People, Pots, Words and Genes

Multiple sources and reconstructions of the transition to food production in eastern Africa

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ABSTRACT

This chapter provides a review of the currently available archaeological evidence relating to the transition to food production in eastern Africa, and some of the supporting linguistic and genetic evidence. In broad terms, livestock herding preceded crop cultivation in the region, with an initial emphasis on sheep and goats, commencing around 4500 to 5000 years ago. By around 3000 years ago, full-blown pastoralist societies with an emphasis on cattle herding occupied much of the savannah areas. From ca. 2500 years ago, metal using farming communities, practicing hoe cultivation of roots crops and cereals were also present, interacting with both pastoralist and autochthonous hunting-gathering-fishing communities. These interactions gave rise to diverse ethnic mosaics, alongside extensive genetic and linguistic exchanges.

KEYWORDS

Early Farming and Herding, East Africa, Archaeology, Historical Linguistics, Population Genetics

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1. INTRODUCTION

The development and spread of farming and herding in sub-Saharan Africa was a long, drawn-out and uneven process spanning many millennia with many stops and starts. It entailed the local domestication of different plant species, and the introduction and adoption of domesticated animals and plants from other continents (Fuller and Hildebrand 2013; Gifford-Gonzalez and Hanotte 2011). The timing of these introductions and the rates of their adoption and direction of spread varied widely. Knowledge transfer, innovation, demographic expansion and migration all likely contributed but in varying degrees depending on local and regional contexts. Climatic factors, along with variations in soils, vegetation and surface water availability undoubtedly both enabled and shaped these responses. The distribution in human- and animal- diseases and their vectors also potentially influenced the direction and rate of spread, especially among herding communities (Gifford-Gonzalez 2000). Consequently, the manner in which different domesticated plants and animals were combined as part of a farming system, the degree of continuing reliance on gathered and hunted wild species of plants and animals, and the relative dietary contributions of marine and lacustrine foods, all varied widely (Marshall and Hildebrand 2002). This chapter explores some of the evidence for these processes currently available from eastern Africa, here defined as encompassing the modern nation states of Kenya, Uganda, Tanzania, Rwanda and Burundi, and immediately adjacent parts of Somalia, Ethiopia and South Sudan.

The essay begins with a review of the archaeological evidence concerning eastern Africa’s pre-farming, Late Stone Age (LSA), hunting-gathering-fishing populations (hereafter HGFs, or ‘foragers’), before turning to consider the material record of the early, Pastoral Neolithic (PN) herding populations and Early Iron Age (EIA) societies (also referred to as Early Farming Communities, or EFCs). Having reviewed the archaeological evidence, the correlation of these datasets with the evidence of regional historical linguistic data and population genetics is discussed with reference to relevant palaeoecological data.

Overall, three broad points will be made. First, no single model of the transition to food production can account for either the observed variability in these records or in the timing and rate of adoption of domesticated plants and animals. Secondly, the currently available data are spatially and temporally unevenly distributed and key lines of evidence, especially relating to crop cultivation, are often lacking and so weaken interpretive arguments regarding the degree of correlation between archaeological, linguistic and genetic evidence. And finally, the influence of pre-farming HGFs on the direction and rates of spread of food production in the region, and their subsequent contributions to regional economies has been insufficiently studied.
The overall conclusion to be drawn from these arguments, therefore, is the need for much more coordinated and targeted cross-disciplinary, collaborative research on the topic.

2. PRE-FOOD PRODUCING SOCIETIES

During the terminal Pleistocene, eastern Africa was characterised by cold, dry conditions between ca. 12,700 and 11,800 years Before Present (BP) (Timm et al. 2010). At the start of the Holocene, roughly 11,700 years ago, regional temperatures and rainfall rose quite rapidly, with a corresponding increase in lake levels, expansion of montane forests into lower altitudes, and a reduction of savannah grasslands in favour of bush and woodland habitats, lasting to ca. 5000 BP (Kiage and Liu 2006). This period is often referred to as the African Humid Period. Regionally, the shift toward more mesic habitats seems to have stimulated demographic and geographical expansion of different groups of LSA hunting-gathering-fishing populations, who exploited a variety of different ecological niches, including the coastal plains, savannah grasslands, and tropical and montane forests (Kusimba 2013).

