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UNTANGLING THE MANY ROOTS OF WEST AFRICAN MANGROVE RICE FARMING: RICE TECHNOLOGY IN THE RIO NUNEZ REGION, EARLIEST TIMES TO *c.* 1800[1]

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ABSTRACT: This study focuses on the ancient past of coastal Guinea's Rio Nunez region, a coastal rice-growing region virtually unexplored by studies of West African rice and rice farmers. It argues that coastal cultivators have adapted mangrove rice-farming systems *in situ* for approximately the past 1,000 years, a historical period pre-dating the European travelers' accounts on which the current literature heavily relies. Rather than diffusing from the interior, these specialized farming systems grew organically out of land-use systems. Using the comparative method of historical linguistics and cultural vocabulary, the study establishes different stages in coastal farmers' experimentation, adaptation and specialization in the coastal environment and approximates historical dates when the different stages occurred. And with botanical and biological studies of mangrove vegetation, the study distinguishes between the softer, spongy roots of white mangroves and hard, twisted roots of red mangroves. The interdisciplinary evidence reveals that knowledge of white mangroves was an early formative stage in cultivators' fabrication of coastal land-use systems. Lastly, from an examination of loanwords, the study discusses the important contributions made by Mande groups, who speak the Susu language in the Rio Nunez region, in intensifying mangrove rice-farming systems indigenous to the coast and extending them from zones of white to those of red mangroves. The interdisciplinary methods and sources enable the study to capture localized experimentation and innovation as continuous processes, thereby breaking with the current literature's emphasis on diffusion from the interior to the coast.

KEY WORDS: West Africa, Guinea-Conakry, agriculture, historical linguistics.

BASED on the existence of the greatest diversity of wild and domesticated *Oryza glaberrima* (African rice) varieties and floating, semi-floating and sub-floating varieties with dominant characteristics and on the diversity and distribution of contemporary African rice varieties, botanist Roland Portères identified the Inland Niger Delta in present-day Mali as the site of rice domestication. In the Inland Niger Delta, the inhabitants adapted to their savanna environment by drawing on the largest pool of potential domesticates in the *O. glaberrima* species.[2] Archaeologists Roderick J. McIntosh

[1] Many thanks to Judith Carney, Walter Hawthorne, Martin Klein, Olga Linares, Bruce Mouser, David Schoenbrun and Valentin Vydrine for commenting on versions of this article.

[2] Roland Portères, 'African cereals: Eleusine, Fonio, Black Fonio, Teff, *Brachiaria*, *paspalum*, *Pennisetum*, and African rice', in Jack R. Harlan and Jan M. J. De Wet (eds.), *Origins of African Plant Domestication* (The Hague, 1976), 441–5; Portères, 'Berceaux agricoles primaires sur le continent Africain', *Journal of African History*, 3 (1962), 197–9.

and Susan Keech McIntosh found *O. glaberrima* in the lowest levels of excavated areas of Jenne-Jeno, dating back to 300 BCE to 300 CE. These are the first reliable dates for the domestication of African rice.[3]

However, there is no consensus among scholars on how inhabitants of the savanna domesticated African rice or how farmers adapted African rice to suit other environments. Despite its influence, Portères's work left unanswered questions about the processes by which inhabitants of the savanna domesticated *O. glaberrima*. Experimentation in uplands and floodplains may not be unrelated to the processes of domestication. Jack Harlan, in particular, diverged from Portères's diffusionist approach. He argued instead that locating a center of cereal domestication in Africa is impossible, because cereal domestication was an ongoing and slow process not a singular event. Based on botanical evidence, Harlan argued that cereal domestication resulted from non-centric experimentation, intensification and manipulation of wild plants by populations in vast expanses of territory and probably over long periods of time.[4]

Cultivation was only the beginning of the domestication process, which resulted in West African farmers adapting *O. glaberrima* to the diverse landscape gradients where it is cultivated today.[5] Portères identified two centers of 'secondary diversification' where West African cultivators selected traits of *O. glaberrima* amenable to physical environments with different soils, rainfall levels and vegetation types from the savanna where African rice was domesticated. Inhabitants along both sides of the Gambia River in present-day Senegal manipulated African rice to grow in swampy, salty mangroves. Inhabitants of the mountainous portion of present-day Guinea-Conakry near Macenta and Guéckédou manipulated rice species to grow in rain-fed upland environments.[6] The location of this study, the coastal littoral of Guinea's Rio Nunez region, falls within an environmental and technological sub-region with Portères's secondary center of diversification along the Gambia River.

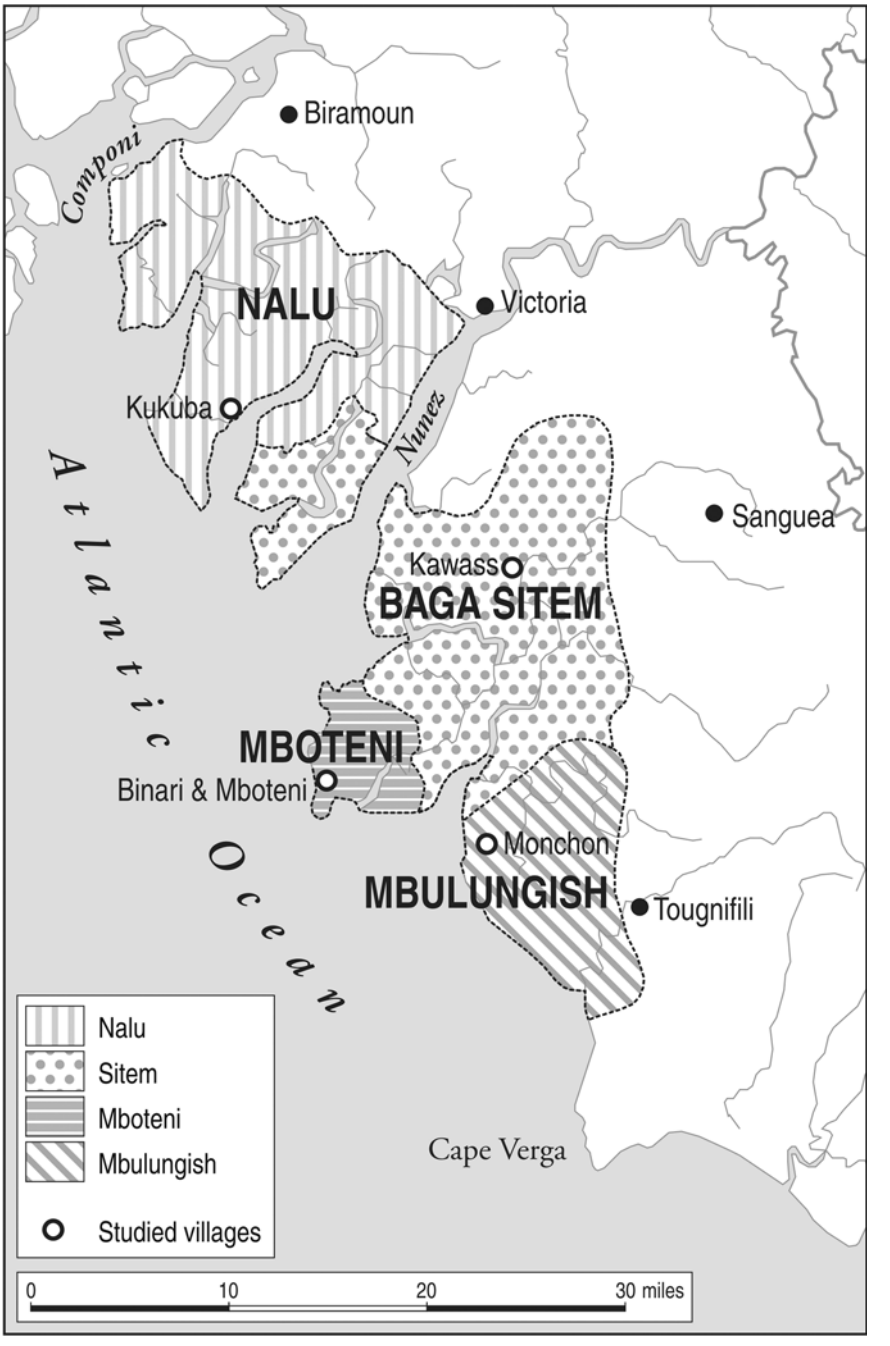
The Rio Nunez region of coastal Guinea is one small corner of West Africa's Upper Guinea Coast (Map 1). On the edge of present-day Guinea, the Nunez River and its tributaries cascade to the coast from its point of origin in the foothills of the Futa Jallon mountains in Guinea's interior. Annually, the Nunez River swells with the torrential downpours of the rainy season creating seasonal streams, floodplains and inland swamps. As the Nunez River passes through the highland plateaus bridging the extremes, the mountains and the sea, it deposits rich alluvium in coastal floodplains. The mouth of the Nunez River empties out into the Atlantic Ocean, the tidal flow of which reaches almost seventy miles upriver. Tidal flooding of low-lying areas deposits silt and saline along the river's banks.

