4.3 Scientific Discussion on Minimum Size of Beech Forest Ecosystems

4.3.1 Minimum sizes required for shifting mosaic dynamics in natural beech forests

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Strict forest reserves and other strictly protected non-intervention forests are aimed to develop natural forest dynamics, if possible to their full extent, both for scientific study of these dynamics, and for the conservation and development of related biodiversity.

For this purpose, reserve sizes should be large enough to incorporate all developmental phases of a forest, and the shifting mosaic dynamics between them.

Several scientific papers and guidelines contain suggestions and conclusions for minimum sizes that are required for this. Required size will be dependent of the dominant disturbance regime of the forest. Forest types that are characterized by large stand-replacing dynamics (like boreal forests) may require much larger reserves to fully incorporate the different developmental phases and the size-range of disturbances.

Beech forests however, are characterised by small-scale gap dynamics. Several studies in natural beech forests show that small gaps (<200 m²) are the dominant driving force of forest dynamics (e.g. Rugani et al. 2013; Tabaku & Meyer, 1999; Zeibig et al., 2005). Large gaps (>1,000 m²) are very rare, but do exceptionally occur (Pontailler et al. 2007).

For Germany, minimum sizes for lowland beech forest reserves are set at 20 ha (Projektgruppe Naturwaldreservate, 1993). In Austria, Mayer (1974), Zukrigl (1990) and Tichy & Frank (1995) suggest minimal sizes of 20 ha, but preferably 50 ha.

The required minimum size for a continuous shifting mosaic steady state in beech forests was set at 25-40 ha for beech-fir forests (Korpel, 1993) and 10 ha, resp. 15-25 ha for lowland beech forests (Emborg et al., 2000; Koop & Hilgen, 1987).

Bücking (1994) suggests a minimum required size for beech forest types in Germany of 50 ha.

Paluch (2007), however, concludes that the minimum area required for a continuous shifting mosaic steady state may even be much lower than previously suggested, based on the random pattern domination and the small-scaled spatial variation of the basal area of live and dead trees in the forests he studied. This conclusion is also drawn for mountain beech forests in the Apennines (Piovesan et al., 2005).

For biodiversity conservation and development, larger areas are generally preferred, as stable and durable populations of species may require vast areas of undisturbed forest. One breeding pair of White-Backed woodpecker may require at least 50 ha of beech forest with standing dead wood amounts of at least 30 m³/ha (Müller & Butler, 2010). A viable population of this species thus requires at least several hundreds of hectares of interconnected suitable habitat. This however is often not achievable in densely populated (especially lowland) areas, where forests over time have become fragmented and have been undergoing high public pressure.

Götmark F. & Thorell M. (2003) found that the quality of forest habitat (especially densities of large trees and amounts of dead wood) is significantly higher in smaller reserves than in large ones, as creating larger conservation areas subsequently requires to include areas of lower quality.

The overall conclusion, based on literature, is that minimum sizes for strictly protected beech forest areas in order to fully develop natural forest dynamics (continuous shifting mosaic steady state) can be set at 20-50 ha, or according to some studies, even less.

However, for biodiversity conservation and development, larger areas (of sufficient quality) are preferred if available and of sufficient overall quality.

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4.3.2 Discussion of the Criterion "Size" for the Two Component Parts Monte Cimino and Monte Raschio

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The low-elevation old-growth beech forests of Monte Cimino and Monte Raschio are rear-edge populations, fundamental "stones" in beech range dynamics (Jump et al. 2009). Although they cover a smaller area (i.e. 58 and 74 ha, respectively) in comparison to mountain stands, their conservation is not at risk because they host well-structured, viable beech populations. These old-growth beech forests, as the others in the network, have a disturbance regime characterised by the dominance of small gap openings (most of them <200 m^2), while larger scale disturbances are very rare and generally do not exceed 3-5,000 m^2 (Hobi et al. 2015). Fire is an ecological disturbance generally not interesting beech forests, even at low elevation. In temperate old-growth forests, the annual disturbance rate is 0.5-2 % (Picket & White 1985), with beech forests at the lower margin of this range (0.5-1 %; Henbo et al. 2004). The low level of disturbance is a typical trait of a pure beech ecosystem and it is the main cause for the competitive exclusion from the stand of other tree species. Monitoring studies demonstrated that 10 ha are enough to provide the complex structural features enclosed in an old-growth forest covering thousands of hectares (Peck et al. 2015) and, in advanced old-growth forests, the finely-textured steady state structure may be realised even on patches smaller than 1 ha! (Alessandrini et al. 2011).