A Provisional Historical Schema for Western Africa Based on Seven Climate Periods (ca. 9000 B.C. to the 19th Century).
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Résumé
Examen de l'évolution historique de l'Ouest africain au cours des sept éras climatiques s'étendant sur onze millénaires. Une périodisation construite à partir des changements climatiques fournit un éclairage significatif sur des phénomènes tels que les structures du peuplement, la diffusion des cultigènes et des animaux domestiques, le développement des routes commerciales reliant les écosystèmes, l'usage de la cavalerie pour la guerre et dans la genèse des États. En outre, la détermination des systèmes climatiques contribue à l'établissement de périodisations historiques indépendantes des chronologies d'inspiration européenne.

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Recent scholarship concerning West African climate patterns in past times has made feasible a provisional periodization of the history of Western Africa which is independent of European-derived chronologies. Concomitantly, historical periodizations offer provocative insights concerning such long-term processes as human migrations and settlement patterns; the diffusion of cultigens and domestic animals; the development of long-distance trade routes; and the use of horse cavalry in warfare—as illustrated by examples presented below.

'Western Africa' comprises the area west of the inland delta of the Niger river and west of the Bandama river, lands principally inhabited by Mande- and West-Atlantic-speaking groups and corresponding with H. Baumann's West-Atlantic and upper Niger 'cercles de civilisation' (Baumann & Westermann 1962: map between 363 and 364). The historical schema discussed here comprises more than ten thousand years—from the onset of a wet climate period around 9000 B.C. to the last quarter of the 19th century. Periodizations and the Map depicting ecological zones (pp. 44-45) are principally derived from the pioneering studies of Sharon E. Nicholson (1979) and Susan and Roderick McIntosh (1981a), and from the analyses I presented elsewhere (Brooks 1985)1.

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1. Rainfall patterns of Western Africa in contemporary times, i.e. 1930-1960, as depicted on Map pp. 44-45 are based on map 5 of University of the Witwatersrand 1961. The isohyets, for wet periods depicted 20% more, those for dry periods 20% less rainfall than those for this 'base' period; e.g. the 1 000 mm isohyets for wet and for dry periods demarcate the 1 200 mm and

wet periods ca 700-1100 A.D.; 1500-1630 A.D.
intermediate periods ca 300-700 A.D.; ca 1930-1960 A.D.
dry periods ca 300 B.C. -300 A.D.; ca 1100-1500 A.D.; ca
MAP. Rainfall patterns and limits of ecological zones in Western Africa.
Seven climate periods will be discussed: (1) a long era, from ca. 9000 to ca. 2500 B.C., marked by two sub-periods of plentiful rainfall, the second one, known as the Atlantic Wet Phase, extending ca. 5500-2500 B.C.; (2) a long period of decreasing rainfall from the close of the Atlantic Wet Phase until ca. 300 B.C.; (3) a dry period lasting from ca. 300 B.C. to ca. 300 A.D., during which rainfall was significantly less than in recent historical times; (4) four centuries of greater precipitation from ca. 300 to ca. 700 A.D., during which rainfall was perhaps comparable to that of the period 1930-1960 (the 'base' period for the Map), followed by a four-century wet phase extending ca. 700-1100 A.D.; (5) a four-century-long dry period lasting from ca. 1100 to ca. 1500 A.D.; (6) a short wet period from ca. 1500 to ca. 1630; and (7) an extended dry period lasting from ca. 1630 to ca. 1860 A.D.

Ca. 9000 to ca. 2500 B.C.: Era of the Aquatic Culture

For some eight millenia, from ca. 18000 until ca. 10000 B.C., while Europe and North America experienced the last period of extensive glaciation, the northern part of the African continent sustained extremely arid conditions. Rainfall was so sparse that the area of the Sahara and Western Africa as far as 11°N, i.e. the southern part of Guinea-Bissau, was virtually uninhabited (McIntosh & McIntosh 1981a: 604). To the south were savanna and savanna-woodland, with rain forests limited to sparse coastal areas in Liberia, along the Ivory Coast-Ghana border, the western Niger delta, and southern Cameroon (Shaw 1981: 106).