[3] Roderick J. McIntosh and Susan Keech McIntosh, 'The Inland Niger Delta before the empire of Mali: evidence from Jenne-Jeno', *Journal of African History*, 22 (1981), 15–16.

[4] Jack R. Harlan, 'Agricultural origins: centers and noncenters', *Science* (29 Oct. 1971), 174, 468–74.

[5] Dorian Fuller, 'Crop-cultivation – the evidence', in Kevin Shillington (ed.), *Encyclopedia of African History*, vol. I: *A–G* (New York, 2005), 326–8.

[6] Portères, 'African cereals', 441–5; Portères, 'Berceaux agricoles primaires', 197–9.



Map 1. Atlantic speech communities and studied villages.

Two ethnic groups, the Baga and the Nalu, inhabit the mangrove swamps and floodplains of the Rio Nunez region respectively. In 1993, approximately 40,000 Baga inhabited both banks at the mouth of the Componi River, the Nunez River and along the coastal fringe of Guinea between the Componi

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River in the north and the Conakry peninsula in the south. Numbering approximately 10,000 in coastal Guinea, the Nalu live upriver on the left bank near the head of the Nunez River. Nalu villages also stretch north into present-day Guinea-Bissau.[7] These ethnic designations, however, belie a much more complicated reality of linguistic identity among coastal inhabitants.

This study focuses on the ancient past of coastal Guinea's Rio Nunez region, a coastal rice-growing region virtually unexplored by studies of West African rice and rice farmers. It argues that coastal cultivators have adapted mangrove rice-farming systems *in situ* for approximately the past 1,000 years, a historical period pre-dating the European travelers' accounts on which the current literature heavily relies. Rather than diffusing from the interior, these specialized farming systems grew organically out of coastal land-use systems. The study reconstructs the evolution of paddy-rice farming systems in the coastal region's ancient past by employing new interdisciplinary methods and sources. Using the comparative method of historical linguistics and cultural vocabulary, the study establishes different stages in coastal farmers' experimentation, adaptation and specialization in the coastal environment and approximates historical dates when the different stages occurred. And with botanical and biological studies of mangrove vegetation, the study distinguishes between the softer, spongy roots of white mangroves and hard, twisted roots of red mangroves. The interdisciplinary evidence reveals that knowledge of white mangroves was an early formative stage in coastal cultivators' fabrication of rice-farming systems. Lastly, from an examination of loanwords, the study discusses the important contributions made by Mande groups, who speak the Susu language in the Rio Nunez region, in intensifying mangrove rice-farming systems indigenous to the coast and extending them from zones of white to those of red mangroves. The interdisciplinary methods and sources enable the study to capture localized experimentation and innovation as continuous processes, thereby breaking with the current literature's emphasis on diffusion from the interior to the coast.

WORDS AS HISTORICAL SOURCES AND THE HISTORICAL LINGUISTICS METHOD

Reconstructing the ways in which farmers in the Rio Nunez region developed their rice-growing technology presents the historian with a

[7] Recent literature on the Rio Nunez region and its inhabitants includes the following: David Berliner, 'An "impossible" transmission: youth religious memories in Guinea-Conakry', *American Ethnologist*, 34 (2005), 576–93; Berliner, 'Nous sommes les derniers Bulongic: sur une impossible transmission dans une société d'Afrique de l'ouest' (Ph.D. thesis, Université libre de Bruxelles, 2002); Marie Yvonne Curtis, 'L'art nalu, l' art baga de Guinée: approches comparatives' (thèse doctorat, Université de Paris-Sorbonne, 1992); Edda Fields, 'Rice farmers in the Rio Nunez region: a social history of agricultural technology and identity in coastal Guinea, ca. 2000 BCE to 1880 CE (Ph.D. diss., University of Pennsylvania, Philadelphia, 2001); Fields, 'Before "Baga": settlement chronologies of the coastal Rio Nunez region, earliest times to 1500 CE', *International Journal of African Historical Studies*, 37 (2004), 229–53; Gerald Gaillard (ed.), *Migrations anciennes et peuplement actuel des côtes Guinéennes* (Paris, 2000), 385–402; Bruce L. Mouser, 'Trade and politics in the Nunez and Pongo Rivers, 1790–1865' (Ph.D. diss., University of London, 1971); Ramon Sarró-Maluquer, 'Baga identity: religious movements and political transformation in the Republic of Guinea' (Ph.D. thesis, University of London, 1999).

methodological challenge. On the one hand, the development of the indigenous technology pre-dates the arrival of the first European visitors to the West African region between Senegal and Liberia, and therefore the recording of the region's first written sources. On the other, in the Upper Guinea Coast, archaeological studies are few and far between for coastal regions south of the lower Casamance River.[8] Botanical studies are few in number as well.[9] The Rio Nunez region is no exception to these rules.

This study builds on the rich and growing literature of historical studies which use the 'words-and-things' subfield of the comparative method of historical linguistics to reconstruct early precolonial African history.[10] It is the first to apply the methodology of historical linguistics to reconstructing the Atlantic languages of West Africa's coastal region.[11] In addition to the lack of archaeological studies in the region, the overwhelming majority of Atlantic languages spoken in West Africa's coastal littoral are understudied and poorly documented.[12] Fulbe and Wolof are

[8] According to Olga Linares, the acidic nature of coastal soils favors decomposition of many fossilized materials. In addition, agricultural practices in which coastal farmers cyclically turn over the soil have disrupted fossils and artefacts interred in the earth. Olga Linares de Sapir, 'Shell middens of Lower Casamance and problems of Diola protohistory', *West African Journal of Archaeology*, 1 (1971), 23–54.

[9] Roland Portères, 'Un problème d'ethno-botanique', *Journal d'Agriculture et de Botanique Appliquée*, 11 (Oct.–Nov. 1955), 538–42.

[10] For examples of the historical and comparative linguistic method applied to the Bantu language group, see Koen Bostoen, 'Linguistics for the use of African history and the comparative study of Bantu pottery vocabulary', *Antwerp Papers in Linguistics*, 106 (2004), 131–54; Christopher Ehret, 'Cattle-keeping and milking in Eastern and Southern African history: the linguistic evidence', *Journal of African History*, 8 (1967), 1–18; Ehret, 'On the antiquity of agriculture in Ethiopia', *Journal of African History*, 20 (1979), 161–77; Ehret, 'Sheep and Central Sudanic peoples in southern Africa', *Journal of African History*, 9 (1968), 213–22; Derek Nurse, 'The contribution of linguistics to the study of history in Africa', *Journal of African History*, 38 (1997), 359–91; David Lee Schoenbrun, *A Green Place, a Good Place: Agrarian Change, Gender, and Social Identity in the Great Lakes Region to the 15th Century* (Portsmouth NH, 1998); Jan Vansina, 'New linguistic evidence and the "Bantu expansion"', *Journal of African History*, 36 (1995), 173–95; Vansina, *Paths in the Rainforest: Toward a History of Political Tradition in Equatorial Africa* (Madison, 1990).

[11] A few previous studies use historical linguistics to reconstruct portions of West and West-Central Africa's interior, but not the coast. See Kairn Klieman, '*The Pygmies were our Compass': Bantu and Batwa in the History of West-Central Africa, Early Times to c. 1900 CE* (Portsmouth NH, 2003); M. E. Kropp-Dakubu, 'On the linguistic geography of the area of ancient Begho', in H. Trutenau (ed.), *Languages of the Akan Area: Papers in Western Kwa Linguistics and on the Linguistic Geography of the Area of Ancient Begho* (Basel, 1976), 63–91; Tal Tamari, *Les castes de l'Afrique occidentale: artisans et musiciens endogames* (Nanterre, 1997); Kay Williamson, 'Linguistic evidence for the use of some tree and tuber food plants in southern Nigeria', in Thurstan Shaw, Paul Sinclair, Bassey Andah and Alex Okpoko (eds.), *The Archaeology of Africa: Foods, Metals and Towns* (New York, 1995), 139–53; Williamson, 'Linguistic evidence for the prehistory of the Niger Delta', in E. J. Alagoa, F. N. Anozie and Nwanna Nzewunwa (eds.), *The Early History of the Niger Delta* (Hamburg, 1988), 65–119.

