Prehistoric farming in the south-eastern Baltic (Kaliningrad Region, Russia): new data and state-of-the-art

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ABSTRACT – The article presents an overview of the currently available palaeoecological data on the prehistoric anthropogenic impact on the environment and emergence of farming in the south-eastern Baltic, an area poorly studied in palaeoenvironmental and archaeological terms. The recently obtained palynological data from the lake and bog sediments along with the existing archaeological finds allow us to consider several stages of prehistoric farming in the south-eastern Baltic. The first indications of forest management – the creation of open deforested areas, wood burning and probably cultivation (propagation) of hazel appear during the Mesolithic, 10,300–6500 cal BP. At about 6500–5200 cal BP, evidence of the first agricultural activity and local animal husbandry emerges. From 5200 cal BP onwards, farming probably occupies a permanent place in the subsistence strategy of the ancient population of the south-eastern Baltic.

KEY WORDS – prehistoric farming; palynology; subsistence strategies; hunter-gatherers; south-eastern Baltic

Prazgodovinsko kmetijstvo na jugovzhodnem Baltiku (Kaliningrajska regija, Rusija): novi podatki in najnovejše raziskave

IZVLEČEK – V članku predstavljamo pregled trenutno dostopnih paleoekoloških podatkov o prazgodovinskem antropogenem vplivu na okolje in pojavu kmetovanja na jugovzhodnem Baltiku, ki je sicer paleoekološko in arheološko slabo raziskano. Nedavno pridobljeni palinološki podatki iz jezerskih in barjanskih sedimentov omogočajo, skupaj z arheološkimi najdbami, razmislke o večstopenskem prazgodovinskem kmetijstvu na jugovzhodnem Baltiku. Prvi znaki gospodarjenja z gozdovi - ustvarjanje odprtih, izkršenih območij, požigalništvo in verjetno gojenje (razmnoževanje) leske se pojavijo v mezolitiku, 10,300-6500 let pr. n. št. Približno 6500-5200 let pr. n. št. se pojavijo dokazi o prvih kmetijskih dejavnostih in lokalni živinoreji. Od 5200 let pr. n. št. naprej ima kmetovanje verjetno stalno mesto v strategiji preživetja pri prebivalcih na jugovzhodnem Baltiku.

KLJUČNE BESEDE – prazgodovinsko kmetovanje; palinologija; strategije preživetja; lovci-nabiralci; jugovzhodni Baltik

Introduction

Farming as a phenomenon that changed the life of humankind is the subject of intensive study in all regions of the world (Ellis et al. 2021; Dubois et al. 2018). It is particularly complex and of great interest to study this phenomenon outside the area of known early agricultural cultures, in ‘non-steppe’ regions, such as the forest zone of the temperate latitudes of Europe. The last two or three decades have seen a qualitative
leap in our knowledge about the emergence of early agricultural practices in this area. While at the end of the 20th century the general scientific consensus was that farming in this region was not established before the Iron Age (Dolukhanov 1987), palynological and archaeological research in the last two decades has made it possible to document much earlier emergence of farming practices, from the Neolithic period. Some of the earliest datings have been obtained in Germany (6300–6000 cal BP), Scandinavia (7200–6200 cal BP), and Lithuania (6400–6300 cal BP) (Piličiauskas et al. 2012; Alenius et al. 2013; Rösch, Lechterbeck 2016). At the same time, archaeological and palaeogenetic data suggest that in the forest areas of temperate latitudes the life strategies of hunter-gatherers (HG) most likely persisted for quite a long time, at least till the end of the Neolithic (Jones et al. 2017; Miliutin et al. 2018). This is particularly true for the eastern coast of the Baltic Region (the modern territories of the Baltic states), whereas the more southern territories (Germany, Poland) were more actively involved in early farming and agricultural land use processes in the Neolithic (Krista 2009; Jones et al. 2017; Grišpedis, Motuzaitė-Matuzevičiute 2017; Piličiauskas et al. 2017; Minkevičius et al. 2020; Novak et al. 2020). In this regard, the palaeoecological study of the southern part of the Eastern Baltic (Kaliningrad Region, Russia) becomes of great interest since this territory is located at the very edge of the interplay of more southern ‘early agricultural’ and northern ‘hunter-gatherers’ cultural and environmental areas.