The period around 9000 B.C. marks the onset of a seven-millenium-long wet phase, interrupted by a half millenium of drought conditions extending from ca. 6000 to ca. 5500 B.C. (see Fig.). The area of the Sahara may have had three or four times more rainfall than during the 'base' period 1930-1960, when rainfall in the Sahara was approximately 100 mm annually. During this long double wet period the Sahara area had a grassland environment with numerous streams, shallow lakes, and swamplands which supported a rich flora and fauna attracting human settlement. Rain forests may have extended to 11°N, i.e. to the Casamance river (McIntosh & McIntosh 1981a: 604).

During the ca. 9000-6000 B.C. wet period, populations inhabiting the Sahara area and a wide belt of territory extending southwards along the 800 mm isohyet for the 'base' period. The only exception is the 100 mm isohyet for wet periods, for which data are lacking. While arbitrary, the estimates of 20% more and 20% less rainfall are conceived to be reasonable possibilities during wet and dry periods, and the ecological zones derived thereby have proved generally congruent with scholarship concerning past climate patterns and with information recorded in oral and written sources.
the upper Nile valley and into the Lakes region of East Africa shared a way of life that J. E. G. Sutton (1974) has characterized as the 'Aquatic Civilization of Middle Africa'. Groups settled along lakes and water-courses subsisted on fish, shellfish, hippopotami, crocodiles, and other aquatic fauna, hunted antelopes and other ungulates grazing the savannas, and collected a wide variety of plant foods. Sutton tentatively identifies the people of the Aquatic Culture as proto-Nilo-Saharan speakers.

Significantly, diminished rainfall during the period from ca. 6000 to ca. 5500 B.C. (see Fig.) greatly reduced the areas that supported the Aquatic lifestyle, compelling groups to extend their dependence on hunting non-aquatic animals and on gathering wild grains and other plant foods, or to migrate to better-watered lands. The Aquatic environment expanded once more during the period ca. 5500-2500 B.C., termed the Atlantic Wet Phase, but not to its former extent (ibid.).

During the Atlantic Wet Phase, new population groups moved into the Sahara along with the proto-Nilo-Saharan speakers. These included hunting and gathering groups migrating north from Western Africa which may be identified with proto-Mande speakers, and proto-Berber speakers from North Africa who introduced ndama (West African short-horn cattle), goats, and sheep into Saharan pasturelands. Scenes of humans and animals living in the Sahara during the Atlantic Wet Phase are dramatically portrayed in rock paintings and etchings in parts of the Sahara that are too arid for human habitation today. Hunters are depicted stalking antelopes and other animals, and pastoralists are shown herding sheep, goats, and multi-colored cattle (Lhote 1958).
Ca. 2500 to ca. 300 B.C.: Era of Progressive Desiccation

As ecological conditions worsened during the long dry period following the Atlantic Wet Phase, people living in the Sahara either adapted to increasingly arid conditions or sought more favorable environments, migrating north, south or east to the Nile valley.

Groups living in the southern Sahara along the receding shorelines of shallow lakes intensified their collection of wild grains and began to cultivate some of them. These included proto-Mande speakers in the Tichit area of present-day Mauretania who cultivated millet sometime after 2000 B.C., and other groups to the east (proto-Nilo-Saharan speakers?) who domesticated sorghum. These grains came to be grown across the wide expanse of sahel and savanna zones extending from Mauretania and Senegal to the Nile valley (Shaw 1981: 102-105; McIntosh & McIntosh 1983: 238-239; Munson 1980: 462-463).