[12] Among Indo-European languages, the comparative method of historical linguistics is used on languages with ancient written traditions dating back several hundreds of years. In the African context, not even Bantu languages possess written records dating back

the two notable exceptions to this rule. A lack of documentation and description for Atlantic languages has contributed to a debate among linguists about whether the languages in question represent a genetic or merely a typological grouping.[13] The overwhelming bulk of the historical linguistics research has been conducted on Bantu languages in East, Central and Southern Africa, which in comparison are relatively well documented and studied.

Based on a previously published analysis of 'core'[14] vocabulary words which identified regular sound correspondences,[15] the Atlantic languages spoken in coastal Guinea's Rio Nunez region belong to two distantly related linguistic subgroups,[16] which I have called 'Coastal' and 'Highlands'.[17] Coastal languages diverged *in situ* in the vicinity of the coastal Rio

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more than a few centuries. This also applies to proto-languages. See Bostoen, 'Linguistics for the use of African history', 133.

[13] In general, the following studies have confirmed the integrity of the Atlantic language group: Jean L. Doneux, 'Hypothèses pour la comparative des langues Atlantiques', *Africana Linguistica*, 6 (1975), 41–129; Fields, 'Rice farmers in the Rio Nunez region', 42–6; Fields, 'Before "Baga"', 229–53; Konstantin Pozdniakov, *Sravnitel'naia grammatika Atlantichskikh iazykov* (Moscow, 1993) (translated by Lioudmila Selemeneva, Carnegie Mellon University, Department of English), 3; J. David Sapir, 'West Atlantic: an inventory of languages, their noun class system and consonant alternation', in *Current Trends in Linguistics in Sub-Saharan Africa* (The Hague, 1971), 45.

There are, however, dissenting voices which argue that one linguistic subgroup, Mel languages, are not part of the Atlantic language group. See David Dalby, 'Mel languages in polyglotta Africana, part I: Baga, Landuma and Temne', *Sierra Leone Language Review*, 4 (1965), 130; Dalby, 'The Mel languages: a reclassification of southern West Atlantic', *African Language Studies*, 6 (1965), 1–17; W. A. A. Wilson, 'Temne and the West Atlantic group', *Sierra Leone Language Group*, 2 (1963), 26.

[14] Cross-cultural evidence has shown that core vocabulary words are some of the oldest words and the most resistant to change in a language. Some linguists resist the notion that one can identify a set of vocabulary words that are culturally neutral in all of the world's languages. See C. H. Borland, 'Computing African linguistic prehistory', in Derek F. Gowlett (ed.), *African Linguistic Contributions: Papers in Honour of Ernst Westphal* (Pretoria, 1992), 6–11; Borland, 'How basic is "basic" vocabulary?' *Current Anthropology*, 32 (June 1982), 315–16.

[15] One way of beginning to classify genetically related languages is by employing 'lexicostatistics' to estimate the degree of relationship among daughter languages that descended from a common linguistic ancestor. Applying lexicostatistics begins with analyzing 100-word lists of core vocabulary: words for basic nouns, verbs, body parts and elements in nature. From 100-word core vocabulary lists, comparative linguists identify and count cognates – words with similar meanings and sound sequences – shared by pairs of languages. The presence of two cognates in a pair of genetically related languages implies the existence of an ancestral form of the word in a common linguistic ancestor. Words spoken in present-day daughter languages are derived from the ancestral language. Comparative linguists confirm the proposed cognate vocabulary by comparing sounds and establishing sound correspondences in a broader selection of vocabulary than the 100-word core lists.

[16] Linguistic subgroups possess a common set of sounds in addition to sets of inherited and innovated vocabulary, remnants of a common ancestral language once shared by the daughter languages. They are evidence that speech communities speaking constituent languages once shared social, political, economic and cultural institutions and came into contact with other speech communities.

[17] What I have called 'Highlands', Sapir classifies as 'Temne, Baga Koba, (Banta), Landuma, Tyapi, other Baga languages (excluding 'Foré and Mboteni)', as the first

Nunez region, while the migration of Highlands speech communities from the interior to the coast contributed to the divergence of their languages.[18]

The linguistic evidence presented in this article will show that Nalu, Mbulungish and Mboteni, the daughter languages, which descended from the proto-Coastal linguistic ancestor, inherited words for aspects of the coastal environment, such as white mangroves. These inherited cultural vocabularies exhibit regular sound correspondences established in the analysis of core vocabulary words. Although words for rice, rice cultivation and harvesting are conspicuously absent from the inherited vocabularies of Nalu-, Mbulungish- and Mboteni-speakers, words for the coastal environment are evidence of the most ancient roots of coastal rice-growing technology.

This paper will also examine a second category of cognate vocabulary, innovated vocabulary, which does not possess regular sound correspondences. Daughter speech communities internally generate new vocabulary. For different reasons – migration, environmental change, warfare and disease are but a few examples – speech communities choose to break with the past and to create new institutions, practices and material culture. Innovations are important signals for historians of the kinds of change which societies have undergone. Sitem-speaking migrants to the region joined Nalu-, Mbulungish- and Mboteni-speaking *indigènes* to coin words for key elements in coastal rice-growing technology, such as dikes, bunds, nurseries for rice seeds and wooden fulcrum shovels. Innovated vocabulary words are indicators of the genesis of the coastal rice-growing technology in the Upper Guinea Coast region.

Lastly, in the coastal Rio Nunez region, loanwords[19] pertaining to rice-growing technology provide evidence of interaction among Atlantic speech communities in the Coastal and Highlands subgroups, and between Atlantic coastal dwellers and Mande strangers from the interior. Loanwords are also evidence of how speech communities interacted with a physical environment that was ancient to some, unfamiliar to others, and unyielding to all.

Most of the Mande loanwords in Coastal and Highlands languages were borrowed from Susu as a result of the southwestern movement of Jalonke-Susu speech communities, a process which spanned from the eleventh to the nineteenth centuries. In the Rio Nunez region, the 'Susu-ization'[20] of Atlantic languages continued and intensified with the

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linguistic subgroup to diverge from the Mel branch of Atlantic languages. Sapir, 'West Atlantic', 49.

[18] Fields, 'Before "Baga"'; Fields, 'Rice farmers in the Rio Nunez region', 57–70.

[19] For examinations of loanwords in other regions of Africa, see Christopher Ehret, 'Agricultural history in central and southern Africa ca. 1000 B.C. to A.D. 500', *Transafrican Journal of History*, 4 (1974), 1–25; Ehret, 'Patterns of Bantu and Central Sudanic settlement in Central and southern Africa (ca. 1000 B.C.–500 A.D)', *Transafrican Journal of History*, 3 (1973), 1–71; Klieman, '*The Pygmies Were Our Compass*', 101–3, 177–83; David Schoenbrun, 'We are what we eat: ancient agriculture between the Great Lakes', *Journal of African History*, 34 (1993), 1–31.

[20] Olga F. Linares, *Power, Prayer and Production: the Jola of Casamance, Senegal* (Cambridge, 1992), 147–9; Linares, 'From tidal swamp to inland valley: on the social organization of wet rice cultivation among the Diola of Senegal', *Africa*, 51 (1981), 2, 577–87.

arrival of Christian missionaries in the mid twentieth century. Mission schools taught Susu among Atlantic speech communities who spoke different and mutually unintelligible languages to facilitate commerce.[21] Today, Susu has become the *lingua franca* of coastal Guinea, particularly in urban centers such as Conakry, Kamsar and Bokè. Up until the present, Susu is still spoken from Guinea's northern border with Guinea-Bissau to the southern border with Sierra Leone in the prefectures of Bokè, Boffa, Fria, Dubreka, Coyah, Kindia, Forecariah, Conakry, and in some villages of Futa Jallon.[22] It remains mutually intelligible with, and closely related to, Jalonke.[23] Identifying Susu loanwords[24] in Coastal and Highlands languages requires an understanding of Jalonke morphology and phonology[25] in order to distinguish words inherited by Susu-speakers from their proto-Susu-Jalonke linguistic ancestors from words innovated by Susu speech communities after their migration to the coastal region. An analysis of Susu loanwords in Atlantic languages spoken in the Rio Nunez region will reveal the knowledge Susu-speakers both inherited from their linguistic ancestors about grain production in the dry, rocky interior region and innovated in the coastal region – their new environment. Susu-speakers also borrowed words related to rice production and the coastal environment from their Nalu-, Mbulungish-, Mboteni- and Sitem-speaking neighbors.

