

Interim Project Report

Sustainability and subsistence systems in a changing Sudan: ethnobotanical and archaeobotanical investigations into past, present and future crop choices.

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Summary Points

- Interviews with farmers have revealed dramatic, little-recorded changes in crops grown over the last 100 years in north Sudan.
- Traditional agricultural knowledge is rapidly disappearing with some information only remembered by elderly farmers.
- Several cereals and pulses that were the most important food crops grown by villagers until recent decades, but are now little used, are comparatively tolerant to aridity and heat. Their presence in the regional archaeobotanical record also reveals their long term use, further suggesting their environmental suitability.
- The case-study highlights the relevance of traditional agricultural knowledge to debates concerning future food security and agricultural resilience.

Introduction

Nubian agricultural practices are rapidly altering due to many reasons including new crop introductions, technological shifts and environmental changes. Our project *Sustainability and subsistence systems in a changing Sudan* explores how comparisons of present-day and ancient crop choices can inform on risk management within agricultural strategies of small-scale Nile settlements. This research is funded through the Arts and Humanities Research Council theme *Care for the future: thinking forward through the past*. There are four main components within the project structure:

- i. Ethnographic study of 'traditional' farming and foodstuffs (focusing on cereals and pulses), focusing on the case study of Ernetta Island.
- ii. Archaeobotanical research at 2nd millennium BC Amara West, an ancient island town, 4km downstream of Ernetta.
- iii. Situating the subsistence information from Amara West and farmer interviews within the context of existing archaeobotanical and 20th century AD information to create a long temporal view of crop choices.
- iv. Exploring how archaeobotanical and ethnobotanical evidence can contribute to debates about farming practices and agricultural risk management today.

The Study Region

Rainfall is virtually zero on the border with Egypt, increasing southwards to 400 mm per year on the border with South Sudan (Zaroug 2006, Walsh 1991). Crop growing possibilities range from entirely irrigated in the north to rain-fed with various permutations in between. The current study is focused on the middle Nile valley within the hyper-arid desert in northern Sudan. Interviews have focused the small river bank town of Abri (720km north of Khartoum), and the adjacent island of Ernetta, both of which are near the archaeological site of Amara West. Villages have been visited for comparison between the border of Wadi Halfa and the Dongola Reach. Interviews were concentrated in family farms to try and capture information about traditional practices and crops. This report summarises some of the findings, predominantly from Ernetta Island.



Map showing location of Amara West and Ernetta Island

Ethnography of changing Nubian agriculture, Ernetta Island as a case-study

Ethnographic approaches

We have been interviewing farmers about crops grown, their uses, and relative importance. We asked farmers about cultivation and crop processing methods, and associated foodstuffs. Farmers were interviewed about crops grown during the time of the *sagia* (waterwheel), and how these have changed through time alongside new methods of farming and ways of using crops. Farmers were asked how agricultural strategies and crop decisions are influenced by environmental and climatic factors, access to particular soils, crop introductions and trading opportunities as well as the availability of foodstuffs in local markets. Interviews were carried out in Arabic and Nubian in two field seasons during 2014 and 2015. A detailed questionnaire was constructed prior to fieldwork to help frame the range of questions, but in the field it was more practical and appropriate to hold

interviews as semi-structured informal conversations with farmers. However, an overarching aim was to try and obtain a detailed list of pulses and cereals grown by farmers today and in the recent past to understand agrobiodiversity and enable the temporal comparison of crops grown per village and between villages. This information is important as it is otherwise not written down, and – from our classroom sessions with local schoolchildren – is in danger of being lost within a generation or two.