Pastoral groups migrating south introduced ndama cattle, goats, and sheep to sub-Saharan pastures, some groups reaching the area of the Niger bend by ca. 2000 B.C. (Shaw 1981: 102, fig. 10). The spread of pastoralism south of the Sahara was inhibited by the tsetse fly, the vector for sleeping-sickness, which inhabits savanna-woodland ecologies receiving more than ca. 1,000 mm of annual rainfall. During the past four millennia, changing rainfall patterns have caused the ‘tsetse-fly line’ to oscillate north and south within an approximately 200-kilometer-wide belt between 10° and 15°N (see Map).

The introduction of horse chariots among Berber groups living near Phoenician settlements founded in North Africa after ca. 1000 B.C. had far-reaching consequences for groups remaining in the Sahara. Rock paintings and etchings and archaeological investigations show that from the 7th to the 3rd century Berber groups ranged the Sahara, raiding, trading with, and settling among groups dwelling along the shrinking lakes and marshlands (Lhote 1982; Munson 1980: 462, 465). The extent of long-distance exchanges is indicated by the western sweep of the trans-Saharan chariot and bullock-cart route which traverses the area of Idjil (an ancient salt source) and Akjoujt (where copper was mined and worked from the middle of the first millenium B.C., if not earlier), then curves eastwards towards the bend of the Niger river (Lambert 1971: 9-12). Presumably there were fishing and trading communities along the Niger bend that were precursors of Jenne-jeno and other settlements dated to the 3rd century B.C. Such trans-Saharan links facilitated the spread of knowledge of iron-working across the Sahara, probably by itinerant smiths who founded the endogamous blacksmith groups widely distributed in Western Africa (McIntosh & McIntosh 1981a: 610-611).
Ca. 300 B.C. to ca. 300 A.D.: Era of Advanced Aridity

By the 3rd century B.C., progressive desiccation halted, or made sporadic, trans-Saharan and intra-Saharan travel, which was not to be renewed until the early centuries A.D. However, during this period two developments contributed significantly in preparing the way for the renewal of trans-Saharan exchanges on a greatly expanded scale. These were the progressive elaboration of inter-zonal commercial exchanges in Western Africa, and the diffusion of camel herding across the sahelian zone.

Excavations at Jenne-jeno and neighboring sites have demonstrated that by the 3rd century B.C. there were riverine trading communities along the Bani and Niger rivers inhabited by fisherfolk, smiths, potters, and other artisans (McIntosh & McIntosh 1981b). The Map shows that during this arid period the bend of the Niger river and its tributaries traversed the Saharan, sahelian, and savanna ecological zones, thereby facilitating the development of inter-zonal trade—exchanges that were precursors and prerequisites for the subsequent development of trans-Saharan commercial routes. Still to be determined is whether similar settlements and commercial exchanges occurred along the Senegal river and its tributaries during this period. Seemingly, such developments came later, during the early centuries of the Christian era.

The ca. 300 B.C.-300 A.D. arid period seems likely to be the era during which rice and yams were domesticated in West Africa. The earliest evidence for domesticated rice is found at Jenne-jeno and dates to the third century B.C. (McIntosh & McIntosh 1983: 238). The food needs of the growing riverine trading communities would have provided a stimulus for rice cultivation in the fertile soils of the inland delta of the Niger. Rice growing probably diffused widely across Western Africa under the favorable conditions of the subsequent ca. 300-700 period of increasing rainfall, during which time cultivators of millet and sorghum would have found these crops progressively less productive as compared to rice as ecological zones shifted northwards (see Map).

The difficulties that archaeologists encounter while excavating in tropical forest areas have thus far prevented scholars from dating the origins of yam domestication. An ecological model advanced for the development of yam and oil-palm agriculture targets the borderlands of savanna and forest areas inasmuch as yams and oil palms grow naturally neither in open savanna nor under dense forest cover (Shaw 1981: 105-106). The presumed area of domestication, a belt extending from central Ivory Coast to Nigeria, approximates the margins of the savanna and savanna-woodland zones projected for the ca. 300 B.C.-300 A.D. arid period (see Map; also Shaw 1984: plate ix; Harlan 1971: 471, fig. 5).

