The translocation of useful trees in African prehistory

Presented at the 8th **International Workshop for African Archaeobotany**

Modena, Italy, 23 – 26 June 2015

This version submitted for the proceedings

Roger Blench
McDonald Institute for Archaeological Research
University of Cambridge
Kay Williamson Educational Foundation
Correspondence to:
8, Guest Road
Cambridge CB1 2AL
United Kingdom
Voice/ Ans (00-44)-(0)1223-560687
Mobile worldwide (00-44)-(0)7847-495590
E-mail rogerblench@yahoo.co.uk
http://www.rogerblench.info/RBOP.htm

This version: Mantua, 28 September, 2015

TABLE OF CONTENTS

TABLES

MAPS

PHOTOS

ABSTRACT

Agriculture in Africa is usually conceptualised as having a distinct era when it begins and specific indicators of early plant domestication. However, as research on African vegetation evolves, it is increasingly clear that the identification, use and subsequent translocation of trees and other woody plants constituted a major process in the transformation of the African landscape far earlier than agriculture proper. The paper presents some examples of tree translocation, discusses methodology of identifying such tree species, and suggests that the African rain forest is in many ways comparable to early domestication process in the Amazon and the Pacific.

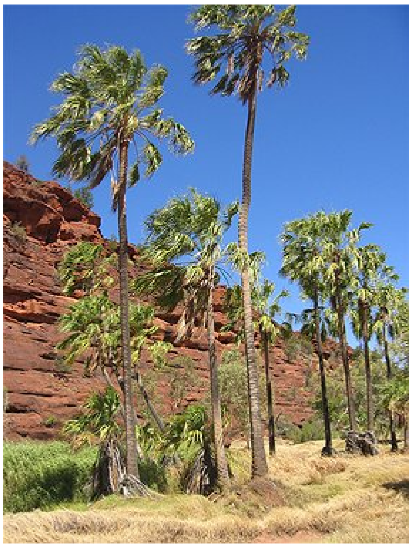
Key words: Woody vegetation, trees, translocation, Africa

1. Introduction: the 'domesticated' rainforest

An all-too common conceptualisation of African vegetation contrasts domestic landscapes with 'wild' forest, typically the humid forest spreading along the West African coast and continuing into the equatorial regions of the Congo. NGOs and governments have a strong interest in portraying rainforests as a primeval Eden and the people who live in them as *Naturvölker*, in harmony with nature. The conclusions each institution draws are somewhat different, according to whether the goal is to protect the forests at all costs, or to log them extensively, on the presumption that the few inhabitants have no rights over the trees. However, it is becoming increasingly clear that this characterisation of forests is a fantasy, that the great equatorial forests are more like gardens or farms and only our cereal-based concept of agriculture that prevents us from seeing this.

Globally speaking, a key step in the identification of tree management and translocation as a distinct process has been the archaeobotany of the Pacific islands (e.g. Barrau 1956; Walter & Sam 1999; Kyle Latinis 2000). Since archaeological coverage is good and increasingly reliable direct dates relatively abundant, particular species can be identified as not part of the 'natural' flora and thus transplanted by humans (Blench 2005). These processes must have long preceded the horizon attributed to conventional agriculture in the Asia-Pacific (Blench 2008). It is becoming increasingly clear that similar processes occurred in the Amazon (Clement at al. 2015; Piperno et al. 2015). Trees were identified as useful as much as 11 kya and were spread around the Amazon basin, notably the corozol palm and the peach palm. The Amazon, far from being 'untouched', is a managed resource with an entirely unnatural floristic composition. Even older is evidence for the anthropic translocation of the red cabbage palm (Photo 1), *Maris livistona*, into central Australia as much as 30,000 years ago (Kondo et al 2012)[1].

Photo 1. The red cabbage palm in Central Australia



Agriculture in Africa is usually conceptualised as beginning at a distinct horizon which can be delineated via the results of archaeobotany. While this can be successfully applied to cereals and pulses recovered from drier areas, evidence for tree domestication and other types of vegeculture will never be so neat. Trees may or may not show distinctive morphological changes, according to their uses and the purposes of their managers. The great majority of trees identified in early periods for food or other products may well have been translocated, protected from fire, and otherwise encouraged, but may not show morphological change. As research on African vegetation evolves, it is increasingly clear that the identification, use and subsequent translocation of trees and other woody plants constituted a major process in the transformation of the African landscape, sometimes concurrent with but often significantly earlier than seed agriculture.

As cartography of indigenous African tree species becomes increasingly available[2], it is more evident that many species extend far beyond their natural range (Morin-Rivat *et al*. 2014). This is the result of a variety of processes, including both intentional translocation and facilitation by human migration as seeds of edible fruits were discarded (Vivien & Faure 2011a,b). Well-known species in this category include the baobab (*Adansonia digitata*) and the silk-cotton (*Ceiba pentandra*), but there are many more, including the wild date-palm (*Phoenix reclinata*), the oil-palm (*Elaeis guineensis*), the shea (*Vitellaria paradoxa*) and the locust (*Parkia biglobosa*). Most of the evidence for this is biogeographical, although additional support can be gathered from palynology, ethnography and linguistics (Williamson 1993; Connell 1998; Blench 2007a,b, 2014; Bostoen 2005, 2014; Bostoen et al. 2013; Oslisly et al. 2013a,b). It is worth noting that online databases such as that maintained by *Conservatoire et Jardin botaniques, Ville de Genève*, typically

[1] Ironically this was thought to be a disappointing result, as the palm had previously considered to be a relic of Gondwanaland.

