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Thematic Review

Current State of Archaeobotanical Research in Ghana: On Diet, Food Resources and Research Perspectives

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ABSTRACT

This review delves into the changes in food consumption patterns over time in West Africa, emphasising the significant role played by archaeobotanical studies. West African food consumption has been influenced by various factors such as economic, environmental, and external influences. Our initial studies focused on plant and animal domestication and the spread of grains. The arrival of Europeans in the 15th century brought changes in foodways, introducing new crops from the New and Old World. Some misconceptions about African food and agriculture have been challenged, accentuating the region's diversity and resilience. The paper discusses the initial focus on economic factors and the domestication of plants, leading to a better understanding of the connection between food and society. Additionally, it dispels misapprehensions about West African cuisine and highlights the impact of the Atlantic trade on foodways. The study underscores the significance of interdisciplinary research in rectifying any biases surrounding Africa's food history. Archaeobotanical research has shed light on the dynamic nature of African foodways, including the integration of American crops into local food traditions. However, knowledge of the extent of adoption and use of these crops during the precolonial era remains limited. More research is required to comprehend the adoption of American crops and the resilience of African food systems.

1. Introduction

Ghana is a country on the West African coast with a rich heritage and diverse cultures that have spanned generations. Ghana's dietary habits and food resources have evolved in response to a complex interplay of environmental, social, and economic influences. Archaeobotany, a subdiscipline of archaeology, is crucial in uncovering the intricate web of food-related practices and their evolution in Ghana and Africa. In this review, we delve into the development of food consumption trends in West Africa, focusing on the critical role of archaeobotanical studies. We also explore the current state of archaeobotanical research in Ghana, emphasising its crucial role in understanding ancient Ghanaian societies' dietary habits and food resources. Additionally, we debunk myths about West African cuisine and highlight the influence of Atlantic trade on foodways. Finally, we discuss the promising research perspectives that lie ahead.

Archaeobotany is important in archaeological studies and it is critical in understanding human-environmental interactions. The concept of archaeobotany is central to understanding food history in areas where there is no evidence or where written records are limited. Some knowledge of plant exploitation enhances the understanding of prehistoric and historic cultures. The plant remains from archaeological sites can tell us about the diet, economy, and other aspects of a society (Cappers, 2007). Archaeobotanical research in West Africa has gained considerable attention due to the region's position as the origin of many African crops that were the first to be domesticated, as noted by Neumann (2009).

The African continent has played a significant and autonomous role in plant exploitation (Cappers, 2007). However, there need to be more research, publications, and scholarly discourse regarding foodways, food history, and

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daily practices within African archaeobotany. Most African archaeobotanical research focuses on the history of crops, agriculture, and the use of wild plants for food and fuel (Neumann, 2009). Most archaeological research in West Africa has predominantly focused on examining the impact of the Atlantic slave trade and colonialism while neglecting the potential of African archaeobotany.

The study of archaeobotany in Ghana has the potential to play a vital role in global discussions regarding food security, sustainable agriculture, and resilience to climate change. Researchers can offer valuable insights into modern agricultural practices while safeguarding traditional knowledge by analysing the historical patterns of crop cultivation and the techniques ancient Ghanaian communities employed to adapt to changing conditions. However, in West Africa, most research on Atlantic era foodways has been limited to documentary evidence (Curtin, 1969; Guyer *et al.*, 1988; McCann, 2001), restricting our ability to see how people responded to significant economic and culinary transformations (Kuma, 2017). The grand narratives created through this historical interpretation fail to consider the agency of the ordinary local people who contributed to broader societal and economic changes (Stahl, 2002). Nonetheless, this interpretation of food history is relevant to archaeological and anthropological studies of social, cultural, political, and economic developments. The present study argues that including archaeobotanical and other relevant data sources can significantly expand our knowledge about Ghana's food history while addressing the theoretical biases surrounding Africa's food history.

This review will delve into the current state of archaeobotanical research in Ghana. We aim to not only summarise critical findings but also explore future research perspectives that have the potential to shape our understanding of Ghana's food history. Additionally, we aim to discuss the broader implications of this research for the fields of archaeology. The story of Ghana's past diets and food resources is a fascinating historical narrative that highlights the resilience and ingenuity of its people and provides valuable lessons for the present and future. The ability of archaeobotanists to track changes through time is imperative in allowing us to transcend the assumptions that paint past communities as static and primitive. Moreover, the archaeology of West African foodways during the Atlantic era is paramount in highlighting African agency and providing counter-narratives that effectively demonstrate the profound impact of Africans on the Atlantic trade.

2. Archaeobotanical studies in West Africa

The earliest food production economies in Africa were established based on cattle domestication, which was developed by the Saharan pastoralists in northeast Africa (McIntosh and McIntosh, 1983; Stahl, 1994a; Akyeampong, 2006; Ozainne *et al.*, 2014). Unlike other parts of the world, where plants were domesticated before animals, African history witnessed a different scenario: cattle appeared several millennia before the first domesticated plants are recorded in the archaeological record (Akyeampong, 2006). Plants were introduced as a secondary livelihood to ensure better subsistence safety in the face of increasing aridity within the mobile seasonal lifestyle of the African people. African food production was autochthonous and primarily based on cattle domestication.