More arid conditions returned after the mid-Holocene starting ca. 4500 BP, with gradual or more punctuated regional drying until ca. 2700 BP, when the climate became more variable. For the Late Holocene, significant alternating fluctuations between wetter and drier conditions occurred, broadly relating to global trends but with regionally specific characteristics. Overall, the trend appears to have been toward wetter conditions for much of inland East Africa after peak drought conditions ca. 2050-1800 BP (Battistel et al. 2016). There was a further phase of aridity ca. 950-680 BP, roughly corresponding to the northern hemisphere Medieval Climate Anomaly, followed by wetter conditions from ca. 680 to 200 BP, with localised variations and anomalies (Gelorini and Verschuren 2013).

Archaeological research on the region’s Holocene LSA foragers, although uneven, indicates considerable variation in their food procurement strategies, prey choices and settlement dynamics. Lacustrine and riverine settings were rich in food resources, and as a consequence were a focus of HGF activities and settlement. Ecotones, the boundaries between different habitats, were also favoured locations, especially the boundary between montane forests and savanna. Coastal locations were also exploited, although significant sea level rise since the height of the Last Glacial Maximum between ca. 23,000-18,000 BP, when global sea levels were ca. 120 m lower than currently, has submerged much of the early to mid-Holocene coastline. The surviving sample of coastal LSA sites, therefore, may not be entirely representative.

In terms of stone tool technologies, LSA assemblages from different sites exhibit differences across several variables, including ratios of local versus
non-local raw material, flaking technique, typological composition, tool-to-waste/debitage ratios, artefact morphometric characteristics, and tool use/curation. Most LSA lithic assemblages exhibit Mode 5 technological characteristics as defined by Clark (1961), and a preference for blade or bladelet production, geometric microliths (especially crescent and segment forms), backed tools and convex scrapers. However, none of these are universally diagnostic and researchers have identified several later LSA stone tool industries with variable temporal and spatial ranges (Wilshaw 2016; Ménard and Bon 2015). These include the Kiteko, Lemuta, Silale, Olmoti, Eburran, and Wilton industries, among others. Of these, the best known are the Eburran (formerly encompassed within the Kenyan Capsian) and Wilton industries (Leakey 1931; Barham and Mitchell 2008).

The Eburran comprises five phases (Eburran I-V) dated to between ~12,700 B.P. to ~1800 BP (Ambrose 1998), and is associated with forager sites in the Central Rift Valley, typically those located along the montane forest–savanna grassland ecotone (Ambrose 1985). Detailed morphometric and typological studies indicate that the technology was oriented toward the production of fairly standardized, replaceable and disposable tools which suggests planned tool-production and use, rather than more a more opportunistic technology (Slater 2016). Faunal assemblages from Eburran V sites such as Enkapune ya Muto and Maasai Gorge indicate a preference for small- and medium-sized bovids and other forest and forest-savanna game, possibly more frequently caught by trapping and snaring (Ambrose 1984; Marean 1992). Honey collecting may have also been a significant component of annual subsistence strategies. The division between Eburran IV and V, the final phase, is dated to around 4,500 BP. This broadly coincides with the appearance of domestic livestock in central and western Kenya, and Eburran V lithic material is often found in association with ceramics. Whether these ceramics were produced by Eburran foragers, or were obtained through exchange with early pastoralists is uncertain, however.

Further west, around Lake Victoria but with a distribution that includes sites in the Eyasi basin, northern Tanzania, another distinctive, pottery-using, HGF tradition emerged around 8300 BP and ending ca. 2600 BP. Known as Kansyore (also Oltome) after the type site on the Kagera River (which forms the boundary between modern-day Uganda and Tanzania), Kansyore sites include relatively large open-air settlements, commonly located near fast-flowing rapids (e.g. Kansyore Island, Uganda; Gogo Falls and Wadh Lang’o, Kenya), lake-edge shell-middens (Pundo, Usenge 1, Kanem and White Rock, Kenya) and rock-shelters (e.g. Mumba Cave, Tanzania; Rangong, Kenya). The main concentration of Kansyore sites is around the eastern sides of Lake Victoria. Sites here indicate a distinctive focus on lacustrine and riverine resources, with fish (and shellfish at lake-edge sites) dominating faunal assemblages. Early Kansyore HGFs were probably quite residentially mobile,
shifting toward a semi-sedentary settlement and food procurement system overtime, with seasonal use of lakeshore settlements during the dry season (Dale et al. 2004; Prendergast 2010). As on Eburran V sites, domestic caprines appear on Kansyore sites in low numbers after ca. 4400 BP (Lane et al. 2007). Diachronic shifts in ceramic style and production are loosely correlated with some of these changes (Ashley and Dale 2010).

