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DROUGHT AND BEECH SILVICULTURE - WHAT WILL BE THE RELEVANT REGENERATION STRATEGIES AND TECHNIQUES?

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Introduction

European beech (*Fagus sylvatica* L.) is one of the main tree species in the ongoing conversions of coniferous plantations to deciduous forests, since beech dominates the potential natural vegetation (PNV) in large parts of Central Europe. However, the reputed drought sensitiveness of beech has led to discussions about the growth and regeneration of beech on dryer sites in southern Germany in the context of climate change predictions (Rennenberg et al. 2004, Ammer et al. 2005).
Summer 2003 was one of the warmest and driest periods in Central Europe for almost 100 years. The air temperature between June and August was anomalous, deviating from the 30 year average (1961-1990) by +2°C to +5°C (Schär et al. 2004). In northeastern Central Europe (north-eastern Germany and western Poland) a deficit in precipitation of 180 mm resulted from the 2003 drought. In this year the precipitation rate amounted to 440 mm p. a. only (Rudolf 2004).

In eight pure and mixed European beech forests in northeastern Central Europe the growth response of natural beech regeneration during the 2003 summer drought and the additional effects of shading was investigated. According to the results, adequate strategies for the natural regeneration of beech forest under conditions of frequent drought events are discussed.

Materials and Methods

The selected stands, comprising four to six year old natural beech regeneration situated on sites with similar sandy soils, spanned a 600 km geographic gradient from Northeast Germany to Northeast Poland (Masuria).
During the extended drought period from end of July to mid August 2003, the water status of beech regeneration was assessed by measuring the predawn potential (ψPD) of 17 to 22 randomly selected saplings with a Scholander pressure chamber (Scholander et al. 1965). All stands were then classified into class (1) without water stress ($\psi PD > -0.4$ MPa), class (2) with moderate water stress (ψPD - 0.4 MPa to -0.8 MPa) or class (3) with high water stress ($\psi PD < -0.8$ MPa, Czajkowski et al. 2005). Inventories of natural regeneration took place on permanently marked plots 0.12 ha to 0.25 ha in area. On six to eight subplots (20m² area), up to 20 beech saplings were labeled and total aerial shoot length, root collar diameter, and terminal shoot length were recorded. A second inventory in September 2004 enabled relative length and diameter increment in 2003 and 2004 to be calculated in relation to plant size at the beginning of the growth period.
Hemispherical photography was used to consider additional effects of below-canopy irradiance on plant performance by deriving the diffuse site factor (DIFFSF) of each subplot (Wagner 1994).