Numerous archaeological and botanical studies have identified at least five potential centres of independent plant domestication in Africa (Fuller and Hildebrand, 2013). Refer to the Domesticating Plants in Africa for a more detailed look into the initial centres where plants were domesticated in the Africa chapter (Fuller and Hildebrand, 2013). The first cereals domesticated in West Africa were pearl millet and rice, emerging as part of an ecological-based subsistence exchange. This led to complex societies in West Africa (Ozainne *et al.*, 2014). Pearl millet was cultivated in Mali's Tilemsi Valley around 2400 BC, followed by Mauritania and Ghana in approximately 1700 BC (Fuller and Hildebrand, 2013). The earliest direct evidence of pearl millet seeds comes from Awker in Mauritania and Birimi on the Gambaga plateau in Ghana (Akyeampong, 2006). Pearl millet is renowned for its drought tolerance (D'Andrea and Casey, 2002; Akyeampong, 2006).

In the past five centuries, crops from Africa have been introduced to the low and intermediate latitudes of the New World, according to Bjornlund *et al.* (2020; 2022) and Carney and Rosomoff (2009). During the era of the slave trade, African people were transported across the Atlantic, and West African food became a crucial source of sustenance from the same West African ports. These crops were ideal for growing in the tropical and sub-tropical regions of the Americas, and the African diaspora brought their expertise in cultivation practices with them, as noted by Fuller and Hildebrand (2013).

In the early stages of archaeological research in Africa, an economic approach was adopted for studying the region's food practices. This led to an exploration of the domestication of plants and animals, the identification of regional crop varieties, the tracking of the diffusion of grains, and the development of agricultural traditions (Decorse, 1992; Stahl, 1994b). These studies were critical in opening debates about the connections between food and society. Recent historical (Carney and Rosomoff, 2009; La Fleur, 2012) and archaeological trajectories in the scholarship of African foodways (Dietler, 2006; Logan, 2012; 2016a; 2016b; Gijanto and Walshaw, 2014; Logan and Dores Cruz, 2014; Monroe and Janzen, 2014; Logan and Stahl, 2017) emphasise African's use of agency in shaping the multiple interactions that characterised the Atlantic trade.

In La Fleur's book "Fusion Foodways of Africa's Gold Coast in the Atlantic era" (La Fleur, 2012), the historian critiqued the widely-held assumptions by some historians of Atlantic era Africa that the botanical qualities of crops (for example, the quick fruition of maize) determined changes in the lives of those who grew and ate them (Decorse, 1992;

Figure 1. Map of Ghana showing selected sites mentioned in this article. Source: Spatial Solutions & Services, Esri, HERE Garmin, FAO, NOAA, USGS.

DeCorse, 2001; McCann, 2001; La Fleur, 2012). La Fleur argued that these assumptions were based on limited research on a few American crops, such as maize and cassava, which were erroneously believed to be the only new crops of the Atlantic. La Fleur pointed out that these assumptions failed to consider the social, political, and economic contexts in which new crops were adopted and incorrectly attributed more agency to the plants than to the Africans who cultivated and consumed them (La Fleur, 2012). Furthermore, these assumptions suggested that the cultivation and consumption of New World foods were immediately incorporated into local foodways and were widely and homogeneously accepted. Logan's work provided an alternative perspective by analysing archaeobotanical finds from Atlantic-era Banda, Ghana (Figure 1) (Logan, 2012; 2016a). Logan similarly criticised these assumptions even though maize matured faster than African pearl millet and sorghum and was more tolerant of wet savannas; however, Logan opines that pearl millet is highly drought-tolerant and has more nutritional value than maize (Logan, 2020).

3. Archaeobotanical studies before the Columbian exchange in Ghana

Archaeobotanical studies have contributed significantly to our understanding of the origin and growth of the sedentary communities in West Africa. The emergence of agriculture in Sub-Saharan Africa has been linked to the Ceramic Late Stone Age, also known as the Kintampo complex, which dates back to 3600–3200 BP (D'Andrea *et al.*, 2007; Logan and D'Andrea, 2012; Watson, 2005; 2010). The Kintampo complex is a fascinating subject of study. It represents the earliest known sedentary population in Sub-Saharan West Africa and has been extensively researched (Stahl, 1985; 1986; D'Andrea, Klee and Casey, 2001; D'Andrea and Casey, 2002). The Kintampo complex sites are spread throughout Ghana, ranging from the drier wooded savannas of the Gambaga escarpment in the north to the central savanna-forest transition and humid forest zones of the southern coast (Stahl, 1985; 1994a; Oas, D'Andrea and Watson, 2015). The Kintampo complex is particularly notable for its early evidence of food production in Sub-Sahelian West Africa. It is characterised by a range of artifacts, including polished stone axes, armed rings, pottery with distinctive comb stamping or walking-comb decoration, ground-stone armbands, grooved stones, grinding stones, chunks of cane-impressed daub, and terracotta cigars (Flight, 1976; Stahl, 1985; 1986; 1994; D'Andrea, Klee and Casey, 2001; D'Andrea and Casey, 2002). Although the purpose of the terracotta cigars, found at all Kintampo sites, remains a mystery, they have been given various names such as pottery-decorating tools, massage sticks, palettes, and rasps (Flight, 1976; Stahl, 1985). Another fascinating aspect of the

archaeological record is the evidence of daub architecture, which suggests that the Kintampo people lived a sedentary village life (Stahl, 1985).

