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Is there a Future for the Isolated Oriental Beech (*Fagus orientalis* Lipsky) Forests in Southern Turkey?

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Abstract – Oriental beech (*Fagus orientalis* Lipsky) is mainly found in the northern region of Turkey. There is also an approximate 40,000 ha of isolated relict oriental beech forest in southern Turkey. This relict population differs somewhat from the northern distribution in terms of average altitudinal distribution, health conditions, and reactions to climate change. Beech forest distribution in southern Turkey starts at about 1000 m, contrary to the northern distribution, which begins at about 150-200 m. In southern Turkey, the average temperature is higher, and summer drought occurs due to irregular rainfall. Beech trees in the south decay at earlier ages due to their sprout origins and higher temperatures than in the north. In recent decades, some part of the beech forests have shed leaves during the summer in response to severe drought. Therefore, these relict populations are on the verge of extinction under unfavorable conditions.

***Fagus orientalis* / Eastern Mediterranean / relict distribution / in situ conservation**

1 INTRODUCTION

Oriental beech (*Fagus orientalis* Lipsky) is one of the major tree species in Turkey. Most of the beech forests are distributed in the northern region of Turkey. In contrast, relict oriental beech forests are distributed in the Eastern Mediterranean region of Turkey, including the Adana, Osmaniye, Hatay, and Kahramanmaraş provinces. Beech trees in this region are coppiced and, therefore, are susceptible to decay at the stump.

It is well known that global climate change strongly impacts plant distribution and survival. It has been determined that the ability of seeds to regenerate is weakened because of the high percentage of empty seeds in the southernmost region of *F. crenata* distribution in Japan, and diameter increment has decreased over the last 50 years due to global warming (Mizunaga et al. 2005). Therefore, it has been postulated that these populations may be replaced by other species. Similarly, some unprecedented features have been observed in the beech forests in southern Anatolia in response to the summer droughts. The vulnerability of these beech forests is significantly different from the remaining distribution.

In the present study, some information is provided about the relict beech forests in the Eastern Mediterennan region, the present conditions and future problems faced by these forests. In addition, the precautions that might be taken against these anticipated negative effects of climate change are discussed in the scope of this study.

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2 BEECH FORESTS IN SOUTHERN TURKEY

There is an approximate 40,000 ha of beech forest in southern Turkey *(Table 1; Figure 1)*, which is about 2.28% of the total beech forest area of the country. The most southerly distribution is found in Hatay region.

Table 1. Beech forests in Southern Turkey (OGM 2006)

Province	Kahramanmaraş	Osmaniye	Hatay	Adana	Total
Area (ha)	5323.6	10256.5	24255.1	165.0	40.000.2

Different from the northern distribution, the beech forests in southern Turkey are located at higher altitudes, which are between 1000-2000 m. In northern Turkey, the levels of the beech forest distribution are at an altitude between 150-200 m.

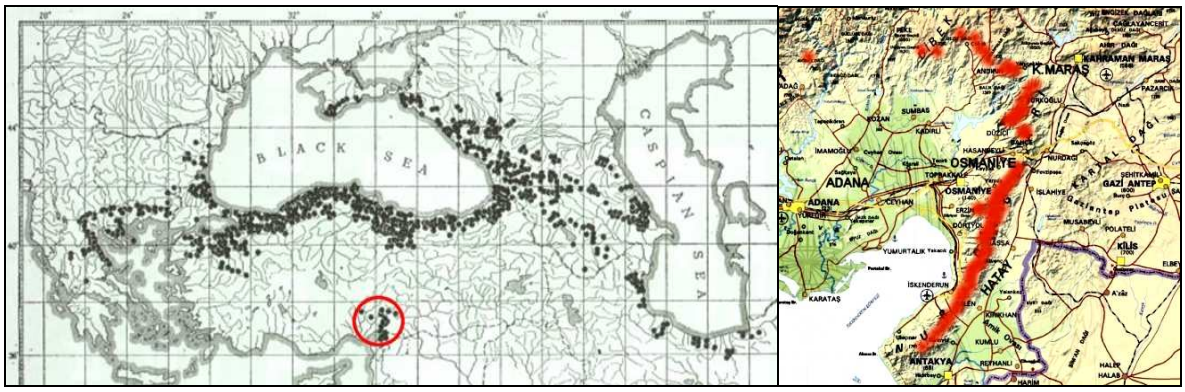

Figure 1. Distribution of the oriental beech and Southern Anatolia populations (Browicz 1982)

3 CHARACTERISTICS OF BEECH FORESTS IN SOUTHERN TURKEY

Relict: The beech forests in southern Turkey are located at a significant distance from the main distribution and are characterized as relict forests and isolated populations. They are very important relict gene sources.

