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References

Baum 2014

Tilman Georg Baum, *Models of wetland settlement and associated land use in South-West Germany during the fourth millennium B.C.* Vegetation History and Archaeobotany **23** (2014), Supplement, S67–S80.

A GIS-based modelling approach is presented that interprets existing data on subsistence strategies of pile-dwelling people of the Lake Constance area in South-Western Germany and North-Eastern Switzerland. This is conducted using the examples of the settlement sites at Hornstaad-Ho¿rnle 1, Sipplingen-Osthafen and Degersee. Soil distribution and the geomorphologic features of a landscape are used as the basis for illustrating various scenarios of land use depicting hypotheses of economic strategies and aspects of the human-environment-system. In particular the implications of the crop system and the discussion about Shifting Cultivation or Intensive Garden Cultivation are used as different modelling inputs, alongside the spatial demand for cattle herding and for the extraction of timber. The Carrying Capacity of the landscape around the three settlement sites is calculated with respect to the agricultural system applied.

Keywords: GIS | Carrying Capacity | Wetland archaeology | Landscape archaeology | Archaeological modeling | Neolithic land use

Baum 2016

Tilman Baum, Claas Nendel, Stefanie Jacomet, Miquel Colobran & Renate Ebersbach, *"Slash and burn" or "weed and manure"? A modelling approach to explore hypotheses of late Neolithic crop cultivation in prealpine wetland sites.* Vegetation History and Archaeobotany **25** (2016), 611–627.

The record of prehistoric crop cultivation in central Europe dates as far back as 5500 BC. In the piledwellings of the north-western pre-alpine forelands, dating roughly from 4300 to 800 BC, favourable taphonomic conditions provide evidence for the ways of cereal cultivation and consumption in unmatched detail. Based on different sets of (bio-) archaeological and palynological evidence, different hypotheses of crop husbandry methods have been developed for the wetland settlements. During the late Neolithic, two partly antithetic ideas are discussed: On one hand Shifting Cultivation assumes frequently shifted crop fields and the use of fire to provide nitrogen for plant uptake; On the other hand Permanent Cultivation reconstructs longer-ranging use of the fields, to which nitrogen may have been provided by various means. From the Bronze Age onwards, most probably some form of extensive ard cultivation was applied. In this article, we explore the implications of the different hypotheses for the socio-ecological system of the wetland sites. We combine the capability of agent-based modelling to simulate dynamic processes with the benefits provided by geographical information systems and the possibilities provided by the use of modern agro-ecosystem modelling tools. First, we used a mechanistic crop growth model, MONICA, to evaluate the influence of important factors of prehistoric crop yield formation: the climatic conditions, the soil texture and the degree of nitrogen availability. Second, we applied an agent-based model (WELASSIMO_crops) to simulate the spatial and economic implications

related to the different crop husbandry Methods. Our results provide quantitative information on the extent of crop husbandry activities in the wetland sites and on the effect of natural and anthropogenic factors on prehistoric crop yields. Without manure application, initial average yields of 1.0 t ha-1 a-1 are shown to decrease rapidly to only 50 % after 10 years. A manuring rate of 10 t ha-1 a-1 allows for higher yields of 1.7 t ha-1 a-1 and a slower rate of fertility decrease, but requires high numbers of livestock per capita. In shifting cultivation, high yields of 2.7 t ha-1 a-1 are reasonable, while necessitating a very large area and high labour input. Using the model results and a case study, we argue that permanent cultivation is more likely to have been the standard method, while burning of the landscape may have had different objectives than crop husbandry. We find that the combination of agent-based social and process-based biophysical modelling is a powerful tool to study the complex interdependencies in human-environment systems in the past.

Keywords: Prehistoric crop husbandry | Wetland settlements | Land use | Agent-based model (ABM) | Crop growth model

Eckmeier 2007

Eileen Eckmeier, Manfred Rösch, Otto Ehrmann, Michael W. I. Schmidt, Wolfram Schier & Renate Gerlach, *Conversion of biomass to charcoal and the carbon mass balance from a slash-and-burn experiment in a temperate deciduous forest.* The Holocene **17** (2007), iv, 539–542.