This study employs one more tool from the comparative method of historical linguistics. In the historical field, which deals primarily with written sources and calendar dates, the ability to establish chronology remains the primary challenge of recording history for periods pre-dating written sources. This study of rice farmers in coastal Guinea will reveal the first

[21] Bruce L. Mouser, 'Qui étaient les Baga? Perceptions européennes, 1793–1821', in Gérald Gaillard (ed.), *Migrations anciennes et peuplement actuel des Côtes Guinéennes* (Paris, 2000), 436.

[22] Erhard Voeltz, 'Les langues de la Guinée', *Cahiers d'étude des langues guinéennes*, 1 (1996), 29–30.

[23] Susu and Jalonke share approximately 90 per cent of their cognates. Based on the high cognate percentage, Susu and Jalonke are still dialects of the same language. Friederike Lupke, 'A grammar of Jalonke argument structure' (Ph.D. diss., Radboud Universiteit Nijmegen, 2005), 14.

[24] Identifying loanwords and their source languages is not an easy task, because languages borrow words at all stages of their development. Thus, loanwords can be borrowed into an ancestral language and inherited by its daughter speech communities. Early loanwords borrowed before the language in question underwent regular sound changes are more difficult to distinguish from inherited vocabulary words, because they can also exhibit regular sound changes. But in some ways early loanwords are easier to date, because they may exhibit the regular morphological or phonological changes used by comparative linguists to assign words to a particular linguistic subgroup and to date the divergence of the subgroup using glottochronology. More recent loanwords do not exhibit these regular correspondences, making it more difficult to date their entrance into the language. See Vansina, *Paths in the Rainforest*, 14–16; Bostoen, 'Linguistics for the use of African history', 145.

[25] Though a complete analysis of the Northern branch of Mande is beyond the scope of this study, some analysis can be made from the core vocabulary lists that I collected during my fieldwork. Present-day Jalonke words possess the definitive marker *-na*, *-nna* in their nominal inflections. However, Susu words do not end in *-na*, *-nna*, because the Susu language appears to have dropped the inflection, possibly since its divergence from proto-Susu-Jalonke. Lupke, 'A grammar of Jalonke', 109–14.

estimated chronology for the innovation of coastal rice-growing techniques based on glottochronology.

Glottochronology was developed to give absolute dates to linguistic subgroups within a language group's genealogy. This chronological calibration was elaborated on the basis of European languages for which copious written records are available. It measures 'the patterned accumulation of individually random change among quanta of like properties'.[26] Glottochronology uses a mathematical constant to measure the cumulative effect resulting from the individually random changes occurring on the vocabulary of a proto-language. From this figure, historians and anthropologists infer an approximate length of time since the divergence of linguistic subgroups.

Since its inception, some linguists and historians have been critical of glottochronology. Some linguists question whether the rate of word replacement could be the same in all of the world's languages from the beginning of time to the present and whether word loss and grammatical change can be measured before a particular linguistic threshold.[27] Others object to different aspects of the comparative method of historical linguistics – lexicostatistics, cognate counts and family trees. Their argument is that the time depth of language divergence can be overestimated if cognates go unrecognized because of sound change. Conversely, time depth can be underestimated if chance similarities and borrowed words are wrongly identified as cognates. These linguists also continue to question the simplicity of language trees, which do not represent the continued effect languages have on each other after they have technically 'split'.[28]

Glottochronology has also become a bone of contention among historians of Africa who employ the comparative method of historical linguistics. Among Africanist historians who pioneered the use of the comparative method, the elder statesman Jan Vansina objects to the use of glottochronology and to the premise that words in all languages are replaced at a steady rate. Instead, Vansina advocates using the relative chronology of language divergence which the comparative method itself yields from the genealogy of languages. Language groupings with higher cognate percentages are more closely related and diverged from their linguistic ancestor more recently. Language groupings with lower cognate percentages are less closely related and existed as one language at an earlier period in time. Languages diverge from each other slowly, taking centuries for adjacent dialects to turn into separate languages and to cease being mutually intelligible. Vansina advocates estimating half a millennium between one level of a language's genealogy and the next. These estimates remain unconfirmed.[29]

[26] Christopher Ehret, 'Testing the expectations of glottochronology against the correlations of language and archaeology in Africa', in Colin Renfrew, April McMahon and Larry Trask (eds.), *Time Depth in Historical Linguistics* (Cambridge, 2000), 373.

[27] Colin Renfrew, 'Introduction: the problem of time depth', in Renfrew *et al*. (eds.), *Time Depth in Historical Linguistics*, ix–xiv.

[28] Sheila Embleton, 'Lexicostatistics/glottochronology: from Swadesh to Sankoff to Starostin to future horizons', in Renfrew *et al*. (eds.), *Time Depth in Historical Linguistics*, 143–66.

[29] Jan Vansina, *How Societies Are Born: Governance in West-Central Africa Before 1600* (Charlottesville, 2004), 4–5, 8.

A second group of Africanist historians, such as Chris Ehret and David Schoenbrun, has continued to use and refine glottochronology. Christopher Ehret in particular demonstrated correlative chronologies from linguistic evidence and pottery traditions in languages throughout Africa. In a recent study, Ehret reviewed empirical linguistic and archaeological data in four language families in four different regions of Africa to test for correlation between dates generated by glottochronology and dates generated by archaeology. Over a 10,000-year period, Ehret found the two methodologies to independently generate similar rough dates. And, over a 1,000-year period of individual random changes, the language families in Africa shared 74 per cent of their retentions.[30] Critics of glottochronology continue to question the assumptions underlying these findings, because Ehret does not test his findings against a third independently generated chronology.

Despite criticism of the method, dates generated by glottochronology are only one stream of data which must be compared to independent evidence from other sources. Scholars of the Bantu in East and Central Africa who use glottochronology do not use it singularly. They rely on correlations between sequences of change – in the formation and dissolution of language groups, the birth, growth and dissolution of pottery traditions, and in the pace and character of change in vegetation communities and climate regimes – dated by radio-carbon and thermoluminescence studies. Whereas linguistic sources provide indirect evidence of, and relative dates for, ancestral speech communities, archaeological and environmental studies provide direct evidence and absolute dates for the historical developments of ancestral communities,[31] which would otherwise be unavailable for time periods pre-dating written sources. In East, Central and Southern Africa, this collective body of work reconstructs the social history of a large portion of the African continent for millennia before the recording of the first written sources.

At the current stage of research, the Rio Nunez region of coastal Guinea lacks chronologies from interdisciplinary data sources, particularly archaeology. Hence, strictly speaking, this study can only use relative dating and can only approximate the absolute involved. One way of giving the reader at least an idea of the order of magnitude of the time spans involved is to compare the genealogy of coastal Guinea's linguistic subgroups to the European situation. For this purpose, the study will cite glottochronological estimates. Readers must realize that they are not confirmed dates, but only comparative estimates employed to help readers visualize the time depths involved.[32] Until independent confirmation is available for the Rio Nunez region from interdisciplinary evidence, the dates generated by glottochronology must be considered provisional.

In addition to linguistic data, the forthcoming narrative presents biological and botanical studies of mangrove ecosystems and coastal land-use change whose utilization is unique to the historical linguistic literature. Together, the two independent streams of interdisciplinary evidence reveal the antiquity of coastal settlement and of coastal land-use systems – of which paddy rice-farming was one part – in the Rio Nunez region, and provide

[30] Ehret, 'Testing the expectations of glottochronology', 373–99.
[31] Vansina, *How Societies Are Born*, 4–5, 8.
[32] *Ibid*. and private communication with Jan Vansina, letter dated 30 Dec. 2004.

the tools to reconstruct its development. The combination of the two independent streams of evidence makes a unique contribution to an innovative body of historical research.

