Questioning the relevance of shifting cultivation to Neolithic farming in the loess belt of Europe: evidence from the Hambach Forest experiment

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Abstract. Despite widespread criticism, the shifting cultivation model continues to inform discussion of Neolithic farming in Europe, beginning with early Neolithic (Linearbandkeramik or LBK) communities concentrated in the loess belt of western-central Europe. Hundreds of LBK and later Neolithic sites have been excavated in this region and many of them sampled for charred plant remains. Archaeobotanical data on the weed floras harvested with crops provide the most direct archaeological evidence of crop husbandry practices, including the permanence of crop fields, but have played a limited role in the debate over shifting cultivation. The Hambach Forest experiment, conducted in the 1970s-80s near Cologne, Germany, provides valuable comparative data on the weed floras growing in newly cleared cultivation plots in an area of long-lived mixed oak woodland on loess-based soil. Correspondence analysis of the Hambach weed survey data suggests that weed floras of fields managed under a shifting cultivation regime would be rich in perennial species, including woodland perennials. Comparison of these results with Neolithic weed assemblages from the loess belt of western-central Europe strongly suggests that Neolithic crop fields were not recently cleared of woodland vegetation but were long-established.

Key words: Shifting cultivation – Hambach Forest – Experimental cultivation – Archaeobotany – Weed ecology

Introduction

Shifting cultivation refers to the use of newly cleared and burned woodland areas for short-term crop growing (c. 1-5 years) followed by a "shift" of cultivation to other newly cleared areas and woodland regeneration (over c. 20 or more years) on old plots. This system, also known as slash-and-burn, swidden, long-fallow or forest-fallow, is distinguished from cultivation regimes involving shorter fallow periods by the type of vegetation - primary or secondary woodland - which is cleared to create new fields (Dennell 1978, p 37). Burning releases nutrients from organic material into the soil, promoting high crop yields for a short period, and may damage the viability of potential "weed" seeds, rhizomes etc. present in the soil (Ellenberg 1996, p 770), reducing the need for tillage and weeding (Sigaut 1975, pp 18-29, 99). Shifting cultivation is attested historically in parts of Europe and North America (Grigg 1974, pp 62-63; Sigaut 1975, pp 18-29; Steensberg 1955, 1993, pp 15-16, 98-153; Larsson 1995; Lüning 2000, pp 52-54). It is also widely practised in tropical regions, where such techniques counteract the rapid leaching of soil nutrients by very high rainfall (Grigg 1974, pp 57-74; Steensberg 1993, pp 16-98).

Childe (1929, pp 45-46) first suggested shifting cultivation to explain the 'spread' of early Neolithic (Linearbandkeramik or LBK) farming communities across central and western Europe, principally in regions of loess-based soil between the North European Plain and the Alps, extending from Belgium to the Ukraine (Fig. 1; Bogucki 1996). The model was widely accepted for the LBK (Clark 1952, pp 92-98; Piggott 1965, pp 51-52) until the 1970s, when the alternative model of permanent fields cropped on a regular basis began to find favour (Modderman 1971; Kruk 1973). Nevertheless, shifting cultivation has contin-
ued to influence more recent discussion of LBK and later Neolithic agriculture in the loess belt of western-central Europe (for example Wasylikowa et al. 1985; Beranová 1987, 1989; Godłowska et al. 1987; Kruk 1988; Milisauskas and Kruk 1989; Wasylikowa 1989; Rösch 1990; Rulf 1991; Whittle 1996, pp 160-162, 1997). Following the early pollen analyses of Iversen (1941) and Troels-Smith (1953), slash-and-burn farming has also long been associated with the later Neolithic *Trichterbecherkultur* or TRB in the North European Plain and Scandinavia (Midgley 1992, pp 384-393). Here again, shifting cultivation has continued to appear in recent accounts of TRB agriculture (for example Góransson 1988, p 70; Milisauskas and Kruk 1989; Andersen 1993; Kalis and Meurers-Balke 1998). Recent writing on the Neolithic period in the foothills surrounding the Alps (Alpenvorland) has also promoted the idea of shifting cultivation (for example Rösch 1996, 2000; Pêtrequin 1996; Pêtrequin et al. 1998). Similarly, shifting cultivation emerges in recent accounts of Neolithic agriculture in Britain (for example Barrett 1994, pp 143-148, 1999; Whittle 1997; Thomas 1999, pp 23-32). Despite sustained criticism of the model over several decades (Modderman 1971; Kruk 1973; Lüning 1980, 2000, pp 49-50, 187-189; Sherratt 1980; Rowley-Conwy 1981; Bogucki 1988, pp 79-82), therefore, shifting cultivation continues to thrive in the archaeological literature on Neolithic Europe. It has evolved from a model explaining the spread of Neolithic "farmer-pioneers" across Europe (Childe 1929) into one which emphasises the indigenous, "Mesolithic" (and hence "mobile") identity of Europe's first farmers.