Changing Nubian agricultural practices on Ernetta Island

Floodwater irrigation was still practised until the completion of the Merowe Dam (2009). Since the dam construction, the river is still high in the summer months (approximately June/July – late August/early September), then it inundates lower-lying areas. Archaeological evidence indicates the *shaduf* (bucket and pole) was introduced to Egypt in the late 2nd millennium BC (and would probably have been used at Amara West), whilst the *sagia* was used in the region since around the early 1st millennium AD. Elderly farmers described how large canal systems built in the first half of the twentieth century extended irrigation further inland (in some areas of the north, including the river bank town of Abri but not on Ernetta), and diesel irrigation pumps replaced the *shaduf* and *sagia* by the end of the 1970s. Small scale family farms, and shared agricultural schemes that exist near some villages, are in complete contrast to the large commercial schemes with large-scale irrigation infrastructure now seen in some areas of the Dongola Reach and around Atbara and Khartoum.

Crops, soils and irrigation

Recording soil categories has been useful because it has revealed how farmers grow certain crops on particular soils, and cultivate them in variable ways. The types of soils crops are grown on influences whether they are grown for home use or for sale. The soil quality impacts not only yield but also taste. On Ernetta Island soils can be subdivided into (i) the sloping river bank areas, inundated in the summer months (still today); these drawdown areas are used to grow the greatest diversity of crops, with the most highly appreciated flavours and textures, and all for home use. (ii) the area between the river banks and the palm belt; before the completion of the Merowe Dam (2009) this area was also flooded when the river was high enough, creating fertile soils that could be cultivated easily immediately after the flood and later on through artificial irrigation. (iii) the sandier, less fertile soils extending to the inner part of the island, which always need artificial irrigation and fertiliser (in the recent past using animal dung, and today chemical fertilisers). All the crops grown on the river banks along Ernetta today are grown as subsistence crops and, although the area is narrow (ranging from 4 – 20 meters inland), it can be intensively and continuously farmed without requiring additional fertiliser or irrigation for much of the year (because of the high water table, and the use of crops with long root systems). These soils also give the highest yields. A major difference today compared to the mid-twentieth century, according to farmers, is how cash crops (especially wheat and broad beans) take up so much field space (particularly on inner island areas). As a result, many other crops are now restricted to more limited areas – either along the fertile low-lying land, or in small ‘garden’ areas within the main field areas, or as border crops. More extensive field areas in the past were also used for growing fodder crops, with draught cattle being required for operating the waterwheels and preparing the land, until the very recent introduction of machinery.



Google Earth image of Ernetta Island, February 2017

Summary of key crop changes

Interviews with farmers, comparing what they grow today and in the past, have revealed distinct shifts in crops grown throughout the twentieth century. Today, agriculture in the region is dominated by newly-introduced wheat varieties and broad beans (known as ful), although a much wider range of cereals and pulses are still grown to varying extents. In contrast, interviews with older farmers (70+) have shown that sorghum (grown throughout the year but especially in the summer), hulled barley (grown in the winter) and lablab (grown in the winter and summer) used to be the main food crops until the mid to late 20th century. Other pulses such as cowpea were also used more for food. Although wheat is noted as grown in some locations of the north in the early twentieth century (Davies 1924), wheat was only introduced to Ernetta in the 1950s and rapidly replaced hulled barley for making bread. The very labour-intensive process preparing barley requires the removal of husks from flour after grinding. Today hulled barley is still grown on Ernetta to make a (non-alcoholic) barley water drink or fodder, but in some villages it is no longer grown at all. In most Nubian areas sorghum is now grown mostly as a fodder crop. Some farmers on Ernetta persisted with growing sorghum for food until the 2000s but abandoned this practice given losses to bird attack. A few farmers interviewed still bought sorghum grains in the market to make a variety of drinks (non-alcoholic) and occasionally to make kiseru. These pancakes used to be made with a wide range of cereal (sorghum, hulled barley, pearl millet, maize) and pulse flours (especially lupin), in varying combinations. Many farmers described the increase in the use of wheat as related to a taste for 'city food' – referring to baked bread and ful (a dish made with casseroled broad beans). In older houses, the kitchens are composed of open hearths – one of which is covered with a round hotplate for flatbreads including 'kiseru', but these rooms are rarely used today. Farmers reported that a wider range of pulses were more routinely consumed for food in the past, and most commonly