The archaeobotanical approach has been used to understand the domesticated plants in Ghana's Kintampo sites. These sites have yielded domesticated plants associated with the earliest domestication in this region, starting with pearl millet (Figure 2) and, subsequently, cowpea. Nonetheless, there has been a pronounced reliance on non-domesticated forest products, especially *Elaeis guineensis* jacq (oil palm) (Oas, D'Andrea and Watson, 2015; Kay *et al.*, 2019). *Pennisetum glaucum* (pearl millet) was the first domesticated cereal in the Birimi region and was also identified as the earliest *P. glaucum* site in Sub-Saharan Africa. Macrobotanical remains analysis of Birimi has divulged substantial evidence of domesticated pearl millet coexisting within the Kintampo complex. Birimi is situated in the dry woodland savanna of the Gambaga Escarpment in northern Ghana (D'Andrea and Casey, 2002). Macro remains from the 394 litres of soil sampled revealed mostly *P. glaucum* and small quantities of wild grasses. According to D'Andrea *et al.* (2001), two dates for *P. glaucum* grains showed low carbon levels, resulting in significant errors. However, these dates still confirmed the Kintampo association (D'Andrea *et al.*, 2001). The same pit also provided charcoal dates consistent with AMS dates of 3490±50 BP obtained from charcoal associated with the area's excavation (*Ibid*). The pearl millet samples from Birimi suggest that this crop was present in the sub-Saharan region and was associated with the Kintampo people living 1000 km further south. This implies that pearl millet was used over a vast area of West Africa, indicating earlier domestication (D'Andrea *et al.*, 2001).

The discovery of Birimi pearl millet has expanded the Kintampo database, confirming its association with the Kintampo complex. The domesticated pearl millet found in Birimi had an obovate and terete shape, consistent with previous findings (D'Andrea, Klee and Casey, 2001; D'Andrea and Casey, 2002). One of the unique features of Birimi pearl millet is its smaller caryopsis size compared to modern domesticated pearl millet. The Birimi *Pennisetum glaucum* dates to the same period as the earliest *P. glaucum* found in the Dhar Tichitt Mauritania site (D'Andrea *et al.*, 2001). At the lakebed in Tichitt, where the earliest *P. glaucum* was identified, evidence of grain impressions on pottery have been found, which indicates the shift to cultivation of *P. glaucum* between 3500 to 2800 BP (1800–950 BC) (McIntosh and McIntosh, 1983; Neumann, 2005).

Pennisetum glaucum has been discovered in regions where tropical forest margins are dominant. In particular, *Elaeis guineensis* (oil palm), *Celtis* sp. (hackberry), and *Canarium schweinfurthii* (Figure 3) have been retrieved from central and southern Ghana sites. The Bosumpra rock shelter, for instance, has provided evidence of pearl millet (Oas, D'Andrea and Watson, 2015). The remains of charred *P. glaucum* and *Vigna unguiculata* were found in the Bosumpra cave, indicating that these domesticates were present in the southern rainforest region of Ghana during the terminal Later Stone Age (LSA), at least by the mid-third millennium BP (Oas, D'Andrea and Watson, 2015). *Pennisetum glaucum* was present by the mid-third millennium BP, as associated charcoal dates from Bosumpra have suggested. At the same time, *V. unguiculata* appeared by the mid-fourth millennium BP (Oas, D'Andrea and Watson, 2015). Notably, the presence of *P. glaucum* at Bosumpra is intriguing, as it is adapted to arid conditions and does not easily tolerate water-logging and high atmospheric humidity. Recent studies suggest that *P. glaucum* had a monophyletic origin in eastern Mali and western Niger (Kahlheber, Bostoen and Neumann, 2009), which is consistent with archaeological finds of *P. glaucum* in the Tilemsi Valley of Mali dating to circa 4000 BP (Manning *et al.*, 2011). The Kintampo site of Birimi offers the earliest evidence of *P. glaucum* in sub-Saharan Africa and its large-scale cultivation, with grains directly dated to 3460±200 BP (D'Andrea *et al.*, 2001). The discovery of domesticated pearl millet and cowpea in the Bosumpra rock shelter has helped examine the LSA hunter-gatherers' subsistence practices and early food subsistence and cultural practices in Southern Ghana (Oas, D'Andrea and Watson, 2015). The evidence of *P. glaucum* and its associated date indicating its presence by the mid-third millennium BP at Bosumpra serves as the

Figure 2. Pearl millet photographed by P. Ayipey in 2023 at Likpe Kukurantumi in Ghana.

Figure 3. *Canarium schweinfurthii* (Latham and Konda ku Mbuta, 2014).

first date of it in the southern rainforest region of Ghana during the terminal LSA (Oas, D'Andrea and Watson, 2015). Archaeobotanical evidence of pearl millet has also been found in other parts of West Africa, such as Burkina Faso and the Chad basin in Northern Nigeria, spanning around 3800 BP to modern times (Neumann, 2005).

Pearl millet has been identified as a crucial crop in West Africa's subsistence economy, particularly from the Kintampo complex site. However, only small quantities of domesticated *V. unguiculata* (cowpea) were found at the B-sites, while K6 yielded possibly domesticated cowpea (D'Andrea *et al.*, 2006; Watson, 2010). Flight (1976) notes that *V. unguiculata* (cowpea or black-eyed pea) was the only potential domesticate found at K6. The size of the cowpea was attributed to its shrinkage due to the carbonisation of the seed. However, Stahl (1994a) experimented with modern cowpea at K6 in 1985 and found no significant decrease in cowpea size. Therefore, the cowpea identified at K6 was considered a primitive version of the cowpea and not necessarily a domesticated form of *V. unguiculata* placed in the area (Stahl, 1994a). In addition, evidence of *V. unguiculata* was found in phase 3 at the Bosumpra rock shelter, and the charcoal association with this seed dated to 3490±35 BP (Oas, D'Andrea and Watson, 2015). Despite the absence of complete *V. unguiculata* specimens from Bosumpra, which makes obtaining reliable metric data challenging (Oas, D'Andrea and Watson, 2015), it is the first indication that this domesticate was present in the southern rainforest region of Ghana during the terminal LSA at least by the fourth-millennium BP. The presence of *V. unguiculata* at K6 and Bosumpra rockshelter sheds light on the diversity of subsistence practices during the terminal LSA in Ghana. It contributes to our understanding of the agricultural history of West Africa.