The early prehistory of the study area is poorly understood archaeologically due to the lack of detailed archaeological research. Despite the dozens of Stone Age sites discovered during archaeological prospection, their firm cultural attribution is still absent (Druzhinina 2010). Some progress has been achieved in the study of the late Mesolithic – Neolithic Zedmar archaeological complex and culture (Dolukhanov 1975; Timofeev 1996), as well as in the study of the Neolithic – Bronze Age Primorskaya culture (Corded Ware culture group) sites (Pribrezhnoe, Ushakovo) (Zaltsman 2019). The archaeological research carried at these sites included a detailed study of substantial archaeological find collections, dwellings, zooarchaeological material, and use-wear analysis of tools, providing information about the husbandry activities of the ancient population that lived here. Although this information alone is not enough to draw conclusions regarding the emergence of prehistoric farming in the south-eastern Baltic, the combined archaeological and newly obtained palaeoenvironmental data make it possible to consider this issue. The preconditions for prehistoric farming in the south-eastern Baltic have been discussed by Pavel Dolukhanov (1987), Olga Druzhinina (2003), Galina Levkovskaya and Vladimir Timofeev (2004), but it is only in the last few years that more reliable data have been made available to advance the study of this issue.

The aim of the paper is to provide an overview of the existing evidence for the prehistoric farming in the southern part of the eastern Baltic (Figure 1). Recently published results of the Kamyshevovoe and Chistoe lake sediments (Druzhinina et al. 2023) and Kozje peat bog (Napreenko et al. 2021) studies are considered together with the archaeological, palynological and zooarchaeological data obtained earlier from the sites, attributed to the Zedmar and Primorskaya Corded Ware cultures (Timofeev 1996; Zaltsman 2019). This paper is also thought to be a starting point for considering several questions regarding the emergence of prehistoric farming in the eastern Baltic. When did local HG become acquainted with the experience of farming? Was there coexistence with farming communities, and if so for how long, and why did the coexistence of HG and early farmers continue in the area? Were the skills and achievements of both subsistence strategies (hunting-gathering and farming) exchanged, and were the strategies mixed, or is there evidence of one strategy displacing the other? Is there any chance of tracing back agricultural practices (such as the cultivation and propagation of wild plants other than those ‘steppe’ crops brought to the area) to HG? Which factor – climate, cultural influences, demographic processes – proved decisive for the initiation and eventual transition to farming?

**Study area, materials and methods**

At present, the study area is located in a transitional zone from temperate marine to moderate continental climate with mild, variable winters and relatively cool summers. The mean annual temperature in this area is 7.9°C. The mean annual precipitation is around 750mm (Druzhinina et al. 2023).

The palaeoenvironmental data considered in this paper were obtained from the Kamyshevovoe and Chistoe lakes and Kozje peat bog study in 2021–2023 (Napreenko et al. 2021; Druzhinina et al. 2023). We also
refer to palynological studies at Zedmar Palaeolake compiled some decades ago (Levkovskaya, Timofeev 2004). Lake Kamyshovoe (N 54°22'; E 22°42'; 192 masl; 40.8 km²) and Lake Chistoe (N 54°38'; E 22°72'; 202 masl; 17.9 km²) occupy the late glacial depressions within the terminal moraine ridge of the Weichselian (Vistulian) glaciation, while Zedmar Palaeolake (N 54°36'; E 22°04'; 100 masl) is located more at the foot of the morain hills. A hilly relief with a great number of lakes and mires is a characteristic feature of this area. The sediments forming relief are mosaic: glaciofluvial sand, gravel interlayers and boulder loam (till). Pine, fir and mixed forests, as well as alder carrs are the main types of vegetation (Druzhinina et al. 2023). Details geochronological and palynological studies have been carried out at all the locations, with descriptions of the methods used presented in previous papers (Levkovskaya, Timofeev 2004; Napreenko et al. 2021; Druzhinina et al. 2023).