prepared as a bean stew dish (balilae). However, such balilae dishes are now eaten less regularly; instead ful and tameae (falafels) are the daily dishes. Crops grown for animal fodder have also changed on Ernetta, not least because draught cattle are no longer used, and mostly small livestock are kept for milk and meat. Previously, wide areas of cowpea and sorghum (sometimes intercropped) lablab and hulled barley were grown for fodder crops. Berseem (*Medicago*) is an increasingly-grown fodder crop today, grown more in the Abri area than on Ernetta, especially on sandier more inland areas. Historical literature dating to the early twentieth century and a more recent ethnographic study in the Mahas region of the north provide a useful means from which to compare data from the interviews about the history, and timing, of crop changes (Batal 1991; Tothill 1948).



Cultivating the river banks on Ernetta Island (February 2015); a diverse range of crops grown in small patches including sorghum, maize, lablab, cowpea, pigeon pea and lupin

The problem with bread wheat?

New varieties of wheat (all still *Triticum aestivum*, bread wheat), especially from the 1970s onwards, and of broad beans since the 1990s have seen these crops, in succession, become the key cash crops on Ernetta. This increase in wheat use is part of a broader trend in Sudan (e.g. Mustafa et al. 2013). However, one of the most recent and dramatic crop changes was actually between 2014 and 2015, with farmers on Ernetta and Abri abandoning wheat crops in 2015 because they failed in 2014 due to bird attack. Wheat was still grown in many other regions of the north in 2015. Farmers explained that if several farmers grow the same type of wheat crops at the same time, and in adjacent areas, that the problem of bird attack is managed because the impact is distributed amongst their field areas. The problem on Ernetta is partly that at least 5 varieties were being grown by farmers (each taking a different number of days to grow), and all being sown at slightly different times (as they

were sharing a threshing machine). Additionally, the river banks in this area are covered in dense vegetation and trees giving cover – exacerbating the local bird problem.

Differences in agricultural strategies amongst villages: local ecology, soils and crop choices

Analyses at the level of individual farms is revealing local narratives of agricultural change. Despite being located within the same broad agroecological setting, there are distinctive differences between individual farms and villages in relation to the categories of soils available to farmers. Differences in crops grown between villages are being further explored. We are also examining how agricultural strategies have been influenced by the timing and scale of technological developments (such as road and canal construction) in those areas. Other aspects, which will also contribute to overall publication preparation, are the percentages of farmers growing particular crops today and in the recent past, and how these figures compare amongst the areas visited in the north

The long history of crops in the region: the archaeobotanical context

The antiquity of present-day crops reveals the long-term use in the region of several crops that were key crops until recent decades – especially hulled barley, lablab and sorghum. Emmer wheat and hulled barley (Near Eastern winter crops) were present in the middle Nile valley from around 5000 BC (Ryan et al. 2016, Madella et al. 2014). These, and other Near Eastern winter crops such as peas and lentils, were the main crops (including at Amara West) through to the end of the 1st millennium BC. The first evidence for sorghum in the Nile valley dates to approximately the mid-1st millennium BC (post-dating Amara West by a few hundred years), and, after the introduction of the waterwheel, sorghum and other cereals and pulses (including lablab) that can also be grown in hotter months became increasingly important (Clapham and Rowley-Conwy 2007, Fuller 2014). By the early 1st millennium AD, emmer wheat was largely replaced by bread wheat (which is easier to process) but wheat overall then seems to have become a minor crop until the twentieth century.