The Kintampo complex in Ghana relied heavily on non-domesticated plant resources. Macroremains of tree fruits, including *Celtis* sp. (hackberry), *Canarium schweinfurthii*, *Elaeis guineensis* (Figure 4), and legumes, have shown that wild plant resources were continuously and locally utilised by Kintampo groups (Stahl, 1985; Watson, 2005). Evidence of *C. schweinfurthii* suggests it was a forager subsistence overshadowed by *E. guineensis* in most Kintampo sites in Ghana. At Bosumpra rock shelter, *C. schweinfurthii* seeds were heavily relied upon, but there was a significant transition to using *E. guineensis* after 5000 BP (Stahl, 1985; Oas, D'Andrea and Watson, 2015). *Canarium schweinfurthii* was a managed resource at Bosumpra rockshelter and is a valuable marker of forager subsistence in tropical forest regions. It dominated Phase One of the Bosumpra rockshelter and about 68% of Phase Two (Oas, D'Andrea and Watson, 2015). The exploitation of *C. schweinfurthii* persisted in the early and middle Holocene. Still, it was eventually replaced by *P. glaucum*, *V. unguiculata* (cowpea), and *E. guineensis* in the late Holocene. Apart from the Bosumpra rockshelter, *C. schweinfurthii* endocarp has been identified in other archaeological sites in Ghana, such as Kintampo site 6 and B4C, B5C, B6B (Oas, D'Andrea and Watson, 2015). Although *C. schweinfurthii* has been identified in various archaeological sites in Ghana, Cameroon, and the Democratic Republic of Congo, it has yet to be incorporated into modern West African agroforestry systems (Oas, D'Andrea and Watson, 2015).

The most dominant nut in Kintampo sites is *Elaeis guineensis*. Around 3500 BP, increased palm pollen in Lake Bosumtwi led to the discovery of *E. guineensis*. The finding of pollen in the lake indicates that humans were manipulating the environment during the Late Stone Age period to clear the forest region for oil palm cultivation.

Figure 4. *Elaeis guineensis* photographed by P. Ayipey in 2022 at Likpe Kukurantumi in Ghana.

It suggests that oil palm was a staple food associated with the later Kintampo complex. According to research by D'Andrea, Klee, and Casey (2001) and D'Andrea and Casey (2002), the earliest macrobotanical evidence of *E. guineensis* in this tradition dates back to 3600–3200 BP. While it was found in limited quantities in Phase One of Bosumpra rock shelter's stratigraphic sequence, it was identified throughout the phases. A date of 8410±40 BP for *E. guineensis* was also discovered using Accelerator Mass Spectrometry (Oas, D'Andrea and Watson, 2015), making it the earliest example of the plant in West Africa and indicating pre-Kintampo LSA populations in the forested region of Ghana. The highest density of *E. guineensis* at Bosumpra dates to later Holocene Phase Three contexts (post 2425±35 BP), coinciding with a decrease in *C. schweinfurthii* endocarp density and abundance (Oas, D'Andrea and Watson, 2015). While there is no evidence of *E. guineensis* or other tree fruits at the Kintampo site of Birimi in northern Ghana (D'Andrea and Joana Casey, 2002), it has been discovered at Kintampo sites in central Ghana, where heavy fragmentation and high densities of analysed endocarp of *E. guineensis* would suggest processing (Stahl, 1985). The complex process of boiling, palming, and extracting oil raises questions about how *E. guineensis* was used during the early Holocene period. *E. guineensis* is an economically significant plant in tropical regions and plays a role in the modern Ghanaian economy.

Oil palm is commonly associated with the carbohydrate crop yam. The interpretation of the role of carbohydrates at the Kintampo site has been challenging due to the need for more direct evidence in the archaeological record (Flight, 1976). Although yam was an essential crop for the Kintampo people, its presence in the archaeological record remains scarce (Neumann, 2005). According to existing literature, sorghum and yam were among the crops cultivated by the Kintampo people. In contemporary times, oil palm is commonly associated with domesticating a yam-cereal combination that could have been the primary form of agriculture in Sub-Saharan Africa (Flight, 1976). As a result, Posnansky (1984, p.150, cited in Newman, 2005) hypothesised that oil palm management may have accompanied yam cultivation (Neumann, 2005). Despite the lack of direct evidence of the presence of carbohydrates in the Kintampo site, Stahl (1994a) argues that the carbohydrate component varied from Kintampo sites. However, archaeological findings of charred wood and fruit remains, such as *C. schweinfurthii* and oil palm, have been found in Central African archaeological sites, including Kintampo K6 in Ghana (Stahl, 1985).

4. Columbian exchange

The Columbian exchange is a significant historical event wherein the transfer of diseases, ideas, food crops, and populations occurred between the New World (the Americas) in the Western Hemisphere and the Old World (Afro-Eurasia) in the entire Eastern Hemisphere following the voyage to the Americas by Christopher Columbus in 1492 (Nunn and Qian, 2010; Cherniwchan and Moreno-Cruz, 2019; Hancock, 2022). This event had significant historical and cultural implications, enabling the transmission of goods and knowledge across previously isolated regions. The exchange of crops, for instance, transformed global agriculture, leading to the growth of new industries and the improvement of existing ones. However, the movement of people and diseases also had devastating consequences, such as the spread of epidemics that decimated indigenous populations. Overall, the Columbian exchange was a complex and

multifaceted phenomenon that had far-reaching impacts on the societies and ecologies of the Americas and Europe (Nunn and Qian, 2010). The effect of the activity was felt across Europe and the Americas, but Africa was deeply affected by it (Cherniwchan and Moreno-Cruz, 2019). The West African region was pivotal in exchanging gold and enslaved people. Its abundant gold resources served as a prime source of wealth for several kingdoms and empires in the area.