The archaeological materials considered in the article were obtained during excavations of the Zedmar archaeological complex, attributed to the Zedmar culture (Timofeev 1996), as well as Pribrezhnoe and Ushakovo sites belonging to the Primorskaya Corded Ware culture group (Zaltsman 2019). Archaeological research at these sites was complemented by a detailed geochronological and zooarchaeological studies. While the Zedmar archaeological complex is situated at the shores and islands of the eponymous palaeolake, the Pribrezhnoe and Ushakovo sites are located at the shore of the Vistula Lagoon (N 54°38'; E 20°20'; 8 masl). The area is composed of sand and silt underlain by till. Pine forest represents the modern vegetation, while small depressions are occupied by swamps.

Results

Kamyshovoe Lake
The study of the Kamyshovoe sediment sequence (Druzhinina et al. 2023) showed that the first signs of anthropogenic impact on the landscape could be traced to the Mesolithic (Fig. 2A, see below).

The presence of local open spaces in the woods was recorded, as evidenced by the peaks of Artemisia (wormwood), Calluna (heather), Pteridium (bracken fern), Juniperus (juniper), Poaceae (grasses), and so on. A significant amount of Corylus (hazel) found in the pollen record, coinciding with the elevated values of geochemical indicators of wood fuel burning (Ba, Sr) (Druzhinina et al. 2023), supports the idea of the deliberate burning of forest for exploration and mobility purposes, as well as for the propagation of edible and usable plants. Since the Neolithic, the variations in palaeobotanical data indicated much more pronounced land cover instability: the amount of ruderals (Artemisia), dry pastures (Calluna, Pteridium, Juniperus) and wet meadows (Cyperaceae) increased, while the diversity of herbs also rose. Microcharcoal data combined with the pollen data representing ruderals, open habitats, and dry pastures revealed the variable intensity of human activity with peaks at ~6300, 5900, 5700, 5200, 4700, 4300, 4000 cal BP, while TiO₂ as an indicator of soil erosion showed a gradually increasing trend from ~6000 cal BP (Druzhinina et al. 2023). At approximately 6300 cal BP, Plantago lanceolata appeared as a reliable grazing and hay-harvesting indicator. Pteridium peaks

Fig. 1. a Location of the studied area in Europe; b location of the studied sites in Kaliningrad region (south-eastern Baltic, Russia); c regions and sites mentioned in the text: 1 south-eastern Baltic; 2 northern Poland, Dąbki archaeological site; 3 the Balkans.
were noted, coinciding with peaks of microcharcoal and Onagraceae (fireweed). In the Kamyshevovoe sequence, the appearance of Cerealia was noticed since the beginning of the Bronze Age, at ~3800 and Secale at 2800 cal BP. Both intervals were marked by a simultaneous increase in ruderals and Pteridium curves on the pollen diagram.

**Chistoe Lake**
The analyses of the Chistoe lake sediments (Druzhinina et al. 2023) revealed the traces of the anthropogenic impact on the vegetation from the Mesolithic, when a sharp rise of Corylus pollen by up to 25% around 8000 cal BP was recorded (Fig. 2.B). The early farming activities could be traced back to the end of the Neolithic. The first pollen of Cerealia, Centaurea cyanus, and Cannabis-type were found in the samples dated to 4600 cal BP. From this time on the curves for weeds and plants of open habitats tended to increase, as did the curves for cultivated plants; conversely, the pollen spectra for spruce showed a decrease. The decrease in Picea could be due to the fact that coniferous-broadleaved forests, which occupied areas with rich soils, were felled or burnt for arable farming or other purposes. The presence of Chamaenerion angustifolium and Ericales was also detected in the spectrum, and this might indicate the post-pyrogenic character of the birch forests that appear simultaneously in the pollen record, while the presence of Isoetes spores might be an indicator of soil erosion around the lake due to vegetation disturbance (burnt areas, settlements, ploughing, etc.).

Later, in the Bronze Age, and along with the constant and increasing presence of Cerealia, the growing representation of Picea on the background of a decreasing percentage of Betula and Onagraceae were observed. Most likely a change in the agricultural technology took place or other terrains, different from spruce forests, were used for farming activities. The increased amount of segetal (Centaurea cyanus, Chenopodium album, Cannabis, etc.) and ruderal (species of Asteraceae, Chenopodiaceae, Plantago, Polygonum, Urtica, etc.) weeds indicated that the area of arable land was expanding.