[2] See http://www.ville-ge.ch/musinfo/bd/cjb/africa/recherche.php

privilege herbarium specimens, and 'wild' specimens. Thus the map plotting the distribution of the oil-palm completely omits its widespread occurrence in the savanna, where it is a common anthropic migrant. To develop a reliable cartography depends on synthesising both herbarium records and descriptive literature.

The exact circumstances and chronology of tree management in the mid-Holocene remains controversial, but in more recent times, Africa has seen the introduction and spread of a wide variety of cultivated trees. On the east coast, part of the sphere of Indian Ocean trade, important species such as the coconut, the mango, the orange and the areca palm were introduced by the medieval period or earlier. On the west coast, the Portuguese introduced the guava, the pawpaw and the avocado, as part of the trade triangle established with the Americas. In the colonial era, trees such as the mango, and ornamentals such as the neem, Persian lilac, flame tree and jacaranda were all introduced by missionaries and colonial officials, transforming the African landscape. Moreover, plants such as the *Citrus* spp. already established on the East Coast, were brought around and introduced to West Africa.

The paper[3] discusses the process of tree translocation, the methodology for identifying such species, as well as the types of evidence we should seek in extending and testing hypotheses about individual species. It presents an extended example of *Phoenix reclinata*, the wild date palm, which is not domestic in the usual sense, and which is endemic to the continent, but which has evidently been widely dispersed by humans. The broad conclusion is that current approaches to the genesis of the African landscape have consistently underestimated the contribution of managed and translocated trees and that it underwent an early domestication process in many ways comparable to the Amazon and the Pacific islands.

2. The principles of translocation

Ascertaining the motives for tree translocation hangs on the question of intentionality. Do people decide to move trees, and do they manage surrounding vegetation to encourage particular species? For example, although the distribution of the baobab is manifestly anthropic (Duvall 2007), it is highly unlikely that it was primarily transplanted intentionally, because this was unnecessary. Its fruit is carried as a storable snack, and when the shell is cracked open and the edible pulp is cleaned of seeds, the seeds fall and germinate. Hence baobabs often occur along the lines of former or present pastoral migration routes (Wickens & Lowe 2008). In more recent times the distribution pattern has changed, with the growth of fenced agricultural fields, as baobabs are occasionally used as live fences. By contrast, the only use of *Euphorbia* spp. is as live fences and its transplanting and management is characteristic of the post-agricultural period.

By examining characteristic species, we can tabulate a variety of processes responsible for anthropic tree distributions (Table 1);

[3] This paper was first presented at the 8th International Workshop for African Archaeobotany, Modena, Italy, 23 – 26 June 2015. However, its genesis was following an Ethnoscience Summer School in Libreville, Gabon, in 2013. I would like to thank Charles Doumenge, CIRAD, Montpellier and Charles Clement, INPA, Manaus, for discussions underlying the general idea.

Table 1. Processes responsible for anthropic tree distributions

Process	Description	Example
Intentional translocation	The tree has a product so desirable that it is planted in a new location.	oil-palm, bush-candle, pawpaw, orange
Unintentional translocation	The tree has a fruit or other product which is used and leads to transport of seeds to new locations.	baobab
Facilitation	The tree is not translocated, but its habitat and growth prospects are improved by clearance of vegetation etc.	oil-palm
Unintentional facilitation	The tree is not valued, but anthropic processes such a forest clearance, provide enhanced habitat.	umbrella tree
Other indirect processes	Human predation of animals, insects which pollinate plants, leading to skewed distributions.	

The possible products responsible for the intentional translocation of trees are numerous and in many cases reflect economic interactions with an external trade system or broad cultural shifts within the continent. Table 2 presents a list of motives for intentionally translocating trees, including an example species;

Table 2. Reasons for intentionally translocating trees

Motivation	Example
Food and edible oil sources, fruits, roots, leaves etc.	*Vitellaria paradoxa*
Construction materials	*Raffia sudanica*
Weaving of fibres: mats, hats and others	*Phoenix reclinata*
Boundary markers/fencing	*Newbouldia laevis*
Green manure	*Tephrosia vogelii*
Shade	*Ficus platyphylla*
Ritual importance	*Diospyros mespiliformis*
Medicinal	*Bridelia ferruginea*
Ornamental	*Melia azederach*
Pollen attracts bees	*Annona senegalensis*
Provide habitat for hunted animals and birds	
Commercial – timber or other products sold	*Funtumia elastica*
For alcohol	*Raffia hookeri*

Some of these motivations must have been at work in the pre-agricultural era, such as supplementing food supplies, edible oils, medicines or alcohol. Others are post-agricultural, such as large-scale fencing and construction material. Following the era of European contact, demand for products such as timber and rubber accelerated demand for particular species, while at the same time, ornamentals were introduced, as part of the colonial process of making a familiar environment. Books such as Dalziel (1937) or Busson (1965) present a conspectus of West African useful plants from a colonial perspective; the value of woods for railway sleepers, house construction and so on. Whole institutes were established to explore and value tropical products, such as the Imperial Institute in London, which became the Tropical Products Research Institute.