Early to mid-Holocene (c. 9000-4500 BP) HGFs are also well attested in the north of the region around Lake Turkana at sites such as Lothagam and Lowasera. Key material characteristics of these sites, aside from an emphasis on fishing and exploitation of other aquatic resources such as hippopotamus and crocodile, include the presence of a distinctive style of wavy line and dotted wavy line pottery, and numerous bone harpoons (Angel et al. 1980; Barthelme 1985). Analyses of faunal remains from such sites indicate an initial focus on Nile perch and cichlids, probably exploited on a seasonal basis by small hunting parties visiting the lake shore (Stewart 1989). As the lake level fell with the onset of drier conditions in the mid-Holocene (Wright et al. 2015), these HGFs expanded the range of species they exploited.

The wavy-line pottery associated with these sites is stylistically similar to ceramics from Khartoum Mesolithic sites along the Nile and on early Holocene HGF sites in the eastern Sahara (Hoelzmann et al. 2001), leading some to suggest possible cultural affiliations between the different groups, as most notably suggested by Sutton (1974) in his proposition for the existence of an Early Holocene ‘aquatic civilization’ spanning much of what is now the southern Sahara. While Sutton’s concept was subsequently fiercely criticised, the existence of a common adaptive strategy and supra-regional similarities in material culture traditions is now generally accepted even if some of the original correlations made between the distribution of these sites and linguistic groupings now seem less tenable.

3. BEGINNINGS OF FOOD PRODUCTION IN EASTERN AFRICA

The earliest form of food-production in eastern Africa was pastoralism (Marshall and Hildebrand 2002), attested first around 5000-4500 BP by the presence of remains of domestic cattle, sheep and goats at open-air sites such as Dongodien, Ilert and North Horr, located along the shores of Lake Turkana and Lake Chalbi, northern Kenya (Wright et al. 2015). These domesticates were introduced by mobile pastoralist communities that had occupied areas further north during the early to mid-Holocene while rainfall across the Sahara was significantly higher than it is today, creating numerous lakes, swamps, and permanent and seasonal rivers (Kuper and Kröpelin 2006). The latter areas were exceptionally resource rich, and attractive centres of HGF settlement during the Mid Holocene Climatic Optimum. These ‘complex HGF’
societies produced pottery, were semi-sedentary, had delayed return subsistence economies, and relied extensively on the wide range of wild plant foods available. Many eventually integrated domestic livestock into their pre-existing broad spectrum, riparian subsistence economies, and were accustomed to manipulating their immediate environment to enhance its productivity (Smith 1992; Haaland 1995). As climate changed and conditions in the Sahara moved towards the hyper-aridity the region experiences today, these communities would have been displaced. Some groups moved south, bringing with them knowledge of livestock herding, while others possibly moved east into the Ethiopian highlands and beyond.

In regional archaeological terminology, the arrival of early herding groups around Lake Turkana marks the start of the Pastoral Neolithic (PN). As well as being the first groups in the region to integrate domestic livestock into a broad spectrum, riparian economy, PN communities used pottery (although, as noted above, they were not the first to do so in the region), and employed typical LSA technologies for the manufacture of edged tools, often with a preference for obsidian as the main raw material (Wright et al. 2015). Although shown by chemical analysis to be obtained from local sources also exploited by Lake Turkana’s mid-Holocene HGF populations, early PN groups used different stone tool manufacturing techniques (Ndiema et al. 2011). This period also witnessed the first appearance of stone bowls made from lava, pumice, and similar ‘soft’ rocks. These changes in material practices all lend support to the hypothesis of population migration into the Lake Turkana Basin and the case for these newcomers bringing domesticated livestock with them and new ways of exploiting the landscape. It is notable also that new forms of inhumation burial marked by large stone monoliths, as at Jarigole and Lokori, also appear between ca. 5000 and 4000 BP (Grillo and Hildebrand 2012). Although none of the known examples are directly associated with settlements, one possible interpretation of these sites is that they functioned as ‘gathering places’ for various ritual practices aimed at reinforcing social networks between different mobile and possibly widely dispersed communities.