Abstract: Anthropogenic burning, including slash-and-burn, was deliberately used in (pre)historic Central Europe. Biomass burning has affected the global carbon cycle since, presumably, the early Holocene. The understanding of processes and rates of charcoal formation in temperate deciduous forests is limited, as is the extent of prehistoric human impact on the environment. We took advantage of an experimental burning to simulate Neolithic slash-and-burn, and we quantified the biomass fuel and charcoal produced, determined the resulting distribution of the charcoal size fractions and calculated the carbon mass balance. Two-thirds of the charcoal particles (6.71 t/ha) were larger than 2000 µm and the spatial distribution of charcoal was highly variable (15-90 % per m2). The conversion rate of the biomass fuel to charcoal mass was 4.8 %, or 8.1 % for the conversion of biomass carbon to charcoal carbon, and 58.4 t C/ha was lost during the fire, presumably as a component of aerosols or gases.

Key words: Slash-and-burn experiment, temperate deciduous forest, charcoal, carbon mass balance, biomass burning.

Ehrmann 2005

Otto Ehrmann & Manfred Rösch, *Experimente zum neolithischen Wald-Feldbau in Forchtenberg, Einsatz und Auswirkungen des Feuers, Erträge und Probleme des Getreideanbaus – Bericht 2000–2002.* In: *Zu den Wurzeln europäischer Kulturlandschaft – experimentelle Forschungen, Wissenschaftliche Tagung Schöntal 2002 – Tagungsband; Gerhard Lang zum 80. Geburtstag gewidmet.* Materialhefte zur Archäologie (Stuttgart 2005), 109–140.

Ehrmann 2009

Otto Ehrmann, Manfred Rösch & Wolfram Schier, *Experimentelle Rekonstruktion eines jungneolithischen Wald-Feldbaus mit Feuereinsatz – ein multidisziplinäres Forschungsprojekt zur Wirtschaftsarchäo-*

logie und Landschaftsökologie. Prähistorische Zeitschrift **84** (2009), 44–72.

Der Artikel fasst wichtige Ergebnisse eines multidisziplinären Langzeitversuchs zur Ökonomie und Ökologie eines für das Jungneolithikum Südwestdeutschlands rekonstruierten extensiven Brandfeldbaus zusammen. Über rund ein Jahrzehnt wurden frisch eingeschlagene Waldflächen mit Schwachholz überbrannt und darauf für das frühe Jungneolithikum belegtes Getreide angebaut. Im einjährigen Anbau konnten durchwegs hohe bis sehr hohe Erträge erzielt werden, während im Nachbau und auf gehackten Vergleichsflächen die Erträge, insbesondere auf Böden mittlerer und geringerer Güte, nur einen Bruchteil erreichten. Der Artikel dokumentiert die Ertragsdaten sowie ihre bodenkundlichen und agrartechnischen Rahmenbedingungen und stellt eine erste ökonometrische Gesamtbilanz des experimentellen Brandfeldbaus vor.

The article summarises the key findings of a multidisciplinary long-term experiment on the economy and ecology of extensive slash-and-burn agriculture, as reconstructed for the Upper Neolithic period in south-west Germany. For nearly a decade, forest areas were cleared and small timber was burned in preparation for grains cultivated at the beginning of the Upper Neolithic period. While it was possible to achieve high to very high yields in the first year of cultivation, in subsequent years and on reference land that had been hoed the yields were only a fraction of that, especially on soils of average or poor quality. The article documents the yields data as well as the pedological and agricultural conditions and presents the first econometric assessment of the slash-and-burn experiment.

Jungneolithikum; Brandfeldbau; experimentelle Archäologie; Wirtschaftsarchäologie; Archäobotanik; Landschaftsökologie; Agrarwissenschaft.

Néolithique récent; culture sur brûlis; archéologie expérimentale; paléoéconomie; archéobotanique; écologie du paysage; agronomie.

Upper Neolithic; slash-and-burn cultivation; experimental archaeology; economic archaeology; archaeobotany; landscape ecology; agriculture.