Our interpretation of the patterning of African tree translocation is inevitably driven by ethnobotany. We can record the uses of trees in the present, and it is tempting to read these into the past. But current tree exploitation processes are not necessarily a reliable guide to past practice. In other words, ethnobotany is not necessarily archaeobotany. Two contrastive examples illustrate these issues. The shells of the African nettle, *Celtis integrifolia*, are regularly recorded in West African sites and seem to have been eaten extensively in the past (Kahlheber 1999). But it seems they are difficult to digest and are almost never recorded as eaten in present ethnobotany surveys, presumably because they have been displaced by more edible fruits, such as the mango.

By contrast, shea, *Vitellaria paradoxa*, is widely grown in the present from Senegal to Uganda for its oil (Hall *et al.* 1996; Blench 2014). Despite having potentially highly visible macro-remains, it has only a weak archaeobotanical presence. Neumann *et al.* (1998:60) report a testa from the medieval village of Saouga and note that shea-butter production was recorded by Ibn Baṭṭuṭa in the 14th century. Shea is complex to process, involving roasting ovens and large-scale oil expression and purification, and it seems likely that its widespread use may well be late, reflecting an already mature agriculture.

3. Overview of translocated species

3.1 General

The examples given so far have been from trees where the motive for translocation is fairly obvious and can be attested in the ethnographic record. However, there are many species of tree which *might* be translocated but for which the evidence is uncertain. The situation is the same in the Amazon, and only painstaking work with individual species can uncover its history. However, what we can look for is 'suspicious' distributions, i.e. those where the tree appears to reflect human presence or absence in some way.

3.2 Translocated trees in semi-arid regions

Tree translocation in the semi-arid and Sahelian regions is more obvious than in the equatorial forest, since the overall floristic inventory is much smaller, and trees are hardy once established. Table 3 shows a list of common trees indigenous to the African continent, which seem to have partly anthropic distributions.

Table 3. Tree species translocated in semi-arid regions

Common name	Scientific name
African olive	*Canarium schweinfurthii*
Baobab	*Adansonia digitata*
Ben oil tree	*Moringa oleifera*
Borassus palm	*Borassus aethiopum*
Dum palm	*Hyphaene thebaica*
Locust bean	*Parkia biglobosa*
Oil-palm	*Elaeis guineensis*
Red-flowering silk-cotton	*Bombax buonoponenze*
Shea	*Vitellaria paradoxa*
Silk-cotton	*Ceiba pentandra*
Tamarind	*Tamarindus indica*
Whitethorn	*Faidherbia albida*
Wild date-palm	*Phoenix reclinata*

Trees play a part in economic systems, and their products can change in value in various historical eras. Translocation can thus be a dynamic process, entering into feedback loops. Once a specific product of a tree is valued, familiarity leads communities to develop other uses. An example of a species translocated in semi-arid regions which has had different use-values over times is the baobab (*Adansonia digitata*). Table 4 shows the different uses of parts of the baobab with speculations about their relative antiquity.

The value attributed to baobabs is clearly responsible for their widespread occurrence in savannas, but they also spread down the west coast of equatorial Africa, certainly not their natural environment. For example, Photo 2 shows a baobab in the Kinshasa area. It is conceivable their presence is explained by former savanna corridors but human intervention is the most likely explanation. Rather intriguingly, evidence for the complex translocation of the baobab to India has recently emerged. It has long been assumed that the baobabs in India probably arrived in the medieval period along with the populations of Africa former slaves, the Siddi (see discussion in Blench 2003). However, Bell et al. (2015) have mapped baobab populations around India and the evidence from genetics is that regional populations come from distinct areas on the African continent and show different levels of internal diversity, suggesting they were transported at widely varying intervals.

Table 4. Changing uses of the baobab over time

Use	Antiquity	Comment
Edible fruit	Probably old	A white edible pulp surrounds the seeds[4]
Rope	Probably old	Strips of bark are rolled into rope
Religious importance	Almost certainly old	the focus of many shrines in savanna regions and trees strongly protected even in highly anthropic landscapes.
Leaves	Probably recent	making soup from leaves is a practice spread by the Hausa
Fencing	Probably recent	Young baobabs plant to fence compounds
Ice cream	Certainly recent	The white pulp surrounding the seeds used to flavour ice-cream.
Tourism	Certainly recent	Old baobabs attractive sites for tourism