Additionally, West Africa's strategic location made it a hub for the trans-Atlantic slave trade, which resulted in the forced migration of millions of people from the continent to the Americas (Crosby, 2003). Over time, the Atlantic trade has undergone significant changes in its nature and character, and one of the most notable transformations has been in the foodways of West Africans. Today, West Africans primarily rely on American staples such as maize and cassava, which has important implications for food security. This shift in dietary habits indicates the broader changes in the Atlantic world as new crops and foodstuffs were introduced and traded across the ocean. The Columbian exchange provides an illustrative means to understand the foodways of the period in addressing the issue of food scarcity in Africa (Crosby, 2003). Some recent Atlantic era historical works have questioned these grand narratives and emphasised Africa's agency and ingenuity in shaping the Atlantic trade's multidirectional interactions (Carney and Rosomoff, 2009; La Fleur, 2012).

The Atlantic era significantly transformed the local African communities and their foodways. Understanding these changes in foodways is crucial for scholars seeking to gain a deeper understanding of the complex economic, social, and cultural interactions that took place during the Atlantic trade and how they continue to shape the contemporary world (Kuma, 2017; Logan, 2020). It is imperative to comprehend these changes within their respective social, political, economic, and historical contexts. Materiality and context represent salient considerations for archaeologists. Despite the strength of archaeological evidence in tracing everyday life, scholars studying the Atlantic era in Africa have yet to explore changes in foodways. Therefore, there is a need for further research to investigate the impact of the Atlantic era on African foodways and how it shaped the cultural identity of local communities (Logan, 2012; 2016a; 2016b; Gijanto and Walshaw, 2014; Logan and Dores Cruz, 2014; Monroe and Janzen, 2014; Logan and Stahl, 2017).

Initially, investigations into food in Africa centred on economic factors, explicitly tracking the domestication of plants and animals, recognising regional crop varieties, observing the spread of grains, and exploring agricultural traditions (Shaw *et al.*, 1993; DeCorse, 1992; Anquandah, 1993; Clark, 1984; Harlan, 1982). These inquiries were instrumental in sparking conversations about the connection between food and society. Today, historians (Carney and Rosomoff, 2009; La Fleur, 2012) and archaeologists have shed light on the influence of Africans in shaping the multitude of interactions that defined the Atlantic trade (Dietler, 2006; Logan, 2012; 2016a; 2016b; Gijanto and Walshaw, 2014; Logan and Dores Cruz, 2014; Monroe and Janzen, 2014; Logan and Stahl, 2017). These scholars have all made significant contributions to this field of study and emphasise Africa's use of agency in shaping the multiple interactions that characterised the Atlantic trade.

5. Using archaeobotany to understand foodways during the Columbian exchange

The African agricultural industry has been subject to several misconceptions that require clarification. Historians have long described West African cuisine as being plagued by food insecurities and lacking diversity (Logan, 2020). However, examining the region's food history from an archaeobotanical perspective is essential in determining if the current scarcity has always been present, as earlier historians, linguists, and sociologists have suggested. For example, Goody (1982, p.58) observed that in precolonial times, hunger and even famine were more prevalent than today despite the dramatic droughts in most parts of the Sahel region and the rapid increase of population in recent times.

The first European visitors to the Gold Coast were the Portuguese in 1471 AD (DeCorse, 2001). The Europeans' meeting with West Africa in the fifteenth century brought some changes in the foodways of West Africans. The arrival of Europeans marked the beginning of written archives in the savanna, which extended to the coast in the south. While there were earlier Arab records from the interior dating back to the 9th century AD, most research on the adoption of American food in Africa relies on documents from various sources such as Alpern (1992; 2008), Bjornlund *et al.* (2020; 2022), Goody (1977; 1982), La Fleur (2012), and McCann (2001). Most ideologies for writing the African adoption of American crops have been based on the hypothesis from the Columbian exchange (Crosby, 2003), which argues that very few plants used today have originated from Africa; therefore, Africa has to import its chief food from Asia and America. These documents provide a partial view of the coastal food history in Africa. Amanda Logan's book on *The Scarcity Slot* compiles various criticisms regarding the misrepresentation of African food and agriculture (Logan, 2020). In *The Scarcity Slot* book, three central stereotypes were analysed (Logan, 2020, pp.4–6). Misconceptions about African food and agriculture include: firstly, African food is seen as having a lack of food instead of a diversity of local tastes. Secondly, farmers are portrayed as incapable and vulnerable to environmental changes, which is not the case. Thirdly, the African agricultural industry is constantly evolving – despite being described as rooted in an unchanging past. Recent archaeological and historical research on foodways in West Africa during the Atlantic era has shed light on just how dynamic these African foodways were. However, further data must still be collected on the integration of American crops into local African foodways (Logan, 2020).

