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Editor: John Lambshead

doi:10.1111/j.1365-2699.2010.02302.x

The power of potential natural vegetation (and of spatial-temporal scale): a response to Carrión & Fernández (2009)

ABSTRACT

A commentary by Carrión & Fernández (*Journal of Biogeography*, 2009, **36**, 2202–

2203) compared Holocene pollen records with models of potential natural vegetation (PNV) proposed in the phytosociological literature and concluded that the predicted PNV resulted from anthropogenic disturbance. However, the authors misinterpreted PNV, leading to two serious flaws in their assumptions: (1) PNV is not defined as a pre-anthropogenic or climax plant community; and (2) PNV is not a concept restricted to the phytosociological method. Therefore we criticize the conclusions expressed in the commentary, and we stress the need for an interdisciplinary approach based on multi-temporal and multi-spatial scales to achieve a modern framework for the study of plant communities.

Keywords Climax concept, ecological restoration, Holocene vegetation, landscape dynamics, phytosociology, potential natural vegetation, secondary succession, vegetation classification, vegetation science.

In a commentary regarding Holocene pollen deposits from the Canary Islands, Carrión & Fernández (2009) argued that the discovery of *Quercus* and *Carpinus* pollen is noteworthy because ‘the prevailing concepts of natural potential vegetation in the study region imply that the pre-anthropogenic (mature phase or climax) vegetation’ would be an evergreen forest dominated by species of Lauraceae. Inferences of pre-anthropogenic vegetation made by palynologists were also compared with the potential natural vegetation (PNV; incorrectly quoted in the commentary as ‘natural potential vegetation’) proposed in the phytosociological literature at a number of sites in the Iberian Peninsula. The results of the two models indicated that, in many instances, the dominant species differed. Therefore they concluded that the PNV types determined in previous studies were the result of anthropogenic disturbance. Consequently, the authors polemically argued that there is a bias ‘in the conceptualization of the vegetational dynamics’ by ‘traditional vegetation science’, and resistance to abandon this bias ‘has little to do with scientific evidence’, in front of ‘a growing body of work questioning the floristic-phytosociological approach’. Unfortunately, this line of reasoning is based on two serious misunderstandings regarding the PNV concept.

First and foremost, PNV is *not* defined by vegetation scientists as ‘pre-anthropogenic

(mature phase or climax) vegetation’. On the contrary, PNV is defined as the plant community that ‘would become established if all successional sequences were completed without interference by man *under the present climatic and edaphic conditions (including those created by man)*’ (Mueller-Dombois & Ellenberg, 1974, p. 422; our emphasis; see also: Westhoff & van der Maarel, 1973; Ellenberg, 1988; Ricotta *et al.*, 2002). European landscapes exhibit present soil conditions that are often dramatically different from their original state, due to recent or ancient but irreversible human disturbance (cf. Dupouey *et al.*, 2002). Consequently, it is an essential part of the PNV theory that the potential vegetation of a site can be very different from the pre-anthropogenic vegetation at the same site (e.g. Mueller-Dombois & Ellenberg, 1974; Chytrý, 1998; Moravec, 1998; Zerbe, 1998; Gamisans, 1999). The PNV concept was introduced (Tüxen, 1956) to express the *present* (‘heutige’) potential of a region or site as a useful reference to define a target for restoration ecology and ecological engineering projects, or for landscape management purposes (e.g. to forecast and manage landscape evolution on a time-scale of a few decades) (Rodwell & Patterson, 1994; Härdtle, 1995; Miyawaki, 1998; Zerbe, 1998; Verheyen *et al.*, 2006; Dostalek *et al.*, 2007).

It is quite surprising that Carrión & Fernández (2009) completely ignored the large body of works addressing and defining PNV theory. Furthermore, it is perplexing they assumed that ‘climax vegetation’ and PNV are considered synonyms in vegetation science. On the contrary, it is well known that the idea of PNV arose as an outcome of (and reaction to) the long-lasting debate on the ‘climax’ concept (Zerbe, 1998; Ricotta *et al.*, 2002). European vegetation scientists have questioned the concept of climax for decades (Mueller-Dombois & Ellenberg, 1974; Chytrý, 1998; Schulze *et al.*, 2005), and we now acknowledge that vegetation is not returning to an alleged, past equilibrium, but is adapting continuously to a changing abiotic environment and biotic interactions. In addition, the inferred climax phase requires a long period of succession, which introduces not only the effects of long-term climatic changes, but also those of vegetation-induced soil modifications. Finally, the climax concept was developed to study the phytogeography of North America, a continent featuring abiotic homogeneity over large areas, a condition rarely verified in Europe.