3.3 Tree translocation in the modern era

Photo 2. Baobab in the Kinshasa area

Source: Author

An intriguing feature of the African landscape is the very large number of trees that have been successfully translocated in the era of European contact. In part this reflects very different external priorities. For example, although wild fruits were eaten in pre-European Africa, they had a low prestige, indeed were often considered famine foods or suitable for children. As a consequence, little effort was made to domesticate or improve them. This was in contrast to stimulants such as cola and oily seeds such as the bush mango, *Irvingia gabonensis*, which have been the subject of genetic change and anthropic dispersal. Effectively this left an open niche in the agro-ecology of the region, which was complemented by the European taste for fruit. Trees have an additional advantage compared with field crops, in that they do not need a complex agronomic infrastructure to be introduced effectively. A tree such as the papaya was introduced by the Portuguese in the eighteenth century and rapidly spread inland through farmer-to-farmer transmission (Blench 1998). By contrast, the rose-apple, *Syzygium jambos*, although found in a few markets along the West African coast, has never become a major part of indigenous cultivation systems, presumably because it cannot survive in a wide variety of ecosystems. Some of these fruit trees have so far escaped cultivation as to become weed species, such as the mango.

The same is true with ornamentals. The Victorian enthusiasm for flowers was matched by local cultures in India and the Pacific, but flowers and the use of vegetation for decoration have never had much importance in Africa. Missionaries in particular identified a variety of trees and climbers for use in making compounds more attractive and those which were relatively hardly were transported to Africa. The neem and the flame tree have become such common roadside species in many parts of the continent that many people now believe they *are* indigenous.

Table 5 is an abbreviated list of the most common translocated fruits and ornamentals in Africa which have become permanent features of the landscape and integrated into African farming systems.

[4] Curious, this pulp was only approved for food use in Europe in 2008 and in the US in 2009, despite being eaten for millennia in Sub-Saharan Africa.

Table 5. Examples of tree species translocated in the modern era

Common name	Scientific name	Main use value
Orange, lemon, lime etc.	*Citrus spp.*	Fruit
Guava	*Psidium guajava*	Fruit
Avocado	*Persea americana*	Fruit
Coconut	*Cocos nucifera*	Fruit
Mango	*Mangifera indica*	Fruit
Pawpaw, papaya	*Carica papaya*	Fruit
Teak	*Tectona grandis*	Timber
Eucalyptus	*Eucalyptus grandis*	Firewood
Jacaranda	*Jacaranda spp.*	Ornamental
Neem	*Azadirachta indica*	Ornamental
Flamboyant	*Delonix regia*	Ornamental

Many other species recorded in local handbooks of useful plants are found in restricted areas.

3.4 Open niches and continuing transformation

It should not be thought the processes behind tree translocation are static, the African landscape continues to be transformed by introductions but also by the open niches created by farming practices, the policies of development agencies and land degradation. For example, in Northern Ghana, the silk-cotton tree, *Ceiba pentandra*, was formerly a key species in the arable landscape, used for its floss, leaves and bark (Chevalier 1949). While not domesticated in the sense of morphology, the silk-cotton must have been transplanted and protected in the growing stage to account for its high incidence. The traditional uses have now been largely displaced, but the trees remain. Every dry season, the pods fall the ground, split open and floss fills the air. The tree has thus gone from a key useful species to little more than a weed, and only its size makes if difficult to eliminate rapidly. A more modern intervention is analysed in Awono *et al.* (2002) which discusses the promotion of the safoutier, *Dacryodes edulis*, an indigenous African species, which has been taken up by CIFOR (Centre for International Forestry Research). Although already widely traded in West-Central Africa, improved varieties may increase its profitability, leading to more extensive planting and sale (Leakey et al. 2002).

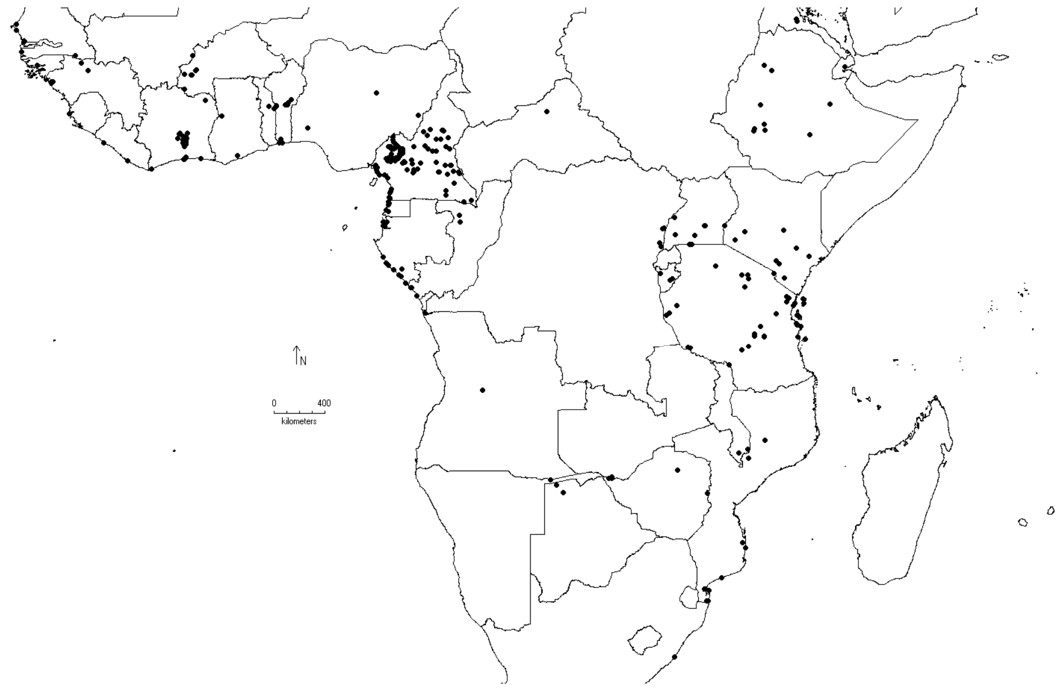
Photo 3: Wild date-palm, *Phoenix reclinata*