INDIGENOUS KNOWLEDGE OF THE COASTAL LANDS, INHERITED AND INNOVATED: EARLIEST TIMES TO *c.* 1000 CE

Reconstructed vocabulary is direct historical evidence of the ancestral speech community, which spoke the Coastal language. Though they did not leave written documents and their artefacts are potentially awaiting archaeological discovery, Coastal-speakers left historical evidence in the words spoken by their Nalu, Mbulungish and Mboteni daughter speech communities.[33] These words give the historian clues to the knowledge Nalu-, Mbulungish- and Mboteni-speakers inherited from their linguistic ancestors about exploiting micro-environments along the swampy and salty coast.

Proto-Coastal-speakers innovated *-*yop*'[34] for two species of mangroves (*Avicennia africana* and *Laguncularia racemosa*) found along the coastal littoral. With glottochronology, we can estimate that proto-Coastal-speakers innovated *-*yop* before the divergence of their common ancestral language, *c*. 3000 to 2000 BCE. These shards of linguistic data are direct evidence of the antiquity of knowledge possessed by proto-Coastal-speakers about white mangroves, an important feature of coastal micro-environments. *-*Yop* is a unique innovation of the Coastal subgroup, because no other Atlantic language from Senegal to Sierra Leone possesses a cognate to the word. The presence of this unique innovation in the Coastal subgroup is not evidence of speech communities north and south of the Rio Nunez region lacking knowledge of white mangroves. It may, however, reflect the highly localized nature of mangrove ecosystems. Reconstructed vocabulary for red mangroves is conspicuously absent from early proto-Coastal-speakers' arsenal.

Prior to the eighteenth century, descriptions of coastal dwellers cultivating rice in mangroves are conspicuously absent from the travelers' accounts. However, as early as the sixteenth century, European travelers' accounts described white mangroves playing a critical role in food security along the coast. In the Rio Nunez region and along West Africa's coast as far north as present-day Senegal, coastal dwellers cured mangrove seedlings by soaking or cooking them in water. If not cured properly, the seedlings remained poisonous. But once cured properly, mangrove seeds could be and were eaten during periods of famine. Among the Baga in Cape Verga, André Donelha described the germinated seeds, propagules, of *Avicennia africana*,[35]

[33] In order to reconstruct words to the proto-Coastal language, they must meet two criteria. First, cognates of the words must be present in the Nalu and Mbulungish languages whose non-contiguous speech communities are located the farthest apart. Second, the words in question must exhibit regular sound correspondences. See Schoenbrun, *A Green Place, a Good Place*, 49.

For a listing of regular sound correspondences for the Coastal linguistic subgroup, which confirm reconstructed vocabulary, see Fields, 'Before "Baga"', 229–53.

[34] White mangrove (*Avicennia africana*) – Nalu: *-yof*; Mbulungish: *-yɔp*.

[35] According to Teixeira da Mota, Donelha uses a term *tarrafe* in Portuguese Creole, which is derived from the Arabic *tarf*, to describe *A. africana* and *Laguncularia racemosa*. See André Donelha, *Descrição da Serra Leoa e dos rios de Guiné do Cabo Verde* (*1625*)

reporting: 'their food is rice, *funde* [fonio], seeds of white mangroves – which they cure like lupines but under the mud in rivers'.[36] A second Luso-African observer, André de Álmada who traveled to Sierra Leone in 1582, described red mangroves and nicknamed them 'oyster trees' – 'trees growing by the waterside with the stalkes full of oisters, and great periwinkles and crabbes amongst them [*sic*]' – because the environment was home to hordes of shellfish.[37] The region's first written documents describe coastal dwellers possessing knowledge of white and red mangroves.

According to biological and botanical research on mangrove ecosystems, in coastal Guinea, red and white mangrove forests once occupied different zones along the coast – red mangroves (*Rhizophora racemosa*) bordered the estuary channels. A mixture of white mangroves (*Avicennia africana*) and *Rhizophora* followed, with a layer of *Avicennia* situated behind.[38] In coastal Guinea, mature mangrove forests exhibited a classic pattern of zonation from the riverbank to dry land: '*Rhizophora*, dense *Avicennia*, clear *Avicennia*, *Avicennia* and Laguncularia, prarie to *Philoxerus* and *Sesuvium*'.[39]

Biologists and botanists attribute patterns of mangrove zonation to several factors. The different species' ability to adapt to waterlogged soils with high levels of salinity is a contributing factor. *A. africana* typically occupy zones closer to dry land, because their roots – pneumatophores – are not equipped to flourish when submerged under water for long periods of time.[40] Unlike the aerial roots of *R. racemosa*, pneumatophores are equipped with lenticels and gas spaces to procure oxygen from underground. But these pneumatophores can only obtain adequate oxygen from shallow waters.[41] Thus, the location of white mangroves growing in sandy soils closer to dry land enables them to take in oxygen from the atmosphere.

Patterns in independent linguistic, biological and botanical evidence diverge. The earliest European travelers recorded descriptions of both

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(notas por Avelino Teixiera da Mota, *Description de la Serre Leoa et des rios de Guinée du Cabo Verde* (*1625*)) (translated by P. E. H. Hair) (Lisbon, 1977). Santo also includes *Rhizophora racemosa* on this list. See J. do Espirito Santo, 'Nomes vernáculos de algumas plantas da Guiné Portuguesa', *Boletim cultural da Guine Portuguesa*, 18 (1963), 458.

Burkill *et al*. also define the Portuguese Creole word *tarrafe* as *A. africana* and describe island people in Western Senegal using the 'germinated seeds of *Avicennia* as a famine food, but, these when uncooked or improperly prepared are actually poisonous'. See H. M. Burkill, J. M. Dalziel and J. Hutchinson, *The Useful Plants of West Tropical Africa Being an Appendix to the Flora of West Tropical Africa* (London, 1937), 453–4, 85–7.

[36] Donelha, *Descrição da Serra Leoa*, f.123, 99.

[37] Andrè Alvares de Álmada, *Brief Treatise on the Rivers of Guinea* (*c. 1594*)*: Part II*, 15/11, Appendix III, 9/3.

[38] M. Sow, A. Diallo, N. Diallo, C. A. Dixon and A. Guisse, 'Formations végétales et sols dans les mangroves des rivières du Sud', in Marie-Christine Cormier-Salem (ed.), *Dynamique et usages de la mangrove dans les pays des rivières du Sud* (*du Sénégal à la Sierra Leone*)*: actes de l'atelier de travail de Dakar du 8 au 15 mai 1994* (Paris, 1994), 51–6; Peter J. Hogarth, *The Biology of Mangroves* (Oxford, 1999), 36–45; P. B. Tomlinson, *The Botany of Mangroves* (Cambridge, 1986), 12–20, 96–8; H. D. Jordan, 'The relation of vegetation and soil to development of mangrove swamps for rice growing in Sierra Leone', *Journal of Applied Ecology*, 1 (May 1964), 209–12; Linares de Sapir, 'Shell middens of lower Casamance', 26.

[39] Sow *et al*., 'Formations végétales', 51–7.

[40] Hogarth, *The Biology of Mangroves*, 4–11.

[41] *Ibid*.; Tomlinson, *The Botany of Mangroves*, 98–100.

white and red mangroves. According to linguistic evidence, it is likely that coastal dwellers first encountered white (*A. africana*) mangroves growing in sandy soils closest to their villages and only later gained knowledge of red (*R. racemosa*) mangroves closer to coastal estuaries and salt water.

In the linguistic sources there is an absence of evidence of coastal first-comers cultivating rice at the earliest settlement of the coastal Rio Nunez region. Instead, the interdisciplinary sources reveal coastal dwellers laid a foundation for agricultural innovation which can be traced back to their earliest settlement of the coastal region. By incorporating white mangroves into their subsistence regimes, coastal dwellers exposed themselves to an entire ecosystem, rich in flora and fauna. This knowledge was critical to the development of coastal land-use strategies, particularly the development of tidal rice-growing technologies.

GAINING MASTERY OVER COASTAL LANDS: NALU-, MBULUNGISH- AND MBOTENI-SPEAKERS, TO *c.* 1000 CE

As the owners of the land, Nalu-, Mbulungish- and Mboteni-speakers inherited knowledge of white mangroves. After the divergence of Proto-Coastal, Nalu, Mbulungish and Mboteni speech communities gained more intimate knowledge about their coastal environment. They innovated words which are historical evidence of the lessons they learned. Gaining mastery over the challenges of the coast represents the next step in the development of tidal rice-growing technology.