**Kozje Bog**
The pollen data from the Kozje Bog (Napreenko et al. 2021) do not provide unequivocal evidence of any anthropogenic impact on vegetation in the Mesolithic, but from the second half of the Neolithic signs of farming are clearly visible (Fig. 2.C). Cereal pollen first appears in the record around 5100 cal BP and does not disappear from the spectrum, except for the time interval around 3500–2600 cal BP. The absence of Cerealia pollen in this period might be related to a change in peat composition in the studied sediments, which may negatively affect pollen grain preservation. It could also be that a change in the water level of the site, recorded in the altered peat composition, forced the population to farm in areas with a more favourable water regime. Secale appears in the pollen spectrum for the first time around 3700 cal BP and is accompanied by a simultaneous peak in Plantago. From 2600 cal BP onwards, Plantago is also consistently present in the spectrum (Napreenko et al. 2021).

**Zedmar Palaeolake and Zedmar prehistoric sites**
The Zedmar Palaeolake is a location where several archaeological sites have been found and comprehensively studied (Timofeev 1996; Levkovskaya, Timofeev 2004). Bones of cattle, goats/sheep found at the Zedmar archaeological complex provided the first zooarchaeological evidence of domestication and small scale local cattle breeding in this part of the Baltic region, from at least ~6000 cal BP. Other important archaeological finds from this site comprise the bone and horn tools for soil tilling, identified by use-wear analysis, and at least, two dozen of these have been found. The earliest dating of the tools is 6950–5550 cal BP (Le-3921) (Timofeev 1996). Pollen of Cerealia and Fagopyrum accompanied by pollen of segetal and ruderal weeds (Brassicaceae, Chenopodium, Plantago lanceolata) was fixed in the cultural layers attributed to different phases of the Neolithic and detected in several locations at the Zedmar complex. The earliest archaeological layer containing Cerealia and Fagopyrum pollen is dated to 5990–5710 cal BP (Le-1389; Bln-2165). Along with Cerealia and the abovementioned segetal and ruderal weeds, hemp pollen was also identified in the samples. Starting from no later than 4400 cal BP Cerealia pollen was constantly present in the records. The layers in which Cerealia pollen was associated with the Corded Ware culture group finds are dated to 4050–3630 cal BP (Le-1520; Le-1255) (Levkovskaya, Timofeev 2004).

**Pribrezhnoe and Ushakovo sites**
Pribrezhnoe and Ushakovo 1–4 sites belonging to the Primorskaya Corded Ware culture group (CWC) embrace the interval of late Neolithic (Zaitsman 2019).
The Pribrezhnoe site is the best studied of these. The thickness of the cultural layer ranges from 0.20 to 0.70m. It is saturated with finds of pottery fragments or crushed vessels, items made of stone and amber, flint flakes, charcoal and fragments of burnt bones. According to Edvin Zaltsman (2019), at an early stage of the settlement’s existence the settlers had gained control over the extraction of amber, which soon became one of the important resources in their livelihood. Archaeological artefacts obtained at the settlement reflect the mixed economy: hunting sea animals, fishing, and farming. The latter is represented by finds of mattocks, quern stones, as well as bones of domesticated animals and the charred grains of *Triticum* found in the pits (Zaltsman, 2000; 2019). The $^{14}$C dates associated with the finds place them into the interval 5250–4850 cal BP (Le-6218; Ki-11352; Ki-10581). Grain grinders were found inside dwellings or directly next to them. They were generally rounded-flattened or had oblong outlines, although elongated pistillate shapes were not uncommon. Round grinders were made from boulders of crystalline rocks. The surfaces of the pestle grinders were well finished, and they were made of light brown sandstone. The millstones were made of sandstone or hard crystalline rock and had a concave working surface (Fig. 3).

Ushakovo 1–4 sites provide evidence for cattle breeding and crop processing: bones and the molar fragment of a cow (*Bos taurus*) and tur (*Bos primigenius*), as well as numerous grinders, grain graters, and pestles, were all found here. The $^{14}$C dates associated with the finds can be placed in the interval from 5100–3750 cal BP (Ki-18096; Ki-18693) (Zaltsman 2019).

