



Late Holocene palaeoclimate variability: The significance of bog pine dendrochronology related to peat stratigraphy. The Puścizna Wielka raised bog case study (Orawa – Nowy Targ Basin, Polish Inner Carpathians)



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ABSTRACT

The results of dendrochronological and palynological analyses of subfossil pine trees occurring in the peat deposits of the Puścizna Wielka raised bog (Polish Carpathians, Southern Poland) – the only site with numerous subfossil pine trees in the mountainous regions of Central Europe presently known – indicate that the majority of the tree populations grew in the peat bog during the periods ca 5415–3940 cal BP and 3050–2560 cal BP. Several forestless episodes, dated to 5245–5155 cal BP, 4525–4395 cal BP and 3940–3050 cal BP, were preceded by tree dying-off phases caused by an extreme periodical increase in humidity and general climate cooling trends. These events are documented based on analyses of pollen and non-pollen palynomorph assemblages, dendrochronological analyses of the trees, as well as numerous radiocarbon datings of the sediment horizons occurring within the peat bog profile. The phases of germinations, and, in turn, of tree and shrub invasions of the peat bog areas have been closely connected to drying and occasional warming of the regional climate. The last of the forestless periods began about 2600 years ago and continued up to the very recent times. Currently, as a result of desiccation of the peat bog and the lowering of the groundwater level (due to improved water drainage system), pine trees have returned the peat bog again. These results demonstrate that studies of subfossil bog-pine trees are quite effective in documenting and reconstructing periods of humidity fluctuation that occurred within the Carpathian region over the last several millennia.

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1. Introduction

Subfossil pine wood (*Pinus sylvestris* L.) occurring in the European peat bogs, has been commonly used in dendrochronological studies to reconstruct and establish chronology of the Holocene palaeoclimatic events. Numerous studies have been carried out in Northern and Western Europe, including in Germany (Leuschner

et al., 2007; Eckstein et al., 2008, 2010, 2011), Sweden (Gunnarson, 1999, 2008; Gunnarson et al., 2003; Edvardsson, 2010; Edvardsson et al., 2012), Great Britain (Lageard et al., 1995, 2000; Moir et al., 2010, 2012), Scotland (Bridge et al., 1990; Moir et al., 2010); Ireland (Pilcher et al., 1995), Lithuania (Pukienė, 2001; Edvardsson et al., 2016) (Fig. 1a – sites: 1–7) and Poland (Fig. 1a – site 7) (Barniak et al., 2014). A considerable portion of the compiled chronologies of subfossil pine trees are floating chronologies, dated using the radiocarbon method (among others Lageard et al., 1999; Pukienė, 1997; Eckstein et al., 2009; Edvardsson et al., 2016), with notable exceptions of chronologies from Northwestern Germany (see Fig. 1a – site 1) and Southern Sweden (Fig. 1a – site 2) where absolute dating was possible due to the heteroconnection with the

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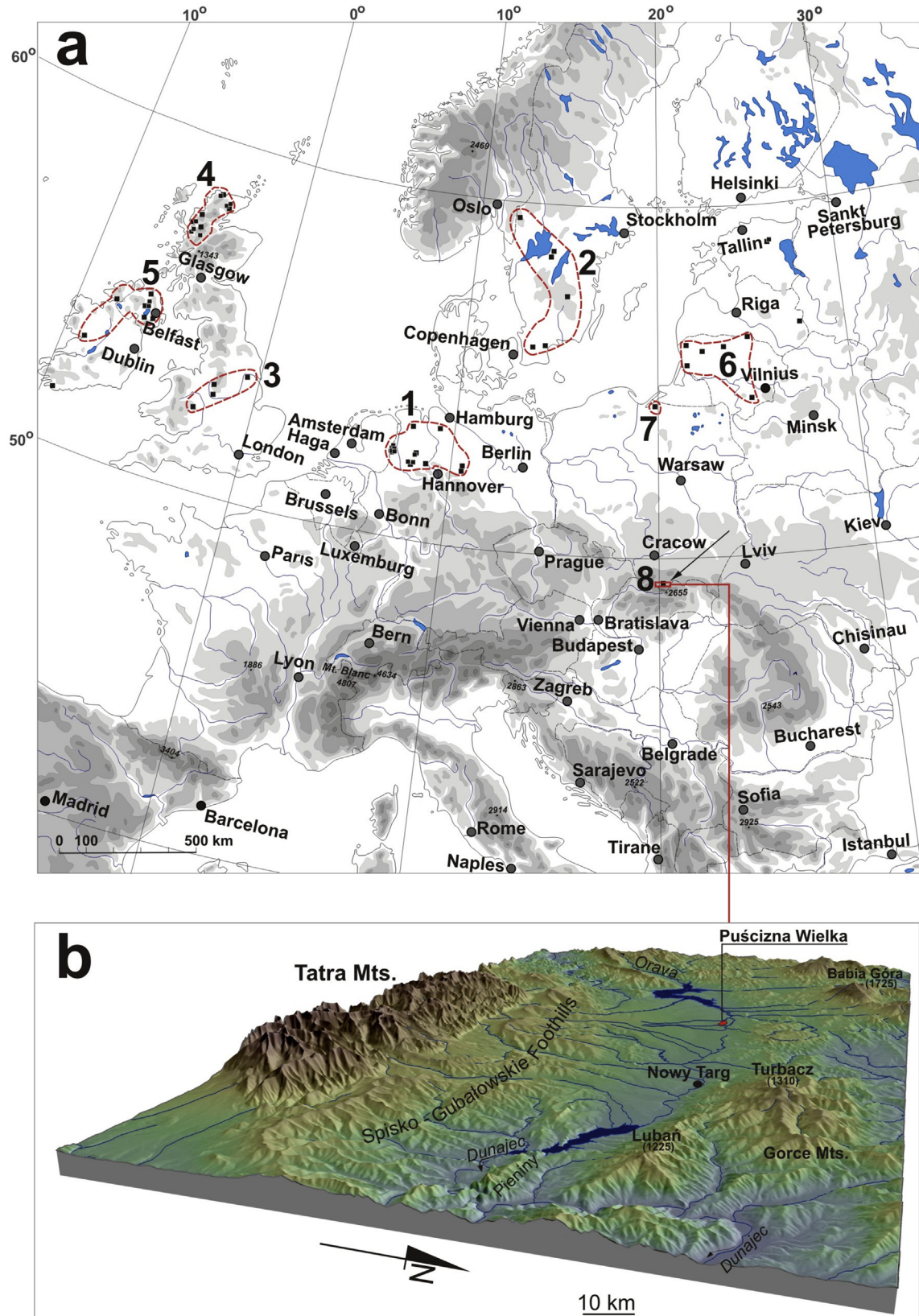


Fig. 1. Study area: a - Location of the Puścizna Wielka raised bog; locations of other European peat bogs deposits with Scots pine (*Pinus sylvestris*) occurrences are also shown: 1 – Germany (Eckstein et al., 2011); 2 – Southern Sweden (Edvardsson et al., 2012); 3 – England (Lageard et al., 2000); 4 – Scotland (Moir et al., 2010); 5 – Northern Ireland (Pilcher et al., 1995); 6 – Lithuania (Pukienė, 2001; Edvardsson et al., 2016); 7 – Northern Poland (Barniak et al., 2014); 8 – Puścizna Wielka raised bog; b – SRTM topography model of the Puścizna Wielka bog within the Orawa - Nowy Targ Basin.

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