Ehrmann 2014

Otto Ehrmann, Harald Biester, Arno Bogenrieder & Manfred Rösch, *Fifteen years of the Forchtenberg experiment, Results and implications for the understanding of Neolithic land use*. Vegetation History and Archaeobotany **23** (2014), Supplement 1, S5–S18.

Experimental research into Neolithic agriculture has been underway in Forchtenberg, southwest Germany, since 1998. The experimental area is a medium age mixed-deciduous forest featuring different soils, mainly haplic and stagnic luvisols. In this experimental setting, research has focussed on comparisons of soil nutrients and crop yields resulting from slash and burn cultivation and from cultivation with hoeing. We show that slash and burn produces significantly higher yields, although always depending on soil quality. Hoe tilling is only profitable on the best soils in the first year after clearance. Continuous cultivation with hoeing produces too low yields, but repeated annual cultivation on slash and burn sites also resulted in progressively lower yields due to decreasing levels of nitrogen in the soil. Nitrogen originates not from burned wood but from the burning and mineralisation of organic matter in the topsoil. After burning and cultivation, a break of about 10–15 years is necessary, not only for forest re-growth, but also for the regeneration of the top soil and its nitrogen content. Slash and burn agriculture is therefore an easy and reliable tool for food production by a small population living in a large forested area.

Keywords: Neolithic agriculture | Experimental archaeology | Slash and burn

Fraser 2011

Rebecca A. Fraser et al., *Manuring and stable nitrogen isotope ratios in cereals and pulses, Towards a new archaeobotanical approach to the inference of land use and dietary practices.* Journal of Archaeological Science **38** (2011), 2790–2804.

Rebecca A. Fraser, Amy Bogaard, Tim Heaton, Michael Charles, Glynis Jones, Bent T. Christensen, Paul Halstead, Ines Merbach, Paul R. Poulton, Debbie Sparkes & Amy K. Styring

This paper explores the impact of animal manure application on the d15N values of a broad range of crops (cereals and pulses), under a range of manuring levels/regimes and at a series of locations extending from northwest Europe to the eastern Mediterranean. We included both agricultural field experiments and areas where 'traditional' farming is practised. Our aim is to ground-truth interpretation of d15N values in archaeobotanical crop remains as evidence of past growing conditions and husbandry practices. The results confirm the potentially radical impact of manuring on d15N values in cereals, depending on manuring level, but indicate only a slight effect on pulses, which can fix atmospheric nitrogen. The expected geographical trend towards greater d15N with increasing climatic aridity is not apparent, probably because the growing conditions for crops are 'buffered' through crop management. Each of these observations has fundamental implications for archaeobotanical interpretation of d15N values as evidence of land use practices and (together with analysis of bone collagen/tooth enamel in potential consumers) palaeodiet.

Keywords: Nitrogen; Stable isotopes; Manuring; Neolithic; Crop husbandry; Palaeodiet

Gehrt 2002

Ernst Gehrt, Michael Geschwinde & Michael W. L Schmidt, *Neolithikum, Feuer und Tschernosem – oder: Was haben die Linienbandkeramiker mit der Schwarzerde zu tun?* Archäologisches Korrespondenzblatt **32** (2002), 21–30.

Gerlach 2006

Renate Gerlach, Heike Baumewerd-Schmidt, Klaas van den Borg, Eileen Eckmeier & Michael W. I. Schmidt, *Prehistoric alteration of soil in the Lower Rhine Basin, Northwest Germany – archaeological, ^{14}C and geochemical evidence.* Geoderma **136** (2006), 38–50.

In Early Holocene, Chernozems were assumed to have covered the entire loess landscape of the Lower Rhine basin – today mirrored by the distribution of Luvic Phaeozems. These Luvic Phaeozems have characteristic dark brown (Bht) horizons accumulating clay and humus, inherited and translocated from their precursors Chernozem black humic A horizons. We examined Luvic Phaeozems along a 33-km-long and 2.0-2.5-m-deep gas pipeline trench in the Lower Rhine Basin, west of Cologne. Along this transect we discovered clusters of hundreds of regularly shaped pits. These pits were always connected to the Bht horizons of adjacent Luvic Phaeozems. The Luvic Phaeozem horizons and the pits were investigated by combining methods from (geo-) archaeology (geographical distribution within the landscape, shape of the pits, soil texture), geochemistry (content of carbon, nitrogen and black carbon), palaeobotany (species determination of charcoals) and AMS 14C measurements.