The renewal of intra- and trans-Saharan communications was preceded by the spread of camel herding westwards from the Nile valley along the
southern fringes of the Sahara during the first century A.D. (Bulliet 1975: 132-134). Increasing rainfall around the beginning of the Christian era encouraged camel-herding pastoralists to migrate northwards into the Sahara, and promoted regional and long-distance trade.

Ca. 300 to ca. 1100 A.D.: Era of Plentiful Rainfall

For purposes of discussion and analysis, the ca. 300-700 A.D. period of increasing rainfall and the ca. 700-1100 A.D. wet period are conveniently treated together.

Increasing rainfall from the beginning of the Christian era promoted the improvement of sahelian and Saharan pastures and water supplies, and facilitated the use of camels in intra- and trans-Saharan commerce, further stimulating the flourishing commercial networks linking people living in the desert, sahel and savanna zones. Trans-Saharan linkages are attested by the production of gold coins in the Roman mint at Carthage from 296 A.D. (Garrard 1982: 447), and by finds of copper ornaments at Jenne-jeno dated to ca. 400 A.D. (McIntosh & McIntosh 1981a: 612), a likely copper source being Akjoujt in the western Sahara.

Improving climate conditions encouraged Berber pastoralists to herd camels, donkeys, ndama cattle, sheep and goats in Saharan and sahelian pastures. It is likely that during the 5th or 6th century Berbers began herding zebu cattle through the Sahara, and that by the 7th and 8th centuries, when Arabs introduced Arabian horses to North Africa, grass and water supplies in the Sahara were sufficiently good to enable horses to be brought to pasturelands in the southern Sahara and sahel (see Map).

The build-up of horse herds in the southern Sahara and sahel zone contributed to conflicts between Berbers and other groups and to the creation of conquest States across the sahel and savanna zones. By the close of the ca. 700-1100 wet period, ecological conditions in the Sahara had changed to such an extent that Ghana's military forces were able to capture Awdaghost oasis early in the 11th century. During the subsequent Ghana-Almoravid conflicts, Berber groups contending for control of Saharan trade routes and pasturelands were discouraged from raiding along the southern margins of the Sahara by tsetse and mosquito infestations resulting from the northward advance of ecological zones (McDougall 1985: 15). Moroccan forces experienced a similar problem some five centuries later during the ca. 1500-1630 wet period.

Fula groups herding zebu cattle in Western Africa were especially challenged by changing ecological conditions during the ca. 700-1100 wet period as the ca. 1,000 mm 'tsetse-fly line' advanced progressively northwards towards the Senegal river (see Map). Consequently, Fula practicing independent pastoralism with zebu cattle were obliged to migrate eastwards. As shown on the Map, eastward migration across
the savanna zone was the only viable option: horse-owning Berbers and Soninke could defend sahelian pastures, while the advancing 'tsetse-fly line' precluded southward migration. Fula and their cattle thus began an epic *Volks-und-Zebuwanderung* that ended centuries later in northern Cameroon, more than 3,000 km from Futa Toro.

Ecological changes during the long wet period, combined with the southerly advance of Mande-speaking traders seeking kola, malaguettapepper, and other products of the savanna-woodland and forest zones, provide a plausible explanation for the differentiation of three languages of the northern sub-group of Mande languages, namely Soninke, Susu-Jallonke-Yalunka, and Vai-Kono. As the *ca. 700-1100* wet period continued, the progenitors of Soninke who moved northwards with improving conditions in the sahel and Sahara were increasingly separated from the progenitors of Susu-Jallonke-Yalunka and Vai-Kono living in the savanna zone along the upper Senegal and upper Niger rivers and their tributaries. The west-east bifurcation of Susu-Jallonke-Yalunka and Vai-Kono would seem to correlate with the ongoing development of commercial networks along the upper Senegal and the upper Niger rivers and their tributaries.

