campania; Megara Hibele, Siracusai, Naxos in Sicily; Kroton, Socalium, Caulonia in Calabria; Figure 1) suggests an introduction in these sites, dating back to the Greek colonization of Southern Italy. This fact is supported by Pliny the Elder reporting that Dionysius the Elder imported the plane tree for the marvel of his palace in Rhegion (Reggio Calabria). In Cilento, the current presence of *P. orientalis* is limited to two rivers, Badolato and Palistro, close to the Greek colonies of Elea-Velia, which was the home of the pre-Socratic school of philosophers founded by Parmenides.

The genus *Platanus*, being wind-pollinated and wind-dispersed, complies with the precondition for the assessment of a native or introduced status of a species, i.e. it produces sufficient and identifiable fossils (such as pollen and fruits; van Leeuwen et al. 2005). However, it should be noted that all the Southern Italy sites, where palynological investigation are available, are far away from the areas where *Platanus* is present today and they do not coincide with Greek and/or Roman settlements. The absence of plane pollen could indicate that this pollen is rare but not surely absent because sporadic presence is usually not reported in pollen diagrams for brevity. However, the scant presence of some pollen may be attributable to some long-distance transport and not to the local plant presence (Mercuri in press).

In the Italian territory, *P. orientalis*, as shown in palaeobotanical data and historical sources, should be considered a non-invasive archaeophyte, in opposition to recent National assessments (Celesti et al. 2009; Rossi et al. 2014).

According to our results on the ecological value of the riparian plant communities hosting *P. orientalis* in Cilento, the presence of the species can be interpreted as an indicator of unfavourable state of conservation of riparian vegetation. The plant community hosting it seemed to be closer, in terms of composition and naturalness, to the *Salix alba* stands that can be found in highly disturbed areas, where the anthropic pressure is higher. *Salix alba* communities are generally considered to be among the most altered habitats due to human pressures and vulnerable to colonization by alien species (e.g. Aguiar & Ferreira 2013). This is particularly important for the practical consequences it implies: local managers need to be informed so that they may decide where and how to invest funds. In Cilento National Park, for the ecological restoration of riparian habitats, we should use as reference coenoses the lowland riparian *Alnus glutinosa* community (*Hyperico hircini–Alnetum glutinosae*) that has to be considered as the Potential Natural Vegetation (sensu Farris et al. 2010) of this habitat, and not the *P. orientalis* stands. Paradoxically, *P. orientalis* seems to have none of the claimed features that are required to be considered as important for conservation, apart from being rare and having a scatter distribution in the Italian territory.

There are no absolute criteria for conservation because all conservation objectives can be considered as cultural values (Froyd & Willis 2008). The archaeophytes are a particularly fascinating group as they constitute “cultural relics”, so in discussing the meaning of their conservation, we might consider a species’ historical value as a reason for its preservation. In this conceptual framework, *P. orientalis* should be protected as a symbolic tree, a vestige of a common Mediterranean cultural heritage connecting the ancient cult of the Eastern Mediterranean people with the sophisticated paintings in the Roman villas in Pompei. Accordingly, it should be cultivated in botanical gardens or used for ornamental purposes in archaeological sites, not in natural habitats.

This study proves that a multidisciplinary approach combining phytosociological, ecological, phytogeographical, palaeobotanical and historical data could help to disentangle conservation questions (Willis & Birks 2006; Froyd & Willis 2008), like the status of a species, whether they are native or introduced (Decocq et al. 2004; Preston et al. 2004; van Leeuwen et al. 2005).

It is true that to efficiently set conservation goals we should focus on the role and ecological function of the species rather than their origin (Davis et al. 2011), but the correct determination of the status of a species remains one of the first steps to correctly propose scientifically based solutions for the conservation of plant diversity.

Acknowledgements

M. Leo improved the English in the manuscript.

Funding

Data gathering on riparian vegetation was supported by the Cilento National Park under the project “Riparian vegetation analyses and mapping”.

References


Lapenna MR, Rosati L, Salerno G, Villani M, Fascetti S, Filesi L. 2014. Landscape planning and biodiversity conservation of...


Tschan GF, Denk T, von Balthazar M. 2008. Credneria and Platanus (Platanaceae) from the Late Cretaceous (Santonian) of Quedlinburg, Germany. Rev Palaeobot Palyno 152: 211–236.