Further south in the central Rift Valley and eastern highlands of Kenya, as noted above, the earliest traces of domestic livestock typically first occur in rock-shelters associated with LSA hunter-gatherers around ca. 4000–3500 BP (Marean 1982; Ambrose 1998) and at some Kansyore sites around Lake Victoria (Robertshaw 1990; Karega-Müñene 2002; Prendergast 2010). South and east of these localities, evidence for the presence of specialised pastoralist economies is documented at several sites in the Tsavo and middle Sabaki River areas of southeast Kenya by ca. 3800–3700 BP; the Maasai Mara, southwestern Kenya by ca. 3200–2100 BP; and in the open woodlands and grasslands of the Serengeti Plains, the western slopes of Mt. Kilimanjaro, and around the Lake Eyasi basin, Tanzania by mid- to late first millennium BC (Prendergast 2011).
This geographical patterning has generally been considered to indicate the formation of a pastoralism-HGF ‘frontier’ south of the Serengeti/Lake Eyasi areas, that was only breached after the consolidation of pastoralist economies and land-management strategies further north (Gifford-Gonzalez 2000; Marshal et al. 2010; Lane 2013). New research in northern Tanzania challenges this hypothesis, particularly with the discovery of occurrences of domestic taxa and associated PN material culture dating to ca. 4000-2900 BP at the site of Luxmanda (Prendergast et al. 2013). The results of isotopic analyses on fauna from PN sites in central and southern Kenya (Chritz et al. 2015) add further insights. Specifically, in the absence of detailed palaeoecological data, it has been generally assumed that extensive areas of woody bush and scrub ideally suited for hosting tsetse fly (Glossina sp.), the primary biological vector for human sleeping sickness and animal trypanosomiasis, created a barrier to the southward expansion of PN herding communities. The new isotopic data, however, indicates that some of the areas previously thought to have been woody, were dominated instead by C4 grasslands well suited to a pastoralist economy.

Further research is nonetheless needed to refine current understanding of the rate, direction and drivers of the spread of livestock herding into southeastern Africa. As Gifford-Gonzalez (2000; 2015) has noted, the majority of faunal assemblages from early PN sites in the Central Rift, the Lake Victoria Basin and adjacent localities indicate that wild fauna provided a significant contribution to annual diets, and an overall predominance of caprines over cattle on early PN sites. Moreover, it is only really after ca. 3000 BP that sites become significantly larger and more obviously associated with cattle herding, Luxmanda being an important exception. The geographical distribution of various disease vectors, especially tsetse fly, would certainly have constrained initial settlement to certain areas and restricted expansion until the development of more disease resistant herds and/or new strategies had been adopted for manipulating habitats so as to limit infection (Gifford-Gonzalez 2000). In this regard, ecological processes of landscape domestication arising directly from recurrent abandonment of pastoralist encampments with dense concentrations of animal dung (Boles and Lane 2016), may have played a critical role.

It is clear, also, that pioneer PN communities interacted with autochthonous LSA foragers (Lane 2004; Prendergast 2011), and the nature of these relationships may well have either hindered or facilitated the development of full-blown herding economies in different areas (Kusimba and Kusimba 2005; Wright 2007). It is important to stress, also, that the term ‘Pastoral Neolithic’ masks considerable diversity regarding not just the relative importance of livestock in subsistence strategies but also preferred ceramic styles; the range of formal stone tools, flaking techniques and debris; site distributions and placement within the landscape; and associated burial practices and forms (Marshall et al. 2011; Lane 2013). In some areas, such as around Lake
Turkana and south-eastern Lake Victoria, PN communities clearly included fishing as part of their subsistence strategies (Marshall and Stewart 1994), and as more research is undertaken evidence for additional adaptive strategies may yet emerge.