The words coined by Nalu, Mbulungish and Mboteni daughter speech communities cannot be reconstructed to the Coastal ancestral language, because they do not meet two basic criteria: present-day Nalu and Mbulungish languages – the two Coastal non-contiguous speech communities separated by the greatest distance and least likely to have had contact – do not retain cognates; the words found in present-day Nalu, Mbulungish and Mboteni languages are not cognates, because they do not possess regular sound correspondences. Instead, they are 'areal innovations', evidence of language contact between intermediate linguistic subgroups, the daughter languages of proto-Coastal. Areal innovations often occur among language speakers whose villages are located in close proximity. Yet, Sitem-speakers, who also live in close proximity and whose languages are distantly related to Nalu-, Mbulungish- and Mboteni-speakers, do not possess these vocabulary words.

Like all forms of historical evidence, areal innovations are limited in their value as historical sources. For example, it is impossible to use glottochronology to date the entrance of areal innovations into a language, because they do not adhere to regular sound correspondences.[42] In these cases, the areal innovations entered Coastal languages after the divergence of Proto-Coastal *c.* 3000 to 2000 BCE. Because the Sitem language does not share the terms, they likely entered Coastal languages before the migration of Sitem-speakers into the Rio Nunez region *c.* 1000 CE.

Though a word for red mangroves, *R. racemosa*, was conspicuously absent from the proto-Coastal language, two of its daughter communities innovated

[42] Schoenbrun, *A Green Place, a Good Place*, 49.

-mak after the divergence of their common linguistic ancestor.[43] Mbulungish- and Mboteni-speakers gained knowledge of *marigots*, seasonal streams created by the collection of rainwater in low-lying areas.[44] In addition, Mbulungish and Mboteni coined a new word for mosquitoes which are prevalent in the stagnant water pools produced by the rainy seasons torrential downpours.[45] By 1000 CE, Nalu- and Mboteni-speakers had acquired knowledge of additional aspects of the coastal region which cannot be reconstructed to the proto-Coastal ancestral language.

In addition, Mbulungish and Mboteni learned about shellfish, an important part of the mangrove ecosystem.[46] In the interdisciplinary sources, associations between red mangroves and shellfish are abundant. For example, in her archaeological research of Senegal's lower Casamance region, Olga Linares found mangrove oysters growing on the aerial roots of *R. racemosa* in archaeological deposits dating back to 200 to 300 CE.[47] By *c.* 1000 CE, the language evidence suggests that in the Rio Nunez region red mangroves were also becoming a key micro-environment for supplying other sources of critical nourishment in coastal dwellers' arsenals for food security.

The shards of linguistic evidence reveal the antiquity of a coastal land-use strategy. In addition to the absolute chronology generated by glottochronology, the linguistic evidence reveals an important relative chronology for the history of the coastal Rio Nunez region. Knowledge of white mangroves is the most ancient component of the coastal land-use system, subsequently followed by knowledge of red mangroves, shellfish and seasonal streams. Words for 'rice' cannot be reconstructed to the Coastal language or its daughter speech communities. Rice, whether it was grown in the mangroves, floodplains or uplands, is conspicuously absent from the earliest languages spoken in coastal Guinea.

COLLABORATION ACROSS THE SWAMPS: AREAL INNOVATIONS FOR RICE-RELATED TERMS AMONG NALU-, MBULUNGISH-, MBOTENI- AND SITEM-SPEAKERS

In the Rio Nunez region, both rice-growing technology and rice terminology were born after the two separate linguistic subgroups – Coastal and Highlands – diverged into daughter speech communities. By *c.* 1000 CE, the Highlands dialects spoken in the forest-savanna region of Guinea, west of the Konkouré River, were differentiating into daughter speech communities. Highlands dialects spoken in the forest-savanna and along the coast of Sierra Leone became the Temne language. Dialects spoken further north in the forest-savanna of Guinea became the Landuma language. And finally, dialects spoken along the coast of present-day Guinea became the Sitem,

[43] Red mangrove – Nalu: *m-mak*/*a-mak*; Mboteni: *ɛ-ma*, *e-ma*/*a-ma*.

[44] Seasonal stream – Mbulungish: *i-pal*/*a-ppalleŋ*; Mboteni: *pɔl*/*sam-pɔl*; large seasonal stream – Mboteni: *pɔlmeni*.

[45] Mosquito – Mbulungish: *ɔ-bo*/*ɔ-bolleŋ*; Mboteni: *a-bɔ*.

[46] Crab – Mbulungish: *i-nep*, *e-nep*/*ɛnippel*, *ɛ-nippel*; Mboteni: *a-nep*/*a-neppel*. Type of crab – Mbulungish: *i-laŋ*/*ayel-laŋ*; Mboteni: *a-laŋ*/*alaŋŋel*.

[47] Linares de Sapir, 'Shell middens of Lower Casamance', 41.

Mandori, Kakissa, Koba and Kalum languages. Cognate percentages and glottochronology support this settlement chronology.[48]

After the divergence of the Coastal and Highlands ancestral languages, the daughter speech communities found themselves in the same proverbial boat. Nalu-, Mbulungish- and Mboteni-speakers had the benefit of inherited knowledge about the region. After *c*. 1000 CE, they were joined by Sitem-speaking villagers who migrated into coastal terrain and found similar conditions in their fields. Though they spoke distantly related but mutually unintelligible languages, they often lived in nearby villages and potentially worked together to design technology uniquely suited to conditions in their micro-environments.

By *c*. 1000 CE, most of the region's languages were distantly related; Coastal and most Highlands speech communities could no longer understand one another. Coining unique terminology to name the fruits of their collective labors was a product of coastal dwellers communicating as they exchanged their newly fabricated technology. The terminology pertaining to coastal inundated rice-growing technology coined by Nalu-, Mbulungish-, Mboteni- and Sitem-speakers of the Rio Nunez region cannot be reconstructed to either Coastal or Highlands. These areal innovations spread throughout micro-environments in the Rio Nunez region.

After *c*. 1000, the inhabitants of the Rio Nunez offer us the first glimpse of a coastal rice-growing technology. Based on the existence of new terminology, they also learned how to trap fresh water in low-lying fields in the floodplains.[49] Together Nalu-, Mbulungish-, Mboteni- and Sitem-speakers coined a new term for 'sowing seeds with finger' in moist soils. Coastal and Highlands speech communities also used their new word to refer to transplanting and to seedlings.[50]

Coastal cultivators in the Rio Nunez region did not stop here. Together, Nalu-, Mboteni- and Sitem-speakers fabricated a key piece of material culture, the 'fulcrum' shovel.[51] Speech communities north of the Rio Nunez region named it *ma-kumbal*[52] and Mbulungish-speakers south of the Rio Nunez region coined a separate term. Cultivators on both sides of the Nunez River found subtle differences in the quantity of rain water and the quality of weeds in their fields, warranting different terminology and subtle variations in technology designs.

[48] Fields, 'Before "Baga"'; Fields, 'Rice farmers in the Rio Nunez region', 100–10.

[49] Mound – Mboteni: *e-nɛk/a-nɛk*'; Ridge – Nalu: *ma-nek/a-nek*; Mbulungish: *ɛ-nɛk/ki-nɛk*, *ta-nɛk tafɛt/ma-nɛk mafɛt*; Mboteni: *e-nɛk/a-nɛk*; Sitem: *a-nek/-nek*; Landuma: *ta-nɛk/ma-nɛk*.

[50] To transplant – Nalu: *ma-cɛɛp*, *m*-cɛɛpan; Sitem: *ki-cɛp*. To transplant rice – Nalu: *-cɛp*; Sitem: *pa-cɛɛp*. To sow rice with finger – Nalu: *ma-cɛɛp*; Sitem: *kɪ-cep tecir*. Seedling – Nalu: *m-kicɛɛpa/aŋ-kicɛɛpa*.

[51] Linares, *Power, Prayer and Production*, 19; Linares, 'Diminished rains and divided tasks: rice-growing in three Jola communities of Casamance, Senegal', in A. Endre Nyerges (ed.), *The Ecology of Practice: Studies of Food Crop Production in Sub-Saharan West Africa* (Amsterdam, 1997), 49.

[52] Shortest shovel – Nalu: *ma-kumbal/a-kumbal*; Mboteni: *faa aŋkumbɛl*; Sitem: *aŋ-kumbɛl*. Short shovel used to turn soil for the second time in ridges – Mboteni: *porbal aŋkumbɛl*.