We found that the Luvic Phaeozems occurred not only in the loess-

covered landscape but also in the sandy Holocene floodplain, and their distribution could not be limited to certain slope positions or parent material. Carbon and nitrogen concentrations in the Luvic Phaeozem horizons and pits were larger than in the surrounding Luvisols, whereas the C/N ratios were small (<10). Material found in the Luvic Phaeozem pits was clearly different from material found in prehistoric settlements. The pits investigated here never contained artifacts, and carbon and nitrogen concentrations and C/N ratios were smaller. We found charcoal particles, and black carbon contributed up to 46 % of the total organic carbon. The AMS 14C ages of charcoals and black carbon indicated that fire occurred from Mesolithic (9500-5500 BC) to the Medieval Ages (500-1500 AD), and mainly in the Late-/End Neolithic period (4400-2200 BC). We conclude that (i) the Luvic Phaeozem pits and horizons are man-made, formed during several archaeological epochs between Mesolithic and Middle Ages, (ii) these pits must have been formed outside the actual prehistoric settlements (offsite) and may serve as a novel archaeological feature, (iii) the purpose of these pits at present is not clear and (iv) human activity has altered and ultimately formed the investigated soils of the Lower Rhine basin in prehistoric time.

Jacomet 2016

Stefanie Jacomet et al., *On-site data cast doubts on the hypothesis of shifting cultivation in the late Neolithic (c. 4300–2400 cal. BC), Landscape management as an alternative paradigm.* The Holocene **26** (2016), 1858–1874.

Stefanie Jacomet, Renate Ebersbach, Örni Akeret, Ferran Antolín, Tilman Baum, Amy Bogaard, Christoph Brombacher, Niels K. Bleicher, Annekäthi Heitz-Weniger, Heide Hüster-Plogmann, Eda Gross, Marlu Kühn, Philippe Rentzel, Bigna L. Steiner, Lucia Wick & Jörg M. Schibler

This article brings together in a comprehensive way, and for the first time, on- and off-site palaeoenvironmental data from the area of the Central European lake dwellings (a UNESCO World Cultural Heritage Site since 2011). The types of data considered are as follows: high-resolution off-site pollen cores, including micro-charcoal counts, and on-site data, including botanical macro- and micro-remains, hand-collected animal bones, remains of microfauna, and data on woodland management (dendrotypology). The period considered is the late Neolithic (c. 4300–2400 cal. BC). For this period, especially for its earlier phases, discussions of land-use patterns are contradictory. Based on off-site data, slash-and-burn – as known from tropical regions – is thought to be the only possible way to cultivate the land. On-site data however show a completely different picture: all indications point to the permanent cultivation of cereals (Triticum spp., Hordeum vulgare), pea (Pisum sativum), flax (Linum usitatissimum) and opium-poppy (Papaver somniferum). Cycles of landscape use are traceable, including coppicing and moving around the landscape with animal herds. Archaeobiological studies further indicate also that hunting and gathering were an important component and that the landscape was manipulated accordingly. Late Neolithic land-use systems also included the use of fire as a tool for opening up the landscape. Here we argue that bringing together all the types of palaeoenvironmental proxies in an integrative way allows us to draw a more comprehensive and reliable picture of the land-use systems in the late Neolithic than had been reconstructed previously largely on the basis of off-site data.

Keywords: archaeobotany | archaeozoology | Central Europe | niche construction | type of farming | use of fire | wetland settlements

Maise 2005

Christian Maise, *Archäoklimatologie neolithischer Seeufersiedlungen*. In: Detlef Gronenborn (Hrsg.), *Klimaveränderung und Kulturwandel in neolithischen Gesellschaften Mitteleuropas, 6700–2200 v. Chr.* RGZM Tagungen 1 (Mainz 2005), 181–187.