From ca. 3000 BP, two broad cultural traditions, known as the Savanna Pastoral Neolithic (SPN) and Elmenteitan, can be discerned across much of the eastern Lake Victoria basin, the Central Rift Valley and adjacent highlands, the Serengeti Plain, and the foothills of Kilimanjaro, partly in terms of material culture differences, settlement locations, and herd management strategies (Marshall et al. 2011; Lane 2013). In general terms, faunal assemblages from both Elmenteitan and SPN sites tend to indicate a commitment to cattle- and sheep/goat pastoralism among both societies. There is, nonetheless, some internal diversity and differing degrees of dependence upon domestic herds, ranging from a generalized pattern of hunting, fishing, gathering, and herding to specialized livestock production in both traditions. For example, the remains from Gogo Falls (Elmenteitan) include a significant wild component and evidence for extensive exploitation of fish, while the faunal assemblage from Prolonged Drift (an SPN site) in central Kenya also has a significant wild component. This site may even represent evidence of former foragers in the process of acquiring stock and ‘becoming’ herders. However, it is also clear that at least some herding communities, as at Ngamuriak and Sugenery in the Maasai Mara (Kenya), were able to sustain a subsistence pattern dependent almost exclusively upon domestic stock, which may have been facilitated in part by the emergence of a bimodal rainfall regime around this time (Marshall et al. 2011).

4. EARLY FARMING COMMUNITIES

Sometime around ca. 2500 BP, new ceramic traditions begin to appear in the west of the region. These belong to what is known in archaeological terminology as the Chifumbaze Complex, and date to between ca. 2500 BP and 1000 BP (Phillipson 1977). The appearance of this new ceramic tradition is commonly believed to be associated with the introduction of crop agriculture linked to the arrival of Early Farming Communities (EFCs) and the first speakers of Eastern Bantu languages (also referred to as ‘Mashariki’) in the region, having migrated from a proto-Bantu ‘homeland’ in northern Cameroon – southern Nigeria (Ehret 1998). EFC sites are also associated with material evidence for the first use of metals in the region (Mapunda 2013), hence the older designation of these sites as part of the Early Iron Age (EIA). Archaeologists have sought to classify EFC ceramics principally in terms of formal and stylistic variations.
The earliest dated sites are those on which Urewe ware occurs, initially to the west of Lake Victoria, concentrated around Buhaya, Tanzania, and the Kivu-Rusizi River region in Rwanda/Burundi (Van Grunderbeek and Roche 2007). From the distribution of Urewe ceramics and iron smelting remains, by ca. 1800 BP EFC communities were present east of Lake Victoria in areas of modern-day western, central and coastal Kenya, and northern and coastal Tanzania. The spread of EFC communities along the coast was by no means uniform, however. The presence of Kwale ware (a typological development from Urewe ware) in the Rufijii River delta region dates to ca. 2200 BP (Chami 1998), for example, and similar dates have been obtained in association with Kwale/Matola ware from southern Mozambique (Ekblom et al. 2014). These comparatively early dates suggest that the spread of new innovations on the southern coast was remarkably rapid. In contrast, systematic survey work further north has yielded limited evidence for LSA material on the coastal lowlands, and on current evidence, no EFC sites are known on the coastal littoral of Kenya prior to ca. 1300 BP (Helm et al. 2012), and EFC occupation of the nearshore islands may have been even later.