**Discussion**

**Stages of prehistoric husbandry**

Recent research provided new data showing the anthropogenic impact on vegetation and landscapes in the south-eastern Baltic since the Mesolithic. The correlation of the results from the Kamyshovoe and Chistoe lakes and Kozje peat bog studies, considered together with the complex of data from the archaeological sites Zedmar, Pribrezhnoe and Ushakovo, allow us to identify several stages in prehistoric farming with increasing anthropogenic pressure (Tab. 1).

The first stage covers a considerable part of the Mesolithic period and the beginning of the Neolithic. At that time localized deforestation occurred, and the forest may have been purposefully burned to enable hunting and mobility, as well as to spread certain plant species, of which hazel was probably the most important. The deliberate burning of the forest to spread hazel (*Corylus*) – which played an important role in the Mesolithic diet, was used for various economic purposes and as fuel – is a phenomenon known in archaeology and palaeoecology (Bishop et al. 2015; Gross et al. 2019). Possibly indicative of precisely this process is the *Corylus* pollen curve in Lake Kamyshovoe, which fluctuates between 20 and 40% throughout the Mesolithic until a sharp decline around 7500 cal BP. The simultaneous high content and peaks of hazel and fern (*Pteridium aquilinum*, up to 18%) in the Kamyshovoe palynological spectrum should also be noted. In its natural habitat, this fern is rarely an aggressively expanding plant, but human activity contributes to its widespread occurrence in burnt areas, abandoned fields and pastures. This phenomenon is also observed in the spore-pollen spectra of Lake Chistoe, although the rise in *Corylus* pollen (up to 25%) is observed later, from 8500 cal BP. The evidence for hazel cultivation and simultaneous forest firing in the surrounding landscape was obtained by studying the palynological data and the...
relevant layers of the archaeological sites situated in
the neighbouring territories of north-eastern Poland
(Wańnik et al. 2020). Here, the intensive use of hazel
is confirmed by the macrobotanical remains of hazel-
nuts and wood found in archaeological layers, while
simultaneous spore-pollen spectra reveal an increase
in the microcharcoal curve and plants of open hab-
itats (Poaceae, Artemisia, Chenopodiaceae, Rumex
(sorrel)) as well as Pteridium aquilinum. It is worth
noting that the fern itself formed part of the Mesolith-
ic diet (Divišová, Šída 2015).

In the next stage, during the first half of the Neolith-
ic period, the intensification of anthropogenic pres-
sure on the environment seemed to be growing. The
increasing number of plants-indicators of anthropo-
genic activity (weed, pasture, and meadow plants)
attests to the larger extent of open spaces and wood
exploitation. Pteridium peaks coinciding with peaks
on the microcharcoal curve, along with Onagraceae
(cypress), appear throughout the period, indicating
continued burning of forests. At the same time, hazel
decreases in the pollen spectrum, but still accounts
for up to 15–20%. This may simultaneously indicate
that the share of hazel in the Neolithic economy was
still significant, but also that forest burning was car-
ried out for purposes other than Corylus propag-
ation. It is interesting to note that the decline in hazel
may be related not only to its use as food, but also as
a source of fibre and raw material for basket weaving.

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**Tab. 1. Stages of anthropogenic impact on the prehistoric landscapes of the south-eastern Baltic.**
and utensils. Indeed, the spread of pottery in the Neolithic may have reduced the need for hazel for these purposes. During this stage the first evidence of husbandry appeared, as represented by the bones of domesticated animals (cattle, goats/sheep) and tools for soil cultivation found at the Zedmar archaeological complex. *Plantago lanceolata*, which is considered to be one of the most reliable indicators of agriculture and, in particular, grazing, is also recorded in the pollen spectrum. The presence of Cerealia pollen in the archaeological layers of Zedmar points to the earliest attempts at cereal cultivation in this period.

In the second half of the Neolithic period, from 5200–5100 cal BP, a new stage of the prehistoric farming activities is observed. It is probably from this period onwards that agriculture started to expand in scale and importance in this part of the Baltic. This is visible in numerous indicators of cereal cultivation: from the pollen records of different sites to archaeological evidence presented by the finds of stone mattocks, grinding stones, pestle grinders and charred grains of wheat. This period is characterized by continuing anthropogenic pressure on landscapes. The number and variety of indicators of anthropogenic activity (*Plantago, Artemisia, Chenopodium, Cirsium, Taraxacum*, etc.) is increasing, and the number of microcharcoal as indicator of forest clearing and other activities is also growing. It is important to note that during this period (around 4600–4200 cal BP) a visible decline of *Corlylus* is observed in the pollen records of the Kamyshevoe and the Chistoe lakes. One might assume that at this stage a significant change in subsistence strategy took place, and the role of traditional resources, such as hazel, diminished and the proportion of other resources, such as cultivated grasses, increased.