Southern edge distribution: The southernmost distribution of oriental beech in Turkey is found in this region. It represents the southern edge population of the species. Similar to the edge distribution of every plant, these trees are affected by various stress factors.

High altitude: The beech forests in southern Turkey are located at higher altitudes. The distribution of the species in this region is found between 1000 and 2000 m. Lower altitudes in the region are too warm for the beech.

Sprout origin: The beech forests in this region primarily originate from sprouts. They were managed as coppice forests until the 1970s and were used as fuel or industrial wood. These coppice forests were composed of trees of 10–30 cm diameter, with some larger individuals with 50 cm diameter. For many plants, vegetative regeneration provides persistence under extreme conditions (Held 1983; Hara 1987). Similar to the relict beech forests in the Eastern Mediterranean region, coppice regeneration in these edge distributions has contributed to the sustenance of the oriental beech.

4 THE THREATS AND PROBLEMS FACING SOUTHERN OCCURRENCES

Climate change: In this region, a distinctive increase in temperature and evaporation during the last 30 years has been recorded (Karabulut and Coşun 2009; Coşun and Karabulut 2009). These significant increases threaten the edge distribution of oriental beech. Summer droughts in the years 2000 and 2008 in the Düziçi region caused beech trees to shed leaves during the drought. In September, the new leaves flushed in response to rainfall. In Hungary, mortality of beech trees was found in the edge distributions due to droughts as well (Lakatos – Molnar 2009). Similar threats to the beech forests in whole southern Turkey are expected.

Genetic stability: Since the beech forests in this area regenerate by sprouts, they have been genetically identical for centuries. The genetic resources of the populations remain unchanged in terms of time and location. The length of time period of coppice culture in the beech forests of the Eastern Mediterranean region is not known. Vegetatively regenerated forests cannot renew their abilities to adapt to changing conditions (Smith et al. 1997). Regeneration of the forests from seeds is therefore important for the genetic improvement of these valuable beech forests in Southern Turkey.

Core decay: The beech forests originating from sprouts begin to decay from the stump at early ages. Stump decay spreads to the bottom parts of other stump sprouts. The individuals arising from root suckers are unaffected by the decay of the mother tree (Nyland 1996).

Irregular stems: The beech individuals arising from sprouts usually have crooked trunks and are susceptible to wind damage (Cao and Peters 1998) and have low wood quality. On the other hand, the root suckers have straighter stems similar to individuals of seed origin.

Thinning operations: In this region, dense stands composed of young coppiced individuals are often found due to a lack of thinning cuttings in the area. It is sometimes observed that 15-20 sprout-origin trees are found together on the same stump and the individuals with small diameters compete with each other. Because of strong competition for light, long unbalanced trees have small diameters. These conditions weaken the stability of the stand. The thinning operations should not be neglected, and the excess competition in the stands must be prevented to provide suitable conditions for each individual's growth.

Conversion to high forest: Coppicing has not been applied to the beech forests in Turkey in recent decades. The beech forests in both Italy (Nocentini 2009) and France have been converted to high forests since the middle of the 20th century (Bock 2006) and they are expected to regenerate naturally. However, these forests are in need of thinning and seed tree selection before the conversion. Both genetic variability and clonal reproduction should be considered while converting the coppice forests to high forests (Valbuena-Carabana et al. 2008). The seed-originated individuals should be maintained as seed trees. To provide information about seed regeneration, the natural regeneration studies should be started in beech forests between 50-60 years of age (Odabaşı et al. 2004).

5 RESULTS AND SUGGESTIONS

The relict oriental beech forests found in Southern Turkey are important gene resources that represent the marginal distribution of the species. The performance of these local beech forests under the effects of climate change provides important insights into the general behavior of the beech forests. Therefore, changes in the beech forests of this study area should be precisely examined.

The marginal distributions of this species are sensitive to environmental conditions. Today, the impacts of global warming is well known. It is expected that the forests are better adapted to

environmental conditions with improved genetic constitution when they are regenerated from seeds. It is urgent that the marginal distribution of *F. orientalis* must be naturally regenerated using local seed sources to improve its adaption to new environmetal conditions. To begin, natural regeneration should be applied in selected areas in the region. Planting of seedlings produced from local seeds would be worth trying. Local seeds should also be collected and stored for natural regeneration and nursery studies.

Seed production of beech forests is usually low in their marginal distributions (Peters 1997). The number of empty seeds is high in the beech forests of the studied region. After the empty seeds are removed, about 90% of the remaining seeds germinate (Yılmaz 2005). The seeds of this relict population should be collected in the mast year and should be stored under the appropriate conditions (Yılmaz 2008) to be used in nurseries and natural regeneration studies.

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