Maize, a globally cultivated crop, has emerged as the dominant crop in Ghana, replacing indigenous crops such

as pearl millet and sorghum, which were vital even during European intervention. The success of maize cultivation in Ghana is attributed to its high yields, short maturity period, and low labour requirements (Crosby, 2003; Cherniwchan and Moreno-Cruz, 2019). The introduction of maize into Ghana dates back to the 16th century (Alpern, 1992); in 1554 AD, maize was introduced to the Ghanaian coast (Alpern, 2008, p.25). Over the past four centuries, maize has replaced sorghum and millet as the primary cereal crop in several parts of Western Africa, including Angola, Cameroon, Benin, Ghana, Nigeria, and Togo, as documented by Alpern (2008).

According to Logan's (2020) study, the Columbian exchange hypothesis is not tenable as maize did not wholly replace traditional African crops in Ghana's cuisine. The investigation, which relied on archaeological, environmental, ethnographic, and documentary evidence, examined the response of the people in Banda, Ghana, to the introduction of new crops.

Logan's analysis of the grain crops during the Kuulo phase (CE 1450–1650) has yielded a significant finding that challenges established historical assumptions (Logan, 2020). Her research suggests that the introduction of American crops did not significantly impact the lives of people in Banda during the Ngre phase (1210–1450 AD) or Kuulo phase (1450–1650 AD); indigenous pearl millet remained the staple crop and was actively used during the Columbian exchange period on the Gold Coast, and maize was not actively used (Logan, 2016b, p.517; 2020, p.123). Maize was first observed at the Banda Kuulo Mound site, specifically at Kuulo Kataa (KK) mound 118; the evidence of maize in Banda was limited (Logan, 2016a). The AMS date of one cupule from KK M118 was between 1484 and 1660 AD (Logan, 2016a; 2020). The written record suggests that maize did not arrive on the Ghanaian coast until 1554 AD, implying that the later date of the AMS sample could be when maize was introduced to Banda (Logan, 2020). Amanda Logan argues that the possible reason for the date of the maize from Banda was the connection Banda had northward at that time (Logan, 2020, p.78). The argument aligns with the theory that Arabs brought maize to West Africa by crossing the Atlantic before Columbus (Alpern, 1992, p.24). For a deeper understanding of this debate, refer to Alpern (1992, pp.24–25).

The presence of maize was not pervasive in the Banda Kuulo phase (Logan, 2016a, p.111). However, this period coincided with the Europeans' arrival on Ghana's coast (Logan, 2016, p.516). The little evidence of maize recovered from this phase is postulated as it having been used only occasionally by a select few individuals, likely those with high status or connections to long-distance trade networks (Logan, 2016b, p.517). These findings suggest that the spread and replacement of indigenous foods by maize and other New World crops was not uniform but non-homogeneous. Such insights open new avenues of inquiry into the complex and dynamic relationships between foodways, trade, and cultural exchange in precolonial Africa. Logan's analysis suggests that maize became more prevalent in Banda-Ghana in the 1890s after violence and displacement (Logan, 2016b, p.518; 2020). Therefore, the archaeobotanical study at Banda revealed that pearl millet and sorghum were the primary crops across all the surveyed sites until the 19th century, when maize became commonly used (Logan, 2016a).

6. Food and foodways

Food consumption is an intrinsic part of our daily lives, serving as a nutritional necessity for survival. Through the lens of anthropological and archaeological studies, the concept of food has been expanded beyond its mere definition as a source of sustenance to encompass a complex set of ideas and patterns of behaviour. The evolution of our understanding of food has led to a more nuanced interpretation of its significance in human societies, highlighting its multifaceted role in shaping cultural practices and social structures (Anderson, 1971). Recently, anthropologists and archaeologists have directed their studies towards the intricate connections between food production, preparation, consumption, and various social factors like power dynamics, status, identity, and social interactions (Hastorf, 2016). Additionally, they explore the creation of economic and symbolic value, construction of collective memory (Mintz and Du Bois, 2002), and taste perception (Stahl, 2002).

When examining the intricacies of food preparation, it is imperative to consider the stages of culinary *chaîne opératoire*. Peres (2017) argues that the term "foodways" is incompatible with subsistence strategies, diet, and cuisine. This highlights the importance of accurately categorising and defining the various components involved in studying food to facilitate a more nuanced understanding of culinary practices and their cultural significance. Foodways and diet are terms often used interchangeably but have different meanings and connotations in academic discourse. While diet refers to the specific foods and drinks an individual consumes, foodways represent a more complex set of behaviours and practices associated with food. These practices include the production and consumption of food and the social and cultural contexts within which they occur. Therefore, foodways encompass many factors influencing food choices and eating habits, such as social norms, traditions, and beliefs. In academic research, foodways are studied to understand the complex relationships between food, culture, and society and to shed light on how people interact with food in different parts of the world (Welch and Scarry, 1995). Foodways are a crucial aspect of cultural and social identity formation, imbued with multiple layers of meaning (Brown, Mussell and Wagner, 1984). Foodways can offer insight into various aspects of interaction and relationships at the individual and group levels. They can also serve as a means of resistance to dominant social norms and foster feelings of solidarity within a group (Hastorf, 2016). Anderson (1971) posits that foodways are a complex interplay of ideas and patterned behaviours that reflect cultural values and practices. Thus, studying foodways provides a rich and nuanced lens to

understand the multifaceted nature of human sociality and identity formation. In this paper, the definition of foodways proposed by Anderson (1971) has been adopted. According to Anderson, foodways constitute not only the food itself but also the intricate web of activities, regulations, contexts, and symbolic meanings that pertain to the production, harvesting, processing, cooking, serving, and consumption of food (Anderson, 1971, p.227). Foodways, therefore, can be understood as a set of culturally-patterned behaviours that reflect a community's shared values, beliefs, and social structures.