**Emergence of agriculture in the south-eastern Baltic in the light of multi-proxy data**

A widespread scientific paradigm explains the emergence of agriculture in the forest zone of Europe as an integral part of the process of Neolithization, which included the introduction of agricultural crops, appropriate implements for tillage, and a sedentary lifestyle by adventurous cultures of agriculturalists and pastoralists (*Oross et al. 2020*). However, the degree and forms of adaptation of the Mesolithic and the Neolithic HG populations to the latest cultural and socio-economic changes connected with the introduction of land-use remain open, despite decades of scholarly debate (*Divišová, Šída 2015; Piličiauskas et al. 2017*). The term ‘Forest Neolithic’ is used to characterize the cultural and socio-economic processes taking place in the temperate forest zone of Europe (and especially in the Baltic), implying the preservation of the HG lifestyle, but using pottery and small-scale animal husbandry (*Wačnik et al. 2020*). Morten E. Allentoft et al. (2022) reveal profound differences in the spatiotemporal Neolithization dynamics across Europe, documenting a broad east-west distinction along a boundary zone running from the Black Sea to the Baltic. While to the west of this line the Neolithic transition was accompanied by large-scale shifts in genetics from local HG to farmers with Anatolian-related ancestry, to the east of this divide no ancestry shifts were observed until 5000–4800 cal BP. For the territory of the southern part of eastern Baltic situated at the edge of the southern ‘early agricultural’ areas, the scientific issue of the Mesolithic and the Neolithic HG adaptation to the changes associated with the introduction of agriculture, becomes particularly interesting.

The results of regional palaeogenetic studies carried out in recent years allow us to consider the available palaeoecological and archaeological data in a new light (*Jones et al. 2017; Mittnik et al. 2018*). The research carried out on the anthropological materials of the eastern Baltic showed that carriers of the Mesolithic, and later Neolithic, HG genome continued to exist in the eastern Baltic area longer than in the rest of Europe, without the infusion of external genetic component (*Mittnik et al. 2018*). The study of extensive local anthropological material has revealed that the infusion of genes of agricultural cultures did not occur before the late Neolithic and it is associated with the population of the Corded Ware culture (*Mittnik et al. 2018*). In the archaeological understanding, this means that the transition from the Mesolithic to the Neolithic in the eastern Baltic does not coincide with a large-scale change in population and a dramatic change in economy, as observed in Central and Southern Europe. There, for instance, in the neighbouring Poland, Neolithic communities of farmers represented by the Linear Band Pottery culture (Linearbandkeramik, LBK), appeared much earlier, around eight to seven thousand years ago (*Nowak et al. 2020*).

Meanwhile, all late Neolithic individuals from the Baltic (dated to c. 5150–3700 cal BP) already carry the genetic component that was introduced into Europe with the pastoralist migration (an admixture be-
between Early and Middle Bronze Age pastoralists from the Yamnaya culture of the eastern Pontic Steppe and Middle Neolithic European farmers) in varying amounts, and the majority also carries the component associated with Anatolian farmers (Mittnik et al. 2018). Therefore, we can probably assume that changes in subsistence strategy of the south-eastern Baltic society observed by palaeoecology and archaeology, and related to the increasing role of agriculture from about 5200–5100 cal BP onwards, can be connected to the inflow of a new population: agriculturalists from the Coded Ware culture (Tab. 1).

There is another important outcome of this palaeogenetic result. In the palaeoecological understanding it can mean that the traces of the prehistoric farming such as deforestation, animal husbandry, soil tilling, cultivating of plants, dated prior 5200–5100 cal BP may be associated with the local Mesolithic and Neolithic HG, that is, representatives of the ‘Forest Neolithic’. With regard to this, the following issues arise: How did the process of incorporating agricultural practices into the lifestyle of the local indigenous population take place? Moreover, was there a possibility and necessity, even before the arrival of agriculturalists, to practise, along with animal husbandry, the local-scale cultivation of plants (e.g., cereals)?