4. The example of the wild date-palm, *Phoenix reclinata* (Arecaceae)

The wild date palm, *Phoenix reclinata* Jacq., is widely valued for its leaves, which are used to make hats and mats (Burkill 1997). Records from Southern Africa suggest it is also tapped for wine, although this use is not significant elsewhere in the continent. Despite its well-known relative, the fruits are virtually inedible. Ethnobotanical surveys usually record it as 'wild' and it is not currently transplanted. It is common in semi-arid zones, south of the date-palm proper, but is also recorded in coastal forest and disturbed habitats in equatorial forest (Map 1). Apart from the African mainland it is also recorded in Madagascar, the Comores and the Arabian Peninsula, and it has been naturalised in Florida, Puerto Rico, Bermuda and the Leeward Islands, presumably through the slave trade. It seems to be entirely absent in Angola, Namibia and the dry parts of Western and Southern Africa[5].

Map 1 shows the distribution of the wild date palm in Africa, and illustrates the hypothesis that part of its distribution at least must be anthropic. Kinnaird (1992) has shown that the fruits play an important role in the diet of mangabeys, so it is possible they may act as secondary dispersal agents. Although a tree of semi-arid savannas, there are records along the west coast of Central Africa as well as in islands within the tropical moist forest. In the northwest of the equatorial forest, it has a split distribution, both along the littoral and down the riverline in the interior. This suggests anthropic colonisation during the forest disturbances associated with the first wave of Bantu expansion, before the opening up of the 'Sangha gap'. However, it also has a striking distribution on the east coast of Africa and in northwest Madagascar. Given that this part of Madagascar is where Swahili settlement was most important, it is reasonable to assume it was carried there, as to the Comores. Evidence from phytoliths shows that *Phoenix reclinata* has an early presence in East Africa, and therefore the lack of records in Central Africa is a relic of more recent movements in the boundary of the forest (Albert et al. 2009). The populations on the east coast of South Africa, with a name clearly cognate with Swahili and other related languages suggests that the wild date palm was brought there are part of the early coastal trade, which left islands of Swahili in the far south of Mozambique (Blench 2012).

Map 1. ***Phoenix reclinata*** **in Africa**



Source: Courtesy Charles Doumenge

Is it possible to match the linguistic evidence with these hypotheses? Blench (in press) discusses some of the methodological pitfalls in using linguistic evidence. Blench (2014) is a preliminary compilation of related vernacular names for the wild date palm, and this is significantly expanded in Table 6. It appears there is a widespread root in West Africa with a general shape *kVl/rV*. This is most commonly applied to the wild date palm, but sometimes to other species. However, in Yoruba and other southern Nigeria languages, this is shortened and then reduplicated, giving forms such as Yoruba *okȕkȕ*. Reflexes of this form are attested in a variety of Bantoid languages. The published Proto-Bantu form **kìndó* might seem to be an obvious extension of this, but in fact the supporting evidence is entirely from Eastern and Southern Africa. According to sources for northwestern languages such as Raponda-Walker & Sillans (1961) the vernacular names in Gabon are quite unrelated. Assuming there is a connection between Bantoid and Bantu of Eastern

[5] According to Rodin (1985) indigenous names in Namibia translate as 'palm of the white people' and attempts to introduce it are within the period of historical records.

Africa, this will be in the poorly documented Bantu languages on the northern edge of the forest savanna ecotone.