The separation of the northern sub-group of Mande languages was compounded and reinforced during the subsequent *ca. 1100-1500* dry period when members of Susu-Jallonke-Yalunka groups moved southwards to settle in Futa Jallon and members of Vai-Kono groups migrated to Sierra Leone and Liberia. Significantly too, the area separating the watersheds of the upper Senegal and the upper Niger rivers is the 'core area' for the development of the fourth branch of the northern sub-group of Mande languages, Mandekan, probably sometime during the *ca. 1100-1500* dry period (Brooks 1985: 75; Greenberg 1963: 8, maps A and B; Bird 1970, 1982).

*Ca. 1100 to ca. 1500* A.D.: Era of Progressive Desiccation

Droughts, desiccation, and far-ranging population movements characterize historical accounts of the *ca. 1100-1500* dry period. Diminished rainfall caused ecological zones to move southwards, perhaps by several hundred kilometers, over four centuries.

As a consequence of desiccating conditions, Mande-speaking traders extended their commercial networks linking the Niger and Senegal rivers farther and farther to the south to maintain trade links between different ecological zones, eventually to settle along the upper reaches of rivers navigated by West-Atlantic- and Kruan-speaking maritime groups. Mande smiths followed Mande traders, founding chapters of 'power associations'—Simo and Poro lodges—which controlled and expedited commerce (Brooks 1985: 132-139).
Mande-speaking traders and smiths contributed to the development of a number of commercial centers in the savanna-woodland zone, which served both as local markets and as entrepôts for trade with groups living in the forest zone and along the Atlantic coast. North to south in the savanna-woodland zone these included Kade, Labe, Timbo, Falaba, Kissidougou, and, probably very late in the dry period, Sondougou and Musadougou. The Map shows that all were located near the head of navigation of rivers linked with the Senegal river and Niger river commercial networks, and all between 200 and 300 km from the Atlantic coast, thereby well-situated to tap valuable resources of kola, malaguetta pepper, salt, and other savanna-woodland, forest, and coastal-riverine products.

West-Atlantic and Kruan middlemen for their part protected long-standing commercial interests, denying Mande traders direct access to the coast and to important areas of kola, malaguetta pepper, and salt production. The major exception, that of the Vai who attained the coast in the Cape Mount area, is notable for being the juncture of West-Atlantic and Kruan language groups, seemingly the only approach to the coast vulnerable to Mande trading groups for hundreds of kilometers in either direction (Brooks 1985: 101-107).

During the ca. 1100-1500 dry period, Mande-speaking smiths moved progressively southwards to exploit woodlands for charcoal-making in order to smelt and work iron and to open new markets for their manufactures. The ecologies of the areas they migrated from—Senegambia and the lands along the northern borders of Futa Jallon—changed from savanna-woodland to savanna and became suitable for the growth of cotton and the production of large quantities of cotton textiles, many of which were carried south by Mande traders for barter with West-Atlantic- and Gur-speaking groups living in the savanna-woodland and forest zones.

By the 15th century, iron-smelting (but not iron-working) had virtually ceased north of the Gambia river. The Futa Jallon massif had become a major area of production, with much iron carried north to areas of former production along overland caravan routes and via coastwise and riverine commercial networks (ibid.: 78-81; Mota 1969, map on 557).

Where smiths felled trees, they and other groups cultivated the soil. And where woodlands and forests were cleared, herders with ndama cattle could follow. Fula traditions suggest that herders first entered the Futa Jallon highlands towards the end of the 15th century at the close of the ca. 1100-1500 dry period, but large-scale migrations of Fula pastoralists began later, during the ca. 1630-1860 dry period (Brooks 1985: 100).

The most dynamic and far-reaching social and cultural changes during the ca. 1100-1500 historical period are associated with Mandekan-speaking groups, or Mandekalu as they term themselves. From