In order to move forward on these questions, it is necessary to elaborate on the role of plant resources in the life of HG and, separately, on the possibilities of domestication of wild cereals from the Mesolithic onwards in the broader context of Europe. The overview presented by Michaela Divišová and Petr Šída (2015) is one example of an exhaustive review of the botanical macroremains found in Mesolithic settlements, demonstrating how large and diverse the number of plant species constituting the diet of HG was, as well as the wider human use of plants, such as for housing, vessels, sources of fibres for cordage and textiles, dyeing, medicinal use, etc. Even if we narrow the importance of plant resources among HG to food, research in the last decade shows how large this role may have been. At least several tens of plant species represented by seeds, fruits and nuts (Gorytus avel- lana, Sambucus sp., Quercus sp., Trapa natans, Ru- bus sp., etc.), roots, tubers and rhizomes (Pteridium aquilinum, Typha latifolia/angustifolia, Allium sp., Sagittaria sagittifolia, Polygonum sp., Phragmites australis, Schoenoplectus lacustris, Nuphar lutea, etc.), as well as parts of plants, which could have been used as green vegetables (Chenopodium album, Ur-

tica dioica, Phragmites australis, Rumex crispus, Rumex sp., Atriplex sp., Stellaria media, Polygonum sp., etc.) are detected in the archaeological context of the Mesolithic and the Neolithic (Divišová, Šída 2015). The latest data on plant microresidue, starch and phytoliths in the teeth of buried people in the Balkans dating from the Palaeolithic and Mesolithic (Cristiani et al. 2016; 2021) have called into doubt the ‘deep-rooted idea that the diet of hunter-gatherers during the Palaeolithic and Mesolithic periods primarily consisted of animal proteins. In addition, it highlights the active role the eating habits of foragers might have played in introducing certain domesticated plant species that have become primary staples of our diet today’ (Cristiani et al. 2021). These researchers give an extra value to this whole issue by suggesting that in the Balkans foragers were already consuming certain species of wild cereal grains 11 500 years ago, before agriculture arrived in Europe. This also provides further justification for revisiting the palynological evidence of the Mesolithic cultivation of cereals, which exists in many parts of Europe, from France to Estonia, but so far has not been adequately used when considering questions of early farming (Divišová, Šída 2015).

The results of Emanuela Cristiani et al. (2016) also showed that several millennia before the introduction of agriculture to Central Europe the Mesolithic population there was already eating domesticated cereals (Triticum monococcum, Triticum dicoc- cum, Hordeum distichon), which means that cereals entered the diet of HG as a result of exchange or ‘trade’ with crops-farmers from Southwest Asia separately from the other ‘attributes’ of Neolithization. Researchers argue that domesticated plants were transmitted independently from the rest of the Neolithic novelties from 8600 cal BP onwards, reaching Balkan foragers through established social networks between them and farmer groups. The question arises as to what extent cultural and economic ties may have spread far and wide from the regions with early consumption of domesticated cereals such as, for example, the Balkans. Could it be that the knowledge and experience of consuming domesticated cereals was spread as far as to the Baltic or other distant territories? The answer to this can be illustrated, for example, by archaeological discoveries made at the prehistoric settlement of Dąbki in northern Poland (the Baltic Region) (Kabaciński et al. 2015). This settlement is a key studied site existing during the period of transition from the Mesolithic to the Neolithic.
on the Baltic Sea coast around 6800–5500 cal BP. The interdisciplinary research showed that the site was probably the centre of regular long distance exchanges of goods and products (fur, amber) with the more southern territories, as evidenced by the finds of pottery from numerous cultures, including those from the Balkans, imported over distances of c. 900 km. The sharing of knowledge between the early agricultural societies and foragers about plant resources may thus have helped introduce domesticated plant species into forager societies in Central Europe, and there did not seem to be any obstacles to the further movement of this knowledge across long distances.