Table 6: #-kundi-, a root for a dryzone palm in Niger-Congo languages

Family	Subgroup	Language	Attestation	Gloss
Mande		Mende	kundi, keli	*Phoenix reclinata*
Mande	West	Bambara	kolo	dum palm
Atlantic	North	Wolof	koroso	*Phoenix reclinata*
Atlantic	South	Temne	a-kent /ɛ-	*Raphia* sp.
Gbaya		Ɓodoe	kò	*Borassus aethiopum*
Kwa	Ga-Dangme	Ga	kɔ̀lɔ̀	k.o. palm tree
EBC	Yoruboid	Yoruba	okũ̀kũ̀	*Phoenix reclinata*
EBC	Edoid	Ẹdo	ukukõ	*Phoenix reclinata*
Bantoid	Ring	Kom	ə̄kú	palm tree
Bantoid	Momo	Ngwo	ànkɔ́n	'date palm'
Bantu		PB	*kìndó	wild date palm
Bantu	E23[6]	Zinza	mʧindu	*Phoenix reclinata*
Bantu	E51	Kikuyu	mukindu	*Phoenix reclinata*
Bantu	E55	Kamba	mukindu	*Phoenix reclinata*
Bantu	E73	Digo	makindu	*Phoenix reclinata*
Bantu	F11	Tongwe	lusanda	*Phoenix reclinata*
Bantu	F21	Sukuma	bukindu	*Phoenix reclinata*
Bantu	G42	Swahili	mkindu	*Phoenix reclinata*
Bantu	J30	Luhya	luʃindu	*Phoenix reclinata*
Bantu	S10	Shona	muʧindwe	*Phoenix reclinata*
Bantu	S42	Zulu	isundu	wild date palm
Bantu	S51	Hlengwe	ʧinzu	*Phoenix reclinata*

Table 6 is compiled from overviews of plant names for Bantu languages (including Wild et al. 1972; Maundu et al.; Ruffo et al. 2002). West African lexemes are from my own fieldwork in Nigeria and Cameroun and Burkill (1997). Only words which I consider cognate are included.

5. Conclusions

Our understanding of the transition from foraging to farming has been strongly influenced by models deriving from the Near East, where humans discover a promising seed and gradually domesticate it by a variety of processes. Due to the density of research in the Asia-Pacific region, the origins of vegeculture are beginning to provide a competing model in terms of crops (Blench 2013). But the translocation of trees and other plants remains difficult to fit into this model. Just as there is increasing evidence for the translocation of animals long before agriculture (Drake & Blench in press) so this is also the case with trees. Foragers can move fruits and seeds around intentionally (as we know to be the case in the Pacific Islands) or as consequence of eating and discarding fruits. Changes in forest boundaries as palaeo-climate alters over time makes discriminating between natural and anthropic spreads more complex. Nonetheless, although tree translocation and arboriculture are well-described processes the Amazon and the Pacific, they hardly figure in accounts of the evolution of vegetation in Africa. Nonetheless, as the evidence mounts, both the semi-arid and equatorial landscapes must increasingly be characterised as domestic, even in periods well before the advent of agriculture.

The second aspect of this is that use-values are dynamic. One of the misleading impressions given by typical ethnobotanical characterisations is that all the uses are synchronic and by implication can be referred back to the period when humans first made use of a particular species. But is easy to see that this is false, that a species may come into prominence for one use, others are thereby discovered and the value of the primary

[6] Bantu languages are numbered using the referential scheme of Guthrie, which may not imply anything about their genetic classification.

use may diminish or even disappear. For example, tree barks used to make rope were clearly of great importance prior to European contact, but with import first of stronger vegetable fibres, and then synthetic substitutes, their value has dropped to near-zero. The baobab (Table 4) is a good example of the dynamic use of a tree species over time. Similarly, the shea, a premium oil species across much of semi-arid West Central Africa, may well have become salient relatively recently, despite being an endemic across the region (Blench 2014). Thus when reconstructing vegetation history, taking this type of dynamism into account is evidently of considerable importance.

Methodologically speaking, we are just at the beginning of developing techniques to detect anthropic translocation. Macro-remains of trees do not always show the type of definitive morphological changes characteristic of cereals. Palynology can help plot the antiquity of a species in a particular region, but without associated palaeo-climatic profiles it is difficult to assess the likelihood of translocation elsewhere. The existence of pollen cores in Africa remains highly patchy, with some areas well-covered, and vast regions barely known (cf. Oslisly et al. (2013b) for a summary of the situation in the northwest equatorial forest). Bostoen et al. (2013) have demonstrated how linguistic evidence can be matched to vegetation dynamics, but this works better for well-documented tree species. Descriptive ethnobotanies for individual groups remain a high priority. Genetics should also provide answers to some of these questions, especially for salient and widespread species. However, except for the baobab, the use of these techniques has hardly begin.

A key part of the process, however, is simply asking the right questions. Ethnobotany can helps focus archaeobotany, and archaeobotanical findings can be matched to the results from other disciplines. That landscapes are domesticated almost everywhere is beginning to be accepted as a general principle, but actually documenting particular species of useful woody plants, and identifying the patterns and mechanisms of their diffusion, remains a considerable challenge.

References

Albert, R.M., Bamford, M.K., & Cabanes, D. 2009. Palaeoecological significance of palms at Olduvai Gorge, Tanzania, based on phytolith remains. *Quaternary International*, 193(1): 41-48.

Awono, A., Ndoye, O., Schreckenberg, K., Tabuna, H., Isseri, F., & Temple, L. 2002. Production and marketing of safou (*Dacryodes edulis*) in Cameroon and internationally: market development issues. *Forests, Trees and Livelihoods*, 12(1-2): 125-147.