The existence of an indigenous word for the fulcrum shovel in Atlantic languages in the Rio Nunez region raises the question of its origins among Atlantic languages. The noun class marker suggests it is a Nalu word. However, the possibility of *ma-kumbal* being a Sitem word cannot be completely ruled out.[53] Thus, the current evidence suggests that Nalu and Sitem speech communities along the Nunez River separately innovated the word *ma-kumbal*. Mboteni speech communities likely borrowed it from the Nalu or the Sitem.

Mbulungish speech communities use a fulcrum shovel almost identical in appearance to *ma-kumbal*. But, they have coined their own terminology to name it.[54] Mbulungish villages are located south of the Nunez River and south of Nalu, Mboteni and Sitem villages. Of the villages where I conducted fieldwork, the Mboteni village of Era and the Mbulungish village of Monchon appear to be the closest in proximity. But Era's micro-environment is closer to that of the Sitem village of Kawass. Present-day Nalu, Sitem, Mboteni and Mbulungish farmers all named the Mbulungish village of Monchon as one of the few locations in coastal Guinea where African rice, *O. glaberrima*, still grows. They also described the rice fields in Monchon as possessing more water and weeds than the other villages.[55] The environmental variations may explain subtle differences in how coastal cultivators in Monchon designed their fulcrum shovels in comparison to cultivators in the other villages studied.

Throughout the coastal littoral of West Africa's Upper Guinea Coast, farmers adapted versions of the fulcrum shovel to the ecological niches in their micro-environments. Variations in the shape and size of the shovel's scoop – flatter or more curved, larger or smaller – depended on land features, such as quality of soil, quality and quantity of weeds, amount of fresh water collected in the fields, and land preparation tasks. The shovel scoop is attached with vines or chords to a long handle measuring the height of its user. The handle height enabled male farmers to rest the tool on their knees when lifting heavy loads of mud. Jola farmers in present-day Senegal use *kayendo* or *kajandu* to build bunds around, and ridges and furrows within, their low-lying rice

[53] In comparison to Nalu's 3 noun classes, Sitem has 15. *Toŋ-kumbɛl/aŋ-kumbɛ* appears to fit into class five, *t-*, *tV-*, *tVŋ-*, *tɪŋ-/m-*, *mV-*, *mVŋ-*, *mɪŋ-*, *m-*, which includes inanimate words like 'drum', 'hut', 'skirt' and 'seedling'. The noun classifiers suggest that *toŋ-kumbɛl* may alternatively be a Sitem word.

In spite of the paucity of source materials, linguists agree that Nalu possesses only three noun classifiers, *m-*, *ma-/a-* for singular/plural inanimate objects and *m-*, *ma-/b-*, *bɛ-* for singular/plural animates. Based on the morphological data, *ma-kumbal* exhibits the noun classifiers we would expect for an inanimate object in the present-day Nalu language. In addition, linguists agree that Mboteni is one of a few Atlantic languages in which the noun class system does not operate. Thus, based on the morphological evidence, the Mboteni language likely borrowed *faa-aŋ-kumbel* from Nalu in that it exhibits a fossilized noun class.

[54] Medium-size shovel used to make mounds – Mbulungish: *-ki-taŋgbanyi/ci-taŋgbanyi*; Susu: *kitangbanyi*.

[55] Interviews in the Nalu village of Kukuba with Ibrahima Camara, 17 Dec. 1998; Souleyman Camara, 19 Sept. 1998; Saliou Bangoura, 10 Dec. 1999; Mohammed Ndjongo Bangoura, 2 Dec. 1998, 4 Dec. 1998.

fields.[56] Balanta farmers in Guinea-Bissau use a similar fulcrum shovel, which they call *kebinde*, to cultivate paddy-rice in coastal lowlands.[57] Even today, farmers throughout the coastal littoral of West Africa's Upper Guinea Coast use fulcrum shovels to carve fertile rice fields out of the mangrove swamps.

In oral narratives, present-day coastal farmers have testified that their ancestors cultivated rice with fulcrum shovels which lacked iron blades affixed to their edges, before coastal inhabitants had access to iron.[58] According to a Mboteni elder in present-day Guinea:

> There are three kinds of *bêche* [fulcrum shovel]. When our ancestors began this work [rice cultivation], they worked only with their strength, because the first *bêche* did not have a blade. At a certain moment, God made it so that we found iron that was not worked by blacksmiths.
> They worked that metal in place of the blade. After that time, there were blacksmiths here. And we began to go to the blacksmiths to make the blades for the *bêche*.[59]

And according to a Balanta elder, 'Since Balanta did not possess iron, the *kebinde* did not have an iron end. The *kebinde* without iron was for farming areas where Balanta cultivate paddy rice'.[60] The independent streams of linguistic evidence and oral narratives collected from elders in coastal Guinea and Guinea-Bissau exhibit similar patterns. The fulcrum shovel was indigenous to the coast and was not an introduction from the interior. The ingenuity behind its design and its fabrication were part and parcel of a continuum of experimentation, innovation and collaboration by speech communities inhabiting the coast since ancient times and those which migrated relatively recently to the coastal region. Both took place centuries before coastal dwellers had access to iron through trans-Atlantic trade.

BORROWED RICE-GROWING TECHNOLOGY AND TERMINOLOGY: LOANWORDS FROM SUSU-SPEAKERS, *c.* 1500 TO 1800

Language contact between coastal dwellers who speak Atlantic languages and Susu strangers has roots in population movements in the seventeenth century when large numbers of Susu began moving out of Futa Jallon towards the coast. Prior to the seventeenth century, some Susu settled on the coast as itinerant caravan traders. Luso-African trader Andrè Alvares de Álmada described Susu and Jalonke traders bringing indigo dye, cloth and clothing from Futa Jallon to the Rio Pongo region in the sixteenth century and traveling in caravans from Futa Jallon to sell dyes in the Rio Nunez

[56] Linares, *Power, Prayer and Production*, 19; Linares, 'Diminished rains and divided tasks', 49; Paul Pélissier, *Les paysans du Sénégal. Les civilisations agraires du Vayor à la Casamance* (Saint-Yrieix, 1966), 738–41.

[57] Walter Hawthorne, *Planting Rice and Harvesting Slaves: Transformations along the Guinea-Bissau Coast, 1400–1900* (Portsmouth NH, 2003), 153.

[58] In Guinea-Bissau, some groups of farmers still use fulcrum shovels without metal blades. The Jola, on the other hand, always cap a *kajandu* with a steel blade, which, interestingly, is usually made by a Mande blacksmith. Personal communication with Olga Linares at the 2004 African Studies Association conference in New Orleans and via email, dated 11 Feb. 2005.

[59] Interview with 'President' Mohamed Yongo Bangoura in the village of Binari, 29–30 April 1998.

[60] Hawthorne, *Planting Rice and Harvesting Slaves*, 45–6.

region.[61] Álmada also reported the establishment of Susu villages west of Futa Jallon, sandwiched between the coastal littoral and the Futa Jallon mountains and situated beyond the (Baga) Sitem villages on the Kapatchez River in coastal Guinea.[62] As coastal Guinea was drawn into trans-Atlantic trade, Susu-speaking strangers settled on the sparsely inhabited coast among the Nalu-, Mbulungish-, Mboteni- and Sitem-speakers.

As a result of the settlement of Susu traders in the Rio Nunez region, coastal dwellers borrowed Susu words for technology, institutions and practices resonating with their ancient strategies for surviving and flourishing in the coastal environment. Susu-speakers extended some of the vocabulary words developed in their savanna homeland to strategies they employed in the coastal region. In addition, they created new vocabulary for the phenomena that they found on the coast. This cultural vocabulary is an important historical source for the interaction between Susu strangers and Nalu, Mbulungish, Mboteni and Sitem owners of the land in the development of coastal rice-growing technology, particularly mangrove rice-growing technology.

Susu-speakers in the Rio Nunez region inherited two sets of vocabulary from their Mande linguistic ancestors before their migration in the *c.* 1500 to 1800 period. First, Susu-speakers brought a wealth of knowledge about cereals, fonio and sorghum, in addition to rice, to the Rio Nunez region.[63] Even though Susu-speakers possessed knowledge of diverse cereals grown in dry climates, the linguistic evidence is clear: it was not 'Susu' knowledge. These are not Susu words. They are Mande words – or in the case of 'fonio', loanwords borrowed into branches of the Mande language group – which were inherited by Susu-speaking daughter communities and subsequently borrowed into Atlantic languages spoken in coastal Guinea. Like the root word for 'rice', words for other cereals may have been borrowed by language groups throughout West Africa at different stages in the language history of the region. In contrast, Susu-Jalonke words for mounds[64] are evidence of knowledge which Susu-speakers inherited from their more immediate linguistic ancestors prior to the *c.* 1500 to 1800 period.