It is generally assumed that EFC populations were mixed farmers, who placed rather more emphasis on crop cultivation than on herding. This is suggested by a preference for settlement locations close to better watered areas along the intersection between sub-montane forest and woody savanna (MacLean 1994/5). Actual evidence for subsistence strategies from Urewe sites is quite rare, however. Regarding faunal assemblages, important exceptions include the sites of Gogo Falls and Wadh Lang’o and Usenge 3 (Nyanza Province, Kenya), from which evidence for the exploitation of both cattle and small-stock has been recovered, and a number of recently excavated sites on the East African coast. These include the open air site of Mgombani (dated to ca.1290–1060 BP), southern Kenya and Panga ya Saidi, a large limestone cave in the nearby Dzitsoni Uplands likely occupied by terminal LSA hunter-gatherers (Helm et al. 2012). These latter sites provide some of the best evidence, also, for the range of cultivated crops. Grains of domesticated sorghum, pearl millet and finger millet and baobab seeds were recovered from both sites, and legume seeds are known from Mgombani. In Rwanda, the remains of pearl millet, sorghum and legumes (most probably cowpea) have been found at Kabusanze, an EIA settlement dated to ca. 1550 BP associated with classic Urewe ceramics (Giblin and Fuller 2011). Additionally, historical linguistic data attest to a knowledge and practice of yam cultivation among EFC societies (Philippson and Bahuchet 1994/5), although recovery of direct archaeological evidence for their presence has been elusive.

The mechanisms, timing and routes by which knowledge of farming and metalworking spread have also been much debated (de Maret 2013; Ricquier 2014; Russell et al. 2014). Whereas older models tended to imply quite signif-
significant and large scale population migration, the processes involved were likely highly varied. It is, nonetheless, clear from palaeoecological research that the arrival of early farming and metal-using communities roughly coincided with the onset of drier conditions across the African Great Lakes region between ca. 2050 and 1800 BP (Battistel et al. 2016). This may have facilitated the establishment of farming settlements by opening up areas of previously forested land, while the increased demand for timber for house construction, cooking and charcoal production for iron smelting may have further transformed the landscape. This moving agricultural frontier was possibly facilitated by a preference for swidden (slash-and-burn) agriculture. Whether increased demand for wood coupled with swidden agriculture triggered extensive deforestation and soil erosion, as some have hypothesised, needs further coordinated research. Geoarchaeological studies, nonetheless, do suggest that in upland areas such as the Pare Mountains, northern Tanzania (Heckmann 2014), vegetation clearance and the inception of hoe cultivation created conditions of incremental soil erosion that ultimately had long-term ecological consequences.

5. CORRELATIONS WITH LINGUISTIC AND GENETIC DATA

The linguistic complexity of East Africa and the extended history of gene flow between Afro-Asiatic, Niger-Kordofan, Nilo-Saharan and autochthonous speakers of East African click-languages (Hadzabe, Sandawe), indicates considerable interaction. Two distinct linguistic clusters seem to have been involved in the initial spread of livestock herding, with perhaps speakers of proto-Southern Cushitic languages (which fall within the larger Afro-Asiatic language family) from the Horn of Africa (parts of modern-day Ethiopia, Somalia and Sudan), being the first to penetrate the region from around 5000 years ago (Ehret 1998), superseded by groups of proto-Nilotic languages moving into the region from the Sudanic zone between 3000 and 2500 BP (Ehret 2003). Over subsequent millennia additional population movements seem to have occurred, as is well attested in the oral histories of most East African pastoralist societies. These later population migrations also exhibited a general southward trend, although because each incursion of new migrants potentially displaced elements of the pre-existing populations of the newly settled area these groups often moved in other directions (Ehret 1998).

The appearance of Pastoral Neolithic material traditions and livelihoods, and their variants, have been linked by some archaeologists to the arrival in the region of these early Cushitic- and Nilotic-language speakers (e.g. Ambrose 1984). The apparent independent evolution in eastern Africa of the allele associated with lactase persistence some 7000–3000 years ago likewise lends support to such arguments, especially as its very rapid spread is con-
sistent with genetic models of population migration (Ranciaro et al. 2014). The distribution of Y-chromosome haplotypes as recorded among different East African Cushitic-, Nilotic- and Bantu-language speakers is also consistent with a southward movement of pastoralist populations ultimately into southern Africa (Henn et al. 2008), as does the east African genetic ancestry of southern African fat-tailed sheep (Gifford-Gonzalez and Hanotte 2011). Judging from the material record, with perhaps some exceptions, this southward expansion still seems to have been more of a ‘trickle’ than a full-blown ‘wave’ (Bower 1991).