Barrau, Jacques Plantes alimentaires de base des Mélanésiens. *Journal d'agriculture tropicale et de botanique appliquée*, 3(1-2):32-49.

Bell, K.L., Rangan, H., Kull, C.A. & Murphy, D.J. 2015. The history of introduction of the African baobab (*Adansonia digitata*, Malvaceae: Bombacoideae) in the Indian subcontinent. *Royal Society Open Science*, 9 September 2015. DOI: 10.1098/rsos.150370

Blench, Roger M. 1998. The diffusion of New World Cultigens in Nigeria. In: *Plantes et paysages d'Afrique*. M. Chastenet. ed. 165-210. Paris: Karthala.

Blench, Roger M. 2003. The movement of cultivated plants between Africa and India in prehistory. In: K. Neumann, A. Butler & S. Kahlhaber (eds.) *Food, fuel and fields: progress in African Archaeobotany*. 273-292. Köln: Heinrich-Barth-Institut.

Blench, Roger M. 2005. Fruits and arboriculture in the Indo-Pacific region. *Bulletin of the Indo-Pacific Prehistory Association*, 24:31-50.

Blench, Roger M. 2007a. Using linguistics to reconstruct African subsistence systems: comparing crop names to trees and livestock. In: *Rethinking Agriculture. Archaeological and ethnoarchaeological perspectives*. Denham, Timothy P., José Iriarte, Luc Vrydaghs eds. 408-438. Walnut Creek: Left Coast Press.

Blench, Roger M. 2007b. The intertwined history of the silk-cotton and baobab in West Africa. In: Cappers, René T. J. (ed.), *Fields of Change. Progress in African archaeobotany*. 1-20. Groning: Barkhuis.

Blench, Roger M. 2008. A history of fruits on the SE Asian mainland. In: *Occasional Paper 4: Linguistics, Archaeology and the Human Past*. Toshiki Osada and Akinori Uesugi eds. 115-137. Kyoto: Indus Project, Research Institute for Humanity and Nature.

Blench, Roger M. 2012. Two vanished African maritime traditions and a parallel from South America. *African Archaeological Review*. DOI 10.1007/s10437-012-91.

Blench, Roger M. 2013. Was there once an arc of vegeculture linking Melanesia with Northeast India? In: *Pacific Archaeology: Documenting the Past 50,000 Years: Papers from the 2011 Lapita Pacific Archaeology Conference*. Glenn R. Summerhayes & Hallie Buckley eds. 1-16. University of Otago Studies in Archaeology, No. 25. Otago University Press.

Blench, Roger M. 2014. New reconstructions of West African economic plants. In: *Language and history in the light of reconstructions. FAB (2010)*. J. Adelberger & R. Leger eds. 111-149. Rüdiger Köppe: Köln.

Blench, Roger M. (in press). Reconstructing African agrarian prehistory by combining different sources of evidence: methodological considerations and examples for west African economic plants. Proceedings of the 7th International Workshop on African Archaeobotany, Vienna, 2-5th July, 2012. U. Thanheiser ed.

Bostoen Koen 2005. A diachronic onomasiological approach to early Bantu oil palm vocabulary. *Studies in African. Linguistics,* 34(2): 143-188.

Bostoen, Koen 2014. Wild trees in the subsistence economy of early Bantu speech communities: a historical-linguistic approach. In: *African Flora, Past Cultures and Archaeobotany. Proceedings of the fifth international workshop for African archaeobotany, London, 3–5 July, 2006.* Stevens, Chris J., Nixon, Sam, Murray, Mary Anne & Fuller, Dorian Q. (eds.) 129-140. Walnut Creek: Left Coast Press.

Bostoen, Koen B., Grollemund R. & Koni Muluwa, J. 2013. Climate-induced vegetation dynamics and the Bantu expansion: evidence from Bantu names for pioneer trees (*Elaeis guineensis, Canarium schweinfurthii and Musanga cecropioides*). *Comptes Rendus Geoscience*, 345:336-349.

Burkill, H.M. 1997. *The Useful Plants of West Tropical Africa, Families M-R*. Kew: Royal Botanic Gardens.

Busson, F. 1965. *Plantes alimentaires de L'Ouest Africain*. Paris: Ministère de la Coopération.

Chevalier, Auguste 1949. Nouvelles observations sur les arbres à kapok de l'Ouest Africain. *Revue internationale de botanique appliquée et d'agriculture tropicale*, 321(2): 377-385.

Clement, C. R., Denevan, W. M., Heckenberger, M. J., Junqueira, A. B., Neves, E. G., Teixeira, W. G., & Woods, W.I. 2015. The domestication of Amazonia before European conquest. *Proc. R. Soc. B*, 282(1812) p. 20150813. http://dx.doi.org/10.1098/rspb.2015.0813

Connell, Bruce A. 1998. Linguistic evidence for the development of yam and palm culture among the Delta Cross River peoples of Southeastern Nigeria. In: R.M. Blench and M. Spriggs (eds.) *Archaeology and Language II*. 324-365. London: Routledge.

Dalziel, J.M. 1937. *The useful plants of West Tropical Africa.* London: Crown Agents.