Food choices are complex and influenced by various stimuli, both physical and emotional. People make decisions regarding what to produce, consume, preserve, and how to dispose of waste at every stage of the food production process (Kuma, 2017). Food choices are influenced by various physical and emotional stimuli from events that may be distant in time and space (Thomas, 1991). Many studies have explored food choices, attempting to divide them into two categories. Still, this approach must be revised as it separates the complex factors influencing food choices into discrete elements. For Smith (2006), food choices are influenced by biological and economic factors, such as taste, value, purity, ease or difficulty in preparation, and accessibility of fuel and other preparation tools (Conner *et al.*, 2002).

It would be erroneous to assume that individuals in the past consumed food items based purely on convenience and availability. Food choices were instead shaped by a complex interplay of social, cultural, historical, and political factors. These choices were guided by conscious and unconscious cultural practices, personal histories, habits, and taste preferences (Stahl, 2002; Dietler, 2006; Hastorf, 2016). To gain a comprehensive understanding of food choices in the archaeological record, it is imperative to consider all these elements that contributed to the conceptualisation of "edibility" and "good" food.

7. Archaeobotany as an emerging field in the archaeology of Ghana

Archaeobotany is a fascinating scientific discipline within archaeology that sheds light on how people interact with their environment and foodways. According to Fuller and Lucas (2014), archaeobotany combines botany and archaeology to uncover valuable insights into past human cultures. To fully understand a site's cultural formation, archaeobotany requires adhering to the principles of archaeological research. While archaeobotany is widely known in Europe, paleoethnobotany is more commonly used in North America. However, both terms refer to the same function. It is worth noting that paleobotany differs from archaeobotany in that it studies the entire history of plant life, including its adaptations and evolution. In contrast, archaeobotany focuses exclusively on plant evidence in past human environments (Fuller and Lucas, 2014). This discipline plays a crucial role in identifying, classifying, analysing, and interpreting plant use and economy in ancient societies.

Archaeobotanists have attempted to use charcoal analysis to understand the environment of the Nok region in Nigeria AD (Kahlheber, Höhn and Rupp, 2009). The Nok culture is known for its famous terracotta sculptures dated 1500–1 cal BC. Archaeobotanical studies at the ancient Nok culture sites in Nigeria have revealed the cultivation of crops such as *V. unguiculata*, *C. schweinfurthii*, *Nauclea latifolia*, wild fruit trees, and wild Poaceae (Champion *et al.*, 2023, p.263). These findings have contributed to understanding the Nok people's agricultural practices and dietary habits. The study conducted at three sites, namely Mbandaka, Iyonda, and Bolondo in the Inner Congo Basin (DR Congo), included an analysis of phytoliths and other materials such as *E. guineensis*, charcoal, and Musaceae phytoliths. The phytolith analysis helped identify Musaceae phytoliths with a high level of certainty, which were attributed to bananas (*Musa* spp). The study also focused on the subsistence patterns of the Iron Age sites and found that the bananas were present in the cal 1400 AD context, as was concluded by Neumann, Eichhorn and Wotzka (2022).

Archaeobotany involves the study of plant remains found in archaeological sites, which can be divided into two categories: macrobotanical and microbotanical remains. The methods used for collecting, analysing, and interpreting these remains depend on the research questions being asked. Macrobotanical remains are visible to the naked eye and range from several centimetres to 250 μm (Cuthrell, 2014). While sieving soil during excavation does not help retrieve all macrobotanical remains, archaeobotanists commonly employ flotation analysis. This method involves melting and diluting stratigraphically-collected soils into a flotation tank or bucket of water to float to the surface. The residue at the surface is then poured through sets of sieves to collect any remaining macrobotanical remains.

The floating plant macrobotanical remains is carefully examined and categorised using stereomicroscopes. While previous studies have focused on the seeds and fruits of cultivated or domesticated plants, recent research has shown that analysing wood charcoal, herbaceous plant material, and parenchyma can provide valuable insights into human interactions with their environment (Cuthrell, 2014). By utilising stereomicroscopes, researchers can identify the specific species or taxa of plants present and determine which ones were most used by humans, such as legumes, spices, cereal, fruits, technical crops, and vegetables. However, preserving macrobotanical remains can vary greatly depending on the environment, so microbotanical analysis is often necessary. Microbotanical research involves the study of plant tissues and structures invisible to the naked eye, such as phytoliths, pollen, and starch grains (Perry, 2014). These micro remains are extracted and examined under high magnification and resolution microscopy to identify microfossils from specific plant taxa, providing valuable information about the use of plants in the archaeological context.

Knowledge of the past can be drawn from various sources, and the kind of questions one seeks answers to influences

the methodology used. Historically, archaeology in Ghana has undergone significant changes, progressing from an amateur practice to a modern, 21st-century field of study. European scholars introduced archaeology into the academic curriculum in 1951 at the University of Ghana (Anquandah, Kankpeyeng and Apoh, 2014). Archaeological research in Ghana from the 1970s to the 1980s focused on technology, subsistence, metallurgy, agriculture, urbanism, trade patterns, art history, and ethnoarchaeology. Foreign scholars collaborated with the Department of Archaeology at that time. From the 1990s, Ghanaian archaeologists partnered with UNESCO and the Ghanaian government to undertake several applied archaeological research projects. Scientific analyses like chronometric dating and phytolith analysis have been used in some of these studies. The University of Ghana's Department of Archaeology has broadened its scope to include heritage studies and a multidisciplinary approach, leading to a name change to the Department of Archaeology and Heritage Studies (Anquandah, Kankpeyeng and Apoh, 2014). However, archaeobotany has yet to be fully incorporated into the curriculum.