Though the current literature on rice in West Africa portrays the Mande predominantly as innovators, in the coastal Rio Nunez region they also played the role of extending coastal Atlantic speech communities' indigenous agricultural technology. The fulcrum shovel is a perfect example. The previous section presented evidence of indigenous terms for specialized material culture – the fulcrum shovel – which spread areally among Nalu, Mboteni and Sitem speech communities. Susu-speakers borrowed a second term for the shovel from the Mbulungish.[65] They also coined a generic term

[61] Andrè Alvares de Álmada, *Brief Treatise on the Rivers of Guinea* (*c. 1594*)*: Part II* (Liverpool, 1984), 132–3, 129.

[62] *Ibid.* 130; Donelha, *Descrição da Serra Leoa*, 270–1 n. 184.

[63] Fonio – Nalu: *m-pindi/a-pindi*; Mbulungish: *pundɛ/cu-pundɛlɛŋ*; Mboteni: *pundu*, *pundo*; Sitem: *pundu*; Landuma: *pende/ya-pande*; Susu: *fundeyi*; Jalonke: *fundema*; Mende: *funde*. Sorghum – Mboteni: *cu-mank*; Susu: *mɛŋgi*; Jalonke: *mɛŋgina*.

[64] Mound – Nalu: *m-tukuɲi/a-tukuɲi*; Mbulungish: *tukunyi/ci-tukunyi*; Susu: *tukuɲi*; Jalonke: *tukuŋma tekina*.

[65] Medium-sized shovel – Mbulungish: *ki-taŋgbaŋ/ci-taŋgbaŋŋel*; Susu: *kitaŋgbanyi*.

to describe the tool whose length and weight coastal farmers customized to fit the quality of the weeds and depth of water in their rice fields, in addition to their own stamina and physical strength.[66] *Kɔp* is only one of many words used by present-day coastal farmers to name this important aspect of their agricultural material culture. This article has presented evidence that Nalu, Mbulungish, Mboteni and Sitem speech communities possessed specialized vocabulary related to coastal rice production which Atlantic speech communities in the Rio Nunez region innovated.

Though Atlantic farmers throughout West Africa's Upper Guinea Coast designed and fabricated the sculpted wooden shovel based on their intimate and extensive knowledge of the coastal environment, linguistic evidence reveals that, in the Rio Nunez, Susu-speakers' iron-working technology fashioned the metal blades.[67] The linguistic evidence of coastal Guinea mirrors a pattern established by Walter Hawthorne in Guinea-Bissau prior to the arrival of Portuguese traders. The Balanta in Guinea-Bissau traded in salt, dried fish and molluscs for iron tools and weapons with traders from the interior. With the advent of trans-Atlantic trade, Luso-African and European traders demanded captives in exchange for iron.[68] Among Susu-speakers, making iron edges for coastal agricultural implements represented an innovation that was unique to the coastal region and not inherited knowledge from Susu-Jalonke or Mande linguistic ancestors.

[66] Shovel (generic)- Nalu: *m-kɔp/a-kɔp*; Mbulungish: *kɔp/ci-kɔppel*; Mboteni: *kɔp/su-kɔp*; Susu: *kɔfi*, *kɔpi*.

Long shovel (described by present-day elders to have been up to 2 meters long and to have been used by young men to show off strength and virility and attract the attention of potential mates): Nalu: *m-kɔp lanna/a-kɔp lanna*; Mbulungish: *kɔp kokilannɛ/ci-kɔppel kokilannɛ*; Landuma: *k-ɔpi/c-ɔpi*; Susu: *kofi kuye*. (The current evidence suggests that they combined the borrowed word with adjectives in their own languages to form compound words describing the size of the shovel.)

[67] Shovel blade – Nalu: *ma-fanc/a-fanc*; Mbulungish: *ɛ-fɛnc/ɛ-fɛnceel*; Sitem: *a-fenc*; Susu: *fɛnsi*.

The root word of *fensi* is probably *-fac*, a word meaning 'iron' and 'iron pot' spoken in the proto-Highlands language, the linguistic ancestor of present-day Temne, Landuma, Sitem and Kalum languages. Temne: *a-fat*; Landuma: *a-fac*; Kalum: *a-fac/ɛ-fac*. Proto-Highlands diverged into its daughter languages *c.* 1000 CE.

European travelers' accounts provide independent evidence that Temne-speakers, particularly of the Scarcies River region in Sierra Leone, possessed and traded in iron ore, but they do not comment on its quality or quantity. Nor do European observers provide evidence that Temne-speakers possessed iron-smelting technology before the arrival of Luso-African observers. See Álmada, *Brief Treatise on the Rivers of Guinea* (*c. 1594*)*: Part I*, 15/8; Álmada, *Brief Treatise on the Rivers of Guinea* (*c. 1594*)*: Part II*, 15/8; Donelha, *Descrição da Serra Leoa*, 235 n. 113; Valentim Fernandes, *Description de la côte occidentale d'Afrique* (*Sénégal au Cap de Monte, Archipels*), trans. T. Monod, A. Teixeira da Mota and R. Mauny (Publicações do Centro de Estudos da Guiné Portuguesa, 11) (Bissau, 1951), 76, 95, 166 n.149; John Matthews, *A Voyage to the River Sierra-Leone on the Coast of Africa* (London, 1966), 52.

Based on this evidence, my hypothesis is that coastal dwellers in the Rio Nunez region may have gained access to some iron ore which came from regions inhabited by Temne-speaking people through trade networks with Temne-speakers. The Susu's iron-working technology fashioned the iron ore into blades for the indigenously made fulcrum shovel. Future research is necessary on this important question.

[68] Hawthorn, *Planting Rice, Harvesting Slaves*, 11.

Having traced the origins and spread of words for the key aspects of the coastal rice-growing technology, there are a host of other words which cannot be traced. This specialized terminology falls outside the categories for inherited vocabulary, areal innovations and loanwords. This is because individual coastal speech communities – Nalu, Mbulungish, Mboteni and Sitem – individual villages and, in some cases, individual families have adapted their own strategies for managing the variable conditions found in their rice fields. For example, in each village coastal farmers perform countless actions associated with field work. In some villages, the actions include walking on the weeds to bury them into the earth, turning the soil for the first and second times with the fulcrum shovel, catching the earth, and packing it into place with one's hands. The same is true for the actions, implements and rituals associated with clearing a new mangrove field, transplanting rice seedlings, surveying fields as the rice matures, harvesting and processing the rice.[69] Throughout the region, coastal farmers' technology varies slightly. And in each community, in each micro-niche, in each village and sometimes in each family, coastal farmers call their actions by different names. These highly specialized and localized vocabulary words are direct evidence of Rio Nunez farmers uniquely adapting rice technology and terminology to micro-niches and micro-environments along the coast.

CONCLUSION

In Guinea's Rio Nunez region, the multiple roots of coastal rice-growing technology resemble the sprawling roots of mangrove trees, penetrating either the surface or the depth of the soil, depending on their antiquity. Though the introduction of iron-edged tools was an important addition to coastal dwellers' land-use strategies, it did not define coastal rice-growing technology. Rather, the technological innovations of the *c.* 1500 to 1800 period were driven by the ingenuity of coastal dwellers experimenting in, and adapting to, their environment since antiquity. The accumulated linguistic evidence – the inherited vocabulary, areal innovations and loanwords – attests to the indigenous nature of this coastal farming system, uniquely adapted to the daunting challenges of the region by the groups which had inhabited it since ancient times. The introduction of iron improved the effectiveness of coastal rice-growing technology.

This study has examined patterns in several independent streams of evidence, particularly linguistic sources and biological and botanical studies of mangrove ecosystems. In spite of the paucity of documentary sources and archaeological studies for the Rio Nunez region, the interdisciplinary evidence reveals the highly localized and continuous nature of coastal dwellers' agricultural innovation. Conducting more archaeology in the Upper Guinea Coast region and comparative linguistic studies among speech

[69] Linares, *Power, Prayer and Production*, 20. Linares's characterization of the complexity and local nature of coastal rice farming among the Jola mirrors my fieldwork observations in coastal Guinea.

communities speaking Atlantic languages will increase our understanding of the processes of agricultural innovation. Future study in the coastal region may challenge scholars to further re-think notions of agricultural technology diffusing from 'cradles' of domestication to the rest of the African continent.