Key arguments in support of shifting cultivation have included the supposed rapid exhaustion of soils (Childe 1929, pp 45-46, 1957, pp 105-106), the occurrence of sites in areas of relatively poor soils (Kruk 1973, 1980, pp 54-57, 1988; Rösch 2000), discontinuity in settlement occupation (Soudsky and Pavlu 1972) and pollen evidence for changes in woodland composition associated with clearance and burning (Iversen 1941; Troels-Smith 1953; Wasylikowa et al. 1985; Wasylikowa 1989; Godłowska et al. 1987; Góransson 1988; Rösch 1990, 1993; Andersen 1993; Kalis and Meurers-Balke 1998). All of these arguments are open to question. First, the claim of soil exhaustion in regions with relatively good soils, such as those based upon loess, is refuted by experimental evidence for the long-term stability of crop yields over decades of continuous cereal cultivation, even without manuring (Lüning 1980, 2000, p 174; Rowley-Conwy 1981; Reynolds 1992). Second, the relationship between basic soil quality and crop growing conditions may not be straightforward; intensive manuring, watering and weeding of cultivation plots, for example, can create a highly fertile garden soil (for example Jones et al. 1999). Third, more or less continuous occupation over several centuries has been demonstrated for some Neolithic settlements in western-central Europe (such as LBK sites in the Aldenhoven plateau, Stehli 1989), though there appears to be considerable variation, even within the LBK (Whittle 1996, p 166). In any case, the relationship between residential permanence and the permanence of cultivation areas may have been complex (Grigg 1974, p 60; Whittle 1997). Fourth, in addition to the fundamental issues of adequate dating and calculation of pollen diagrams (Rowley-Conwy 1981; Kalis and Meurers-Balke 1998), it has been emphasised that changes in woodland composition associated with clearance and burning do not necessarily reflect past arable land-use (Rowley-Conwy 1981; Brombacher and Jacomet 1997; Kalis and Meurers-Balke 1997, 1998).

It is striking that the most direct archaeological evidence for crop husbandry - the seeds of arable weeds harvested with ancient crops and associated with them in samples from archaeological deposits - has played a limited role in the debate over shifting cultivation (cf. Engelmark 1989; Dennell 1992). Within the loess belt of western-central Europe (Fig. 1), hundreds of Neolithic sites have been excavated and many of them sampled for charred plant remains (for example Kreuz 1990; Knörzer 1997). The significance of charred 'weed' seeds accompanying charred crop remains as evidence of crop husbandry has long been recognised (for example Knörzer 1971a; Willerd 1983) but their usefulness for distinguishing the cultivation of shifting versus permanent fields has been limited by the lack of comparative data on modern arable weed floras developed under a shifting cultivation regime. The repeated occurrence of a narrow range of weed taxa (the so-called Bromo-Lapsanetum praehistoricum weed community) in charred crop material from LBK-Rössen sites in the Rhineland, for example, has been interpreted by Knörzer (1971a) as evidence for permanent fields, whereas Bakels (1978, p 69) has argued that such weed assemblages could reflect shifting cultivation. While more recent archaeobotanical studies of LBK and later Neolithic crop husbandry in western central Europe have tended to favour a permanent field model, the difficulty of excluding shifting cultivation based on weed evidence has also been acknowledged (Brombacher and Jacomet 1997).

Descriptions of historical shifting cultivation in Europe and North America provide few observations on the weed floras growing with crops in shifting fields. There are indications that weed growth can be severely limited by burning and/or by exuberant crop growth in the first cultivation season of a shifting regime but that weed growth increases in the second and third cultivation sea-

Fig. 2. The layout of experimental plots in the Hambach Forest and cereals grown on each plot (after Meurers-Balke and Lüning 1990: Fig. 2). Ba = Barley; Ek = Einkorn; Em = emmer; Sp = Spelt