Consequently, a Ghanaian-trained archaeobotanist has yet to have the opportunity to investigate human interactions with the environment using archaeobotanical skills. In the future, the department will acquire the necessary resources to establish an archaeobotanical laboratory to train students in this emerging field. Notably, most archaeobotanical investigations in Ghana have focused on the Later Stone Age sites, with limited attention given to colonial sites. Scholars from the Americas and Europe conducted these studies. Despite progress, there is a notable bias towards the study of charred seeds in West African archaeobotanical investigations, with limited attention given to other materials that decompose quickly in soil. As a result, there is a need to conduct more archaeobotanical research in Ghana, notably in the transition of foodways from the Later Stone Age to the colonial period. As part of the Likpe Kukurantumi Archaeological Project investigation of the abandoned earthwork settlement, a pre-Atlantic site in Ghana, it aims to address a significant research gap by employing a comprehensive approach. This will involve macrobotanical (seeds and charcoal) and microresidual (phytolith) analyses alongside written sources, ethnographic data, oral histories about foodways, and the nuanced interactions between humans and their surrounding environment.

8. Archaeobotanical studies in understanding the introduction of new crops into local foodways in Ghana

West African cuisine is renowned for its distinctive flavours and ingredients, enhanced by its diverse plant-based foods (Dunne *et al.*, 2022). The culinary tradition is characterised by the combination of starchy carbohydrates, vegetables, and meat or fish, often incorporated into soups or stews. The cooking oil used in West African cuisine is commonly derived from *Elaeis guineensis* (oil palm), *Vitellaria paradoxa* (shea butter tree), sunflower, coconut, or vegetable oil. While several plants used in West African cuisine are indigenous to the region, others have been introduced. Archaeobotanical studies of West African cuisine have predominantly focused on charred plants, resulting in the underrepresentation of other leafy plants and tubers that quickly decompose (Dunne *et al.*, 2022). While archaeobotanical research in West Africa is still in its infancy, scant attention has been devoted to identifying other plants that still need to survive in the archaeological record using microbotanical analysis.

During the Atlantic period in Sub-Saharan Africa, external forces interfered with the foodways of the people of the past, leading to a shift from more nutritious staples to cassava and dent maize due to their higher calorific content, faster growth, and lower labour requirements (McCann, 2001). Carney (2001) argues that the Europeans knew precisely where to find food surpluses in Africa and where to find cereals. However, African dehumanisation through slavery led to the disparagement of Africa's agricultural achievements and indigenous African grains were viewed as inferior and rejected as food staples (Carney, 2001). The European encounter with West Africa led to the introduction of new crops from the New and Old World, such as maize, plantain, cassava, sweet potatoes, banana, peanuts, tobacco, pineapples, guava, papayas, avocado, and tomatoes, among others (Alpern, 1992; 2008). The introduction of American crops such as maize and cassava has received attention because these crops are essential in maintaining food security in Africa (Logan, 2020). However, the hypothesis initially proposed by Alfred Crosby and Philip Curtin, termed the Crosby-Curtin hypothesis by Cherniwchan and Moreno-Cruz (2019) and other economic historians, that the introduction of maize made up for the population loss during the enslavement of West Africans during the Trans-Atlantic slave trade. Amanda Logan has criticised this hypothesis because of the racialised assumptions about African capabilities and resources (Logan, 2020). Maize produces greater yields and can feed more people. Still, this hypothesis overlooks the potential of indigenous African crops and implies that African food systems were inadequate, which is invalid.

9. Conclusion

Archaeobotanical research in Ghana is essential for understanding past societies' dietary habits, food resources, and environmental adaptations. However, except for early agriculture, the paucity of archaeobotanical research spanning the past five centuries has limited the ability of archaeobotanists to make meaningful contributions to the discourse on critical theoretical issues (Logan, 2015, p.137). The extent to which American crops were adopted and used in Africa during the precolonial era remains limited and needs to be better understood. There is a need for more archaeobotanical research on the impact of regional foodways on Atlantic trade and the movement of American crops to the African coast. As this paper demonstrates,

recent advancements in methodologies and interdisciplinary approaches will enhance our understanding of Ghana's archaeological and environmental history.

Archaeobotanical research is crucial for Ghana's academic and agricultural landscape. It holds promise for addressing contemporary challenges related to food security and sustainable agriculture in the region. Amanda Logan's analysis in Banda, west-central Ghana, revealed that despite the worst drought in a thousand years around 1400–1650 AD, high food security was maintained. Although this type of research is only in its early stages in Africa, archaeologists are expected to uncover more examples of resilience during droughts as they gather more archaeobotanical data. Therefore, it is crucial that future research thoroughly examines the processes that have led to American crops becoming a part of local food traditions. The prospective study of the archaeobotanical record at the Likpe Kukurantumi Earthwork site in Ghana aims to contribute to this discussion on food security during precolonial times in Ghana.

Therefore, this review paper highlights the need for more research, publications, and scholarly discourse regarding foodways, food history, and daily practices within African archaeobotany. By including archaeobotanical and other relevant data sources we can significantly expand our knowledge of Ghana's food history and correct theoretical biases surrounding Africa's food history. Furthermore, the ability of archaeobotanists to track changes through time is crucial in allowing us to transcend assumptions that paint past communities as static. Finally, the study emphasises the importance of interdisciplinary research in addressing critical theoretical issues in African archaeobotanical research while highlighting the profound impact of Africans on the Atlantic trade.

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