Rösch 1987

Manfred Rösch, *Zur Umwelt und Wirtschaft des Jungneolithikums am Bodensee, Botanische Untersuchungen in Bodman-Blissenhalde*. Archäologische Nachrichten aus Baden **38** (1987), 42–53.

Wie die bisherigen Ausführungen zu zeigen versuchten, wurde im Zuge der jungneolithischen Besiedlung mit Brandschicht- die Waldzusammensetzung großflächig und nachhaltig verändert. Es entstanden ackerbaulich genutzte Flächen und darüber hinaus sammlerisch genutzte Sekundärstandorte. Die große Bedeutung dieser durch Sanimeltätigkeit gewonnenen pflanzlichen Nahrung (Erdbeeren, Himbeeren, Brombeeren, Holzäpfel, Haselnüsse, um nur einige herauszugreifen) legt eine größere Flächenausdehnung der sie beherbergenden Standorte nahe, als dies in der heutigen Kulturlandschaft der Fall ist und als dies auch in der Urlandschaft vor der neolithischen Besiedlung der Fall war. Für die Entstehung dieser Flächen sind zwei Erklärungsmöglichkeiten denkbar: Erstens erzeugen viele kleine Lichtungen mehr Randstandorte fur Gebüsche und Krautsäume als eine große Lichtung gleicher Fläche, und fur enge Nachbarschaft der Felder zum Wald sprechen auch die in Kulturpflanzenvorräten nachgewiesenen Unkräuter. Unter ihnen sind kaum typische Unkräuter heutiger Äcker, sondem hauptsächlich mehrjährige und einigermaßen schattfeste Arten, die heute vor allem an Waldrändern und Ruderalstellen wachsen, wo keine regelmäßige Bodenbearbeitung stattfindet. Zweitens stellen Staudenfluren und Gebüsche mit den erwähnten und anderen nachgewiesenen Arten Übergangsstadien der Rückentwicklung zum geschlossenen Wald dar, wie sie abläuft, wenn man eine gerodete Fläche sich selbst überläßt oder nur noch in ganz bestimmter schonender Weise beeinflußt. Unterbricht man diese sogenannte "regressive Sukzession" nach 15 bis 20 Jahren durch erneuten Einschlag, wird der Übergangs- zum Dauerzustand. Und man erhält mit dieser Art "Niederwaldwirtschaft" gegenüber einem Naturwald – bei etwa gleichbleibender Biomassegesamtproduktion – einen enormen Zuwachs an nutzbaren pflanzlichen Rohstoffen.

Rösch 2011

Manfred Rösch et al., *Spätneolithischer Ackerbau im Experiment, Eine Zwischenbilanz nach zwölf Jahren Forchtenberg*. In: Hans-Rudolf Bork, Harald Meller & Renate Gerlach (Hrsg.), *Umweltarchäologie – Naturkatastrophen und Umweltwandel im archäologischen Befund, 3. Mitteldeutscher Archäologentag 07. bis 09. Oktober 2010*. Tagungen des Landesmuseum für Vorgeschichte Halle 6 (Halle 2011), 175–192.

Manfred Rösch, Harald Biester, Arno Bogenrieder, Eileen Eckmeier, Otto Ehrmann, Renate Gerlach, Mathias Hall, Christoph Hartkopf-Fröder, Ludger Herrmann, Birgit Kury, Wolfram Schier & Ehrhard Schulz

Die seit mehr als zehn Jahren in Forchtenberg durchgeführten interdisziplinären Langzeitversuche haben den extensiven Wald-Feldbau mit regelmäßigem Feuereinsatz als eine praktikable und unter bestimmten Rahmenbedingungen ökonomisch sinnvolle Agrartechnik bestätigt. Es dürfte sich bei dieser bis in die Neuzeit praktizierten Form der Bewirtschaftung also weder um ein "evolutionäres" Zwischen- oder Übergangsstadium auf dem Wege zur Intensiv-Landwirtschaft, noch um ein