Assuming that the consumption of plant resources, including wild or domesticated cereals, occupied a certain (essential?) place in the subsistence strategy of the Mesolithic and Neolithic forest population of the Baltic region, the mechanism which ensured the flexibility and adaptability of their lifestyle, enabling the local population to maintain it for thousands of years in the changing climate and landscapes of the Early and Middle Holocene (Borzenkova et al. 2015), becomes clearer. It is likely that it were not “the incidental and opportunistic use of plants for food”, but “patterns of plant use... in terms of wild plant food husbandry” (Divišová, Šída 2015), and, probably, this is exactly what is reflected in the numerous traces of human activity detected by palaeoecological studies in the south-eastern Baltic in the Mesolithic and the first half of the Neolithic, before the appearance of farmers from the south and east. If early farming was indeed practised by the local population, this may have played a role in the fact that the increase in the proportion of cultivated cereals in the diet and then the transition to larger-scale farming from the late Neolithic period with the arrival of the Corded Ware culture population appeared more natural and integrated into the existing way of life. This assumption is probably reflected by the second important outcome of the palaeogenetic analysis, showing that after the migration of agricultural cultures to the Baltic area “local foraging societies were, however, not completely replaced and contributed a substantial proportion to the ancestry of Eastern Baltic individuals of the latest Neolith and Bronze Age” (Mittnik et al. 2018). The researchers conclude that this ‘rebirth’ of HG ancestors in the local population through mixing between foraging and farming groups resembles the same phenomenon observed in the European Middle Neolithic and is responsible for the unique genetic signature of modern Eastern Baltic populations.

Obviously, research into the problem considered in this paper and further progress in understanding of the role of plant resources in HG subsistence strategies, plant cultivation by HG and the importance of this for the development of agriculture in the forest zone will require not only a broader base of archaeological evidence with regard to the presence or absence of ‘early agricultural’ cultures in the area (Linear Band Pottery, Funnel Beaker, Corded Ware). Perhaps even more important is the expansion of analytical methods in solving this problem. Besides the application of a wide range of palaeobotanical methods (pollen, macroremains, phytoliths, etc.) to culture-bearing layers and palaeoenvironmental sequences, re-evaluation and additional research of the available anthropological material by microresidue, starch and phytolith analysis is also possible. Phytolith analysis can also be successfully applied at the archaeological sites with a sandy culture-bearing layer (which is probably the majority in the Baltic), in which organics are not preserved (Piperno 2006; Golyeva 2008). But the most important thing is to keep in mind the idea that our ancestors may have had versatile applied knowledge of the environment which enabled them to actively participate in the transformation of landscapes and to build adequate subsistence strategies, involving not only hunting, fishing and animal husbandry, but also the cultivation and use of plant resources.

Conclusions

The recently obtained palaeoecological data leads to new insights about the anthropogenic impact on landscapes and ‘early farming’ activities in the south-eastern Baltic region and allows us to assume the existence of three major stages in the husbandry of the prehistoric population in this area.

The first stage covers most of the Mesolithic and the beginning of the Neolithic periods, 10 300–6000 cal BP, and provides indications of forest management with the creation of open deforested areas, wood burning and probably the cultivation (propagation) of hazel as one of the most important plant resources of the Mesolithic. Then, in the first half of the Neolithic, from about 6500–6000 cal BP, evidence of the first agricultural activity and local animal husbandry emerges, with tools for tillage, palynological evidence of plant cultivation and soil erosion, and bones of domesticated animals. Later, from 5200–5100 cal BP onwards, farming probably occupies a perma-
nent place in the subsistence strategy of the ancient population of the south-eastern Baltic. The spread of agriculture in the third stage is most likely associated with the farmers of the Corded Ware culture.

Undoubtedly, the accumulation of data from archaeological, palaeobotanical and palaeogenetic disciplines will help to significantly correct and detail the picture we have at the moment.

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Prehistoric farming in the south-eastern Baltic (Kaliningrad Region, Russia): new data and state-of-the-art

Fig. 2. Vegetation dynamics against historical periods inferred from the pollen data of Lake Kamyshovoe (A), Lake Chistoe (B) and Kozye Bog (C). After Druzhinina et al. (2023) and Napreenko et al. (2021).
Fig. 2. Continued
Prehistoric farming in the south-eastern Baltic (Kaliningrad Region, Russia): new data and state-of-the-art

Fig. 2. Continued