As they expanded their geographical range early farming communities would have also encountered both vibrant HFG (associated with LSA material traditions) and early PN herding societies. The influence of Central Sudanic and Eastern Sahelian speakers on the EFC Mashariki populations during the last millennium BCE, for instance, is particularly clearly demonstrated by the range of Sudanic (Sog) and Cushitic (Tale) loanwords in Eastern Bantu languages for livestock, cereals, various economic practices and certain items of material culture (Ehret 1998: 47–53). Exchange and interaction between EFC, LSA, and PN ‘groups’ has also been documented archaeologically at several sites (Lane 2004). New research has also highlighted that both female (mitochondrial DNA - mtDNA) and male (Male-Specific Y-chromosome - MSY) genetic markers point to considerable population admixture (Henn et al. 2008; Batai et al. 2013). This is especially clear among modern-day populations of Uganda, who exhibit very high mtDNA diversity both within and between different linguistic groups (Gomes et al. 2015). The genetic histories of Nilotic-speaking groups, for example, suggest possible population dispersals from the Horn and Sudan, along with extensive incorporation of autochthonous HGF lineages, while Bantu-language speakers also exhibit genetic admixture with Western Nilotic and autochthonous groups.

Historical linguistic reconstructions provide further insights into the complexity of the processes involved. It is uncertain, for example, whether knowledge of African cereals such as sorghum and millet was introduced by Bantu-language speaking EFCs, or was in fact adopted by these groups from neighbouring Nilo-Saharan and/or Afroasiatic speakers, especially as combined biomolecular and archaeological evidence indicate there were multiple centres of localised domestication of sorghum and other African cereals (Fuller and Hildebrand 2013). Previous studies pointed to Nilo-Saharan associations consistent with inferences drawn from genetic reconstructions concerning the likely locations of sorghum domestication events (Stemler et al. 1975). Conversely, Ehret (2006) has argued on the basis of lexical analyses and linguistic reconstructions that sorghum can be traced to proto-Chadic, an Afroasiatic language.

More recent research adds to this debate. Specifically, three major populations (Northern, Central and Southern) of sorghum have been defined using
Bayesian modelling of recorded genetic diversity. The distribution of these is strongly correlated with the distribution of different language families (Westengen et al. 2014). The Central sorghum population, for example, is concentrated in the region between River Nile and River Chari, where Nilo-Saharan languages dominate. The adoption of sorghum from Nilo-Saharan speakers by early Bantu-language speakers, and its subsequent southward spread as a result of the expansion of EFCs, is also suggested by the co-distribution of the Southern sorghum population and Eastern Bantu languages. The adoption of pearl millet (likely domesticated in the Western Sahel zone) by Bantu-language speakers may have been equally complex. Based on lexical reconstructions, for example, Bostoen (2006/7) has suggested this may have happened twice – first among early Bantu-language speakers in the savannah – rain forest ecotone in West Africa, and subsequently among EFC migrants in eastern Africa, probably as a result of borrowing from neighbouring Nilotic-language speakers. Bayesian clustering analysis of the genetic diversity exhibited by pearl millet landraces in the Lake Chad Basin, on the other hand, found no correspondence between their distribution and that of regional language families, possibly owing to the complexity of later population movement and interaction (Jika et al. 2017).

6. CONCLUSION

In summary, the transition to food production in eastern Africa was a very uneven process, often characterized by quite localized uptake stretching over several millennia, and involving alternating moving and static ‘frontiers’ between farmers, herders and foragers. Collectively, the ethnic and social mosaics and relational networks that evolved were critical to both the form and direction of landscape domestication across the region. Current archaeological, genetic and linguistic research is rapidly expanding knowledge of the timing, extent and nature of these interactions and their wider consequences. In some cases, this research is also overturning older assumptions about the origins of different innovations and adaptations, while also adding new substantive information. Two encouraging trends are an increasing recognition of the complexity of the processes, agents, and networks involved, and a growing trend toward inter-disciplinary research aimed at answering old questions and addressing new ones. There are still many gaps in the archaeological record, both in terms of the types of data that need to be collected and also geographical areas that that remain under investigated despite having likely been important centres of early food production and/or corridors through which domestic crops and animals were spread. As ever, much more integrated research is called for.
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