gelehrtes Konstrukt aus der Frühzeit der prähistorischen Wirtschaftsforschung handeln. Es ist müßig zu betonen, dass experimentelle Ansätze Hypothesen nur falsifizieren, nicht jedoch verifizieren können. Welche Rolle ein feuergestützter Wald-Feldbau im jüngeren Neolithikum gespielt haben könnte, lässt sich nicht experimentell ermitteln. Immerhin sind durch die Forchtenberger Langzeitversuche jedoch die ökonomischen Vorteile klar hervorgetreten: Extensiver Brandfeldbau kann mit verhältnismäßig geringem und saisonal konzentriertem Arbeitsaufwand erstaunlich hohe Erträge produzieren. Der Aufwand für den Einschlag reduziert sich schon im zweiten Anbauzyklus erheblich, da der aus Stockausschlägen regenerierte Niederwald wesentlich leichter mit Steinbeilen zu beseitigen ist und dabei vergleichbare Brennholzmengen liefert wie der hierfür nutzbare Schwachholzanteil des Primärwalds. Die ertragssteigernde Wirkung des Überbrennens (Mineralisierung in der Biomasse enthaltener Nährstoffe, effektive Unterdrückung der Unkrautkonkurrenz, Anhebung des pH-Wertes, Erhöhung der Bodentemperatur durch stärkere Wärmeabsorption) entfaltet sich vor allem auf Standorten mittlerer und geringerer Bodengüte. Sein größter Nachteil ist zweifellos der hohe Flächenbedarf, weshalb mittel- und langfristig immer eine Tendenz zur Intensivierung durch Verkürzung der Umtriebszeiten bestanden haben dürfte.

Rösch 2014

Manfred Rösch, Angelika Kleinmann, Jutta Lechterbeck & Lucia Wick, *Botanical off-site and on-site data as indicators of different land use systems, A discussion with examples from Southwest Germany*. Vegetation History and Archaeobotany **23** (2014), Supplement, S121–S133.

Off-site pollen data as well as onsite plant macrofossil data from Southwest Germany enable the distinguishing of three main phases of agricultural land use history. The last phase, here simplified called the “Extensive ard phase”, had already started in the Bronze Age and ends in the 19th century A.D. It is characterized by extensive land management, permanent fields with short fallow phases, ploughing, the use of animal dung as fertilizer, and grazed woodlands. The first phase, comprising the Old and Middle Neolithic, is characterized by hoe-farming only on very fertile soils and a very restricted set of crops. For the second phase, comprising the Young, Late and Final Neolithic, a slash-and-burn-like agricultural system is most probable. During the Late and Final Neolithic, this cultivation system with fire use and shifting fields was gradually practised on permanent fields and was modified, leading finally to the “Extensive ard” land use system with fertilizer and ploughing instead of burning.

Keywords: Land use systems | Prehistory | Temperate Europe | Pollen data | Plant macrofossil data

Rösch 2017

Manfred Rösch et al., *Late Neolithic Agriculture in Temperate Europe, A Long-Term Experimental Approach*. Land **6** (2017), xi, 1–17.

Manfred Rösch, Harald Biester, Arno Bogenrieder, Eileen Eckmeier, Otto Ehrmann, Renate Gerlach, Mathias Hall, Christoph Hartkopf-Fröder, Ludger Herrmann, Birgit Kury, Jutta Lechterbeck, Wolfram Schier & Erhard Schulz

Long-term slash-and-burn experiments, when compared with intensive tillage without manuring, resulted in a huge data set relating to potential crop yields, depending on soil quality, crop type, and agricultural measures. Cultivation without manuring or fallow phases did not produce satisfying yields, and mono-season cropping on freshly cleared and burned plots resulted in rather high yields, comparable to those produced during modern industrial agriculture – at least ten-fold

