

Influence of climate variability on radial growth of Oriental beech (*Fagus orientalis*) in the Colchic temperate forest

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Oriental beech (*Fagus orientalis*) is a dominant species of the wetter areas in the mountains that border the southern coast of the Black Sea and the Caspian Sea in North Iran (Figure 1). In Turkey, it grows widely across the Black Sea region, from Demirköy (in west) to Hopa (in east), and locally in some Mediterranean parts of the country such as the Marmara region, Amanos Mountains, Adana-Pos forests, and Kahramanmaraş-Andrın (Yaltırık and Efe, 2000). The distribution of this species occupies a wide elevational gradient, from sea level up to 2100 m (Şanlı, 1978). Oriental beech covers almost 2 million ha of pure and mixed forest area, making it the fourth most abundant forest tree species in Turkey (OGM, 2015).

In this study, we identified the most important climate factors affecting radial growth of Oriental beech in a temperate mesic Colchic forest in the Artvin province, of Northeast of Turkey (Figure 2). We built a new Oriental beech tree-ring chronology at a lower elevation range for the species in Artvin province. We compared this new chronology which spans 319 years (1698-2016) with three previous beech tree-ring chronologies spanning over 450 years (Köse and Güner 2012; Martin-Benito et al. 2016; Martin-Benito et al.; in revision) (Table 1). Using response function analysis, we explored the relationships between tree-ring width and climate (temperature and precipitation) from previous October to current October (duration of the hydrological year). Understanding how an ecologically and economically important species responds to climate variability is key to anticipating potential changes in forest productivity under climate change.

References:

- Martin- Benito, D., Ummenhofer, C.C., Köse, N., Güner, H.T., Pederson, N. (2016) Tree- ring reconstructed May–June precipitation in the Caucasus since 1752 CE. *Climate Dynamics* 47: 3011–3027. DOI 10.1007/s00382-016-3010-1
- Martin-Benito, D., Pederson, N., Köse, N., Doğan, M., Bugmann, H., Mosulishvili, M., Bigler, C. (in revision) Pervasive effects of drought on tree growth across a wide climatic gradient in the temperate forests of the Caucasus.
- Köse, N. and Güner, H.T. (2012) The effect of temperature and precipitation on the intra-annual radial growth of *Fagus orientalis* Lipsky in Artvin, Turkey. *Turkish Journal of Agriculture and Forestry* 36: 501-509, doi:10.3906/tar-1109-4
- OGM (2015) Türkiye Orman Varlığı 2015. T.C. Orman ve Su İşleri Bakanlığı Orman Genel Müdürlüğü, Bulten.
- <https://www.ogm.gov.tr/ekutuphane/Yayinlar/T%C3%BCrkiye%20Orman%20Varl%C4%B1%C4%9F%C4%B1-2016-2017.pdf>. Accessed 06 March 2018.
- Şanlı, İ. (1978) Doğu Kayını (*Fagus orientalis* Lipsky.)’nın Türkiye’de Çeşitli Yörelerde Oluşan Odunları Üzerinde Anatomik Özellikleri, Istanbul University Faculty of Forestry Publications, No: 2410/256, Istanbul.

Yaltırık, F. and Efe, A. (2000) Dendroloji Ders Kitabı, Gymnospermae-Angiospermae, İstanbul University Faculty of Forestry Publications, No: 4265/465, İstanbul.

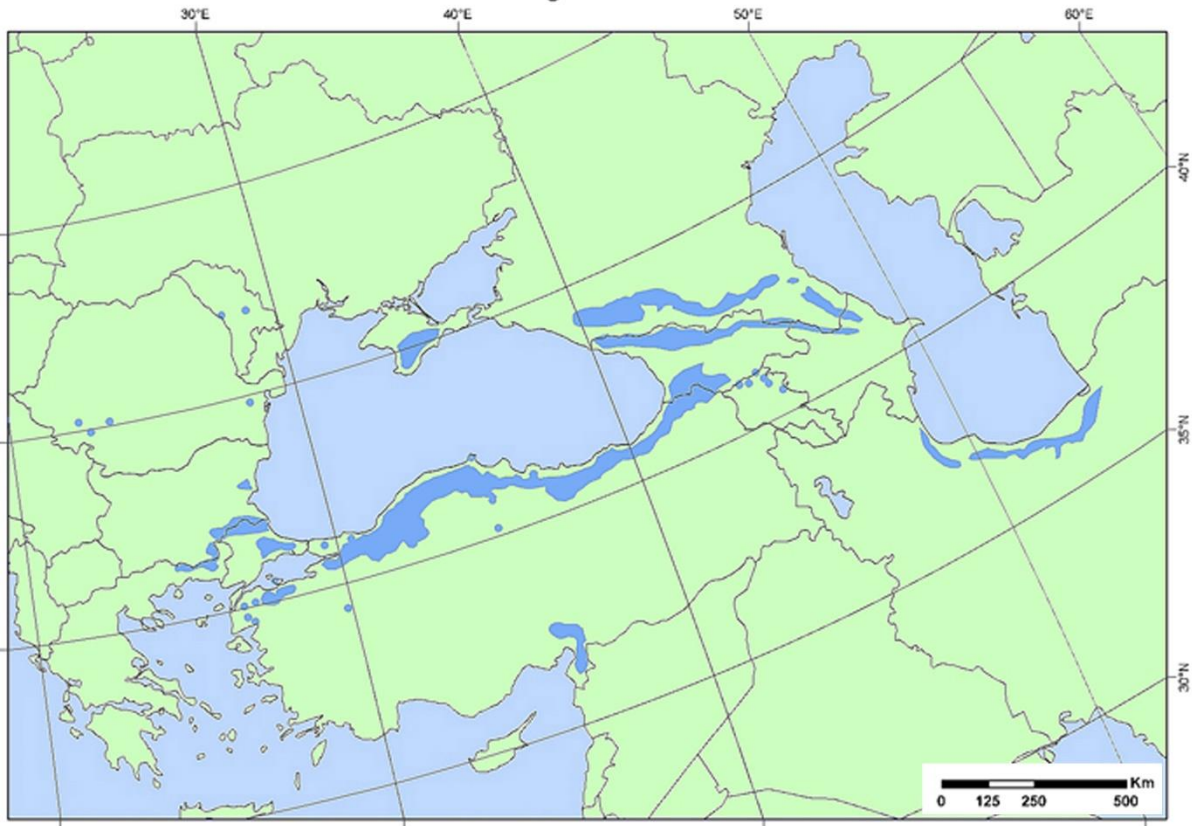


Figure 1: Distribution map of oriental beech (*Fagus orientalis*) EUFORGEN 2009. www.euforgen.org



Figure 2: Location of the study area.

Table 1. Site information and summary statistics for site chronologies.

| Site name | Site code | Province | Species | No. of trees/ cores | Time span | Elevation (m asl) | Latitude (N) | Longitude (E) |
|------------------|-----------|----------|-------------------------|------------------------|--------------|-------------------|--------------|---------------|
| Karadag | KAR | Artvin | <i>Fagus orientalis</i> | 19/34 | 1698 2016 | 785 | 41.37 | 41.59 |
| Gorgit | GOR | Artvin | <i>Fagus orientalis</i> | 13/23 | 1540 2013 | 1980 | 41.37 | 41.94 |
| Kayabası Yaylası | KAF | Artvin | <i>Fagus orientalis</i> | 11/20 | 1159 2008 | 1830-2120 | 41.3 | 41.9 |
| Camili | QPS | Artvin | <i>Fagus orientalis</i> | 18/26 | 1549 2013 | 1780 | 41.49 | 42.04 |