Archaeobotanical investigations at Amara West have been exploring the agricultural economy of the late 2nd millennium BC through a period of known increased aridity. The ancient town was originally located on an island but a river channel around the town dried up during its occupation. At this time, emmer wheat and hulled barley were dominant crops, and would have been grown in the soils exposed after the flood recession. Riverine changes around Amara West were part of a pattern of dramatic phases of paleochannel contractions between the 3rd – 1st millennium BC (Macklin et al. 2015). In the long run, this would have increasingly made untenable a dependence on winter grown crops in the region because of a loss of low-lying land for cultivation. For more details on archaeobotany at Amara West see Ryan (2016), Ryan et al. (2016) and https://www.britishmuseum.org/research/research_projects/all_current_projects/sudan/amara_west_research_project/archaeobotany_of_amara_west.aspx

Initial conclusions: crop diversity, risk management and food security

Interviews have shown that crop changes are connected with new irrigation practices, processing methods, attitudes towards foodstuffs and the growing importance of cash crops since the 1970s. This case study aims to highlight how ethnobotanical and archaeobotanical research can illuminate changing crop diversity and land use. Recording local foodstuffs and processing practices aims to

help maintain the local knowledge of how to grow and prepare certain crops, for example how to cultivate them in a way that makes them palatable (rather than merely animal fodder). Preserving traditional agricultural knowledge is also relevant to investigating resilience to climate change and protecting against environmental degradation. The presence in the archaeobotanical record of a number of crops grown until recent decades suggests their environmental suitability to the region (including cereals hulled barley, sorghum and pearl millet and pulses lablab, cowpea, and lupin). Notably, hulled barley has the longest history; its use dating back to around 5000 BC. Hulled barley is a comparatively arid-tolerant winter cereal, and interviews revealed it grows (in this region) in around 90 days versus between 120-140 days for the different varieties of bread wheat. The balance of use between Near Eastern (winter) and African (summer) crops is key to discussions of past, present and future agricultural risk management in Sudan, throughout much of North East Africa and beyond. Establishing which long term food crops are falling from favour contributes to ongoing debates about the role of increasingly little used cereals and pulses and their importance to future food security ((Ahmed and Mohammed 1997; Blench 1997; FAO 1997; Swiderska et al. 2011). Crop diversification is one way of managing agricultural risk given that using a number of cereals and pulses with different growing tolerances (such as to heat or water stress) helps to buffer against crop failure. This study aims to create a long-term perspective of adaptive solutions and how these are relevant to the future, and aims to record and promote local knowledge of sustainable natural resource exploitation.

		Arabic/Sudanese		
	English	Latin	Arabic	Nubian
Cereals	barley	<i>Hordeum vulgare</i>	<i>el Sha'eera</i>	<i>seringi</i>
	wheat	<i>Triticum aestivum</i>	<i>gemeh</i>	<i>ile</i>
	sorghum	<i>Sorghum bicolor</i>	<i>durra</i>	<i>marige</i>
	maize	<i>Zea mays</i>	<i>durra shami</i>	<i>makada</i>
	pearl millet	<i>Pennisetum glaucum</i>	<i>dukhin</i>	<i>foto</i>
Pulses	broad bean	<i>Vicia faba</i>	<i>ful</i>	
	cowpea	<i>Vigna unguiculata</i>	<i>lubia hilu</i>	<i>deginteh</i>
	chickpea	<i>Cicer arietinum</i>	<i>kapkabeh</i>	
	lablab	<i>Lablab purpureus</i>	<i>lubia afin</i>	<i>kashranyeig</i>
	pea	<i>Pisum sativum</i>	<i>basilla, woreig</i>	
	white lupin	<i>Lupinus albus</i>	<i>termis</i>	
	fenugreek	<i>Trigonella foenum-graecum</i>	<i>helba</i>	
	haricot bean	<i>Phaseolus vulgaris</i>	<i>fasoolya</i>	
	pigeon pea	<i>Cajanus cajan</i>	<i>lubia adassi</i>	
	lentil	<i>Lens culinaris</i>	<i>adis</i>	
	alfalfa	<i>Medicago sativa</i>	<i>berseem</i>	

Summary of crops recorded



Lablab growing along the river bank on Ernetta Island

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