the ones estimated for the medieval period. Continuous cultivation on the same plot, using imported wood from adjacent areas as fuel, causes decreasing yields over several years. The high yield of the first harvest of a slash-and-burn agriculture is caused by nutrient input through the ash produced and mobilization from the organic matter of the topsoil, due to high soil temperatures during the burning process and higher topsoil temperatures due to the soil's black surface. The harvested crops are pure, without contamination of any weeds. Considering the amount of work required to fight weeds without burning, the slash-and-burn technique yields much better results than any other tested agricultural approach. Therefore, in dense woodland, without optimal soils and climate, slash-and-burn agriculture seems to be the best, if not the only, feasible method to start agriculture, for example, during the Late Neolithic, when agriculture expanded from the loess belt into landscapes less suitable for agriculture. Extensive and cultivation with manuring is more practical in an already-open landscape and with a denser population, but its efficiency in terms of the ratio of the manpower input to food output, is worse. Slash-and-burn agriculture is not only a phenomenon of temperate European agriculture during the Neolithic, but played a major role in land-use in forested regions worldwide, creating anthromes on a huge spatial scale.

Keywords: Neolithic agriculture | experimental archaeology | slash-and-burn | temperate Europe

Schier 2009

Wolfram Schier, *Extensiver Brandfeldbau und die Ausbreitung der neolithischen Wirtschaftsweise in Mitteleuropa und Südskandinavien am Ende des 5. Jahrtausends v. Chr.* Prähistorische Zeitschrift **84** (2009), 15–43.

The Neolithication process of Europe is divided into three chronologically distinct stages composed of two phases each. The article differentiates between the cultivation practices of the second (Linear Pottery Culture) and the third stage (beginning of the Late Neolithic in the Alpine foreland and Early Neolithic in the Nordic region) of European Neolithication. In this third stage, slash-and-burn cultivation is believed to have played an important role in exploiting suboptimal farming sites and hence in expanding agriculture beyond established settlements. Palynological as well as pedological and experimental-archaeological data are introduced to substantiate this hypothesis. Finally, possible reasons for the delayed adoption of cultivation practices in the south-west Baltic region are discussed.

Neolithication; slash-and-burn cultivation; economic archaeology; archaeobotany; history of agriculture.

Der Neolithisierungsprozess Europas wird in drei chronologisch deutlich voneinander unterscheidbare Stadien mit je zwei Abschnitten untergliedert. Der Artikel differenziert zwischen der landwirtschaftlichen Produktionsweise des zweiten (Linearbandkeramik) und des dritten Stadiums (frühes Jungneolithikum im Alpenvorland und nordisches Frühneolithikum) der europäischen Neolithisierung. Für dieses dritte Stadium wird dem Brandfeldbau als extensivem Anbausystem eine besondere Rolle bei der Erschließung suboptimaler Ackerbaustandorte und damit bei der Ausweitung der Landwirtschaft über die Altsiedellandschaften hinaus zugeschrieben. Hierfür werden palynologische sowie neue bodenkundliche und experimentalarchäologische Daten erörtert und als Argumente herangezogen. Schließlich werden mögliche Gründe für die verzögerte Übernahme der bäuerlichen Wirtschaftsweise im südwestlichen Ostseeraum diskutiert.

Neolithisierung; Brandfeldbau; Wirtschaftsarchäologie; Archäobotanik; Agrargeschichte.

Schöbel 2010

Gunter Schöbel, *Das Hornstaadhaus, Ein archäologisches Langzeitexperiment 1996– ?* Experimentelle Archäologie **2010**, 85–103.

Styring 2016

Amy Styring, Ursula Maier, Elisabeth Stephan, Helmut Schlichtherle & Amy Bogaard, *Cultivation of choice: new insights into farming practices at Neolithic lakeshore sites.* Antiquity **90** (2016), 95–110.

The high-quality organic preservation at Alpine lakeshore settlement sites allows us to go beyond simplistic reconstructions of farming in the Neolithic. The rich archaeological datasets from these sites may be further complemented by methods such as nitrogen isotope (d15N) analysis of charred crop remains. At Hornstaad-Hörnle IA and Sipplingen, on the shore of Lake Constance in south-west Germany, this method has been used to provide a unique insight into strategies of cultivation such as manuring on both a spatial and temporal scale.

Keywords: south-west Germany | Neolithic | Alpine foreland | agriculture | nitrogen isotopes | archaeobotany