Drake, Nick A. & Roger M. Blench in press. Reconceptualising the palaeozoogeography of the Sahara and the dispersal of early modern humans. In: *Plant and animal dispersals*. M. Pegtraglia & N. Bovin eds. Springer.

Duvall, C.S. 2007. Human settlement and baobab distribution in south-western Mali. *Journal of Biogeography*, 34(11):1947-1961.

Hall, J.-B. *et al.* 1996. *Vitellaria paradoxa: a monograph*. Bangor: School of Agricultural and Forest Sciences.

Kahlheber, S. 1999. Indications for Agroforestry. In: *The exploitation of plant resources in ancient Africa*. Marijke Van Der Veen ed. 89-100. New York: Kluwer Academic.

Kinnaird, M.F. 1992. Competition for a forest palm: use of *Phoenix reclinata* by human and nonhuman primates. *Conservation Biology*, 6(1): 101-107.

Kondo, T., Crisp, M. D., Linde, C., Bowman, D. M., Kawamura, K., Kaneko, S., & Isagi, Y. 2012. Not an ancient relic: the endemic *Livistona* palms of arid central Australia could have been introduced by humans. *Proceedings of the Royal Society of London B: Biological Sciences*, 279(1738): 2652-2661.

Kyle Latinis, D. 2000. The development of subsistence models for Island Southeast Asia and Near Oceania: the nature and role of arboriculture and arboreal-based economies. *World Archaeology* 32(1):41-67.

Leakey, R.R.B., Atangana, A. R., Kengni, E., Waruhiu, A. N., Usoro, C., Anegbeh, P. O., & Tchoundjeu, Z. 2002. Domestication of *Dacryodes edulis* in West and Central Africa: Characterisation of genetic variation. *Forests, Trees and Livelihoods*, 12(1-2):57-71.

Maundu, P.M., Ngugi, G.W., & Kabuye, C.H. 1999. *Traditional food plants of Kenya*. Nairobi: Kenya Resource Centre for Indigenous Knowledge, National Museums of Kenya.

Morin-Rivat, J., Fayolle, A., Gillet, J. F., Bourland, N., Gourlet-Fleury, S., Oslisly, R., & Doucet, J.L. 2014. New evidence of Human activities during the Holocene in the Lowland Forests of the Northern Congo Basin. *Radiocarbon*, 56(1): 209-220.

Neumann, K., S. Kalheber & D. Uebel 1998. Remains of woody plants from Saouga, a medieval west African village. *Vegetation History and Archaeobotany*, 7:57-77.

Oslisly, R., Bentaleb, I., Favier, C., Fontugne, M., Gillet, J. F., & Morin-Rivat, J. 2013. West Central African peoples: survey of radiocarbon dates over the past 5000 years. *Radiocarbon*, 55(2–3): 1377-1382.

Oslisly, R., White, L., Bentaleb, I., Favier, C., Fontugne, M., Gillet, J. F., & Sebag, D. 2013. Climatic and cultural changes in the west Congo Basin forests over the past 5000 years. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 368(1625). http://dx.doi.org/10.1098/rstb.2012.0304.

Piperno, D. R., McMichael, C., & Bush, M.B. 2015. Amazonia and the Anthropocene: What was the spatial extent and intensity of human landscape modification in the Amazon Basin at the end of prehistory? *The Holocene*, DOI: 10.1177/0959683615588374

Raponda-Walker A. & Sillans R. 1961. *Les plantes utiles du Gabon*. Paris: Le Chevalier.

Rodin, R.J. 1985. The ethnobotany of the Kwanyama Ovambos. *Monographs in systematic botany from the Missouri Botanical Garden (USA)*. Missouri Botanical Garden Press.

Ruffo, C.K., Birnie, A. & B. Tengnäs 2002. *Edible wild plants of Tanzania*. Nairobi: Regional Land Management Unit/Sida.

Vivien, J., & Faure, J.J. 2011a. *Arbres des forêts denses d'Afrique centrale*. Saint Berthevin: CTA.

Vivien, J., & Faure, J.J. 2011b. *Fruitiers sauvages d'Afrique:(espèces du Cameroun)*. Saint Berthevin: CTA.

Walter, A.E. & C. Sam 1999. *Fruits d'Océanie*. Paris: IRD. Also 2002. *Fruits of Oceania*. [trans. P. Ferrar] ACIAR/Paris: Canberra/IRD.

Wickens, Gerald E. & Pat Lowe 2008. *Baobabs - Pachycauls of Africa, Madagascar & Australia*. New York: Springer.

Wild, H. A., Biegel, H. M., & Mavi, S. 1972. *Rhodesian Dictionary of African and English Plant Names*. Salisbury: Rhodesia Government Printer.

Williamson, Kay 1993. Linguistic evidence for the use of some tree and tuber food plants in Southern Nigeria. In: *The Archaeology of Africa. Food, Metals and Towns.* Andah, Bassey, Alex Okpoko, Thurstan Shaw & Paul Sinclair (eds.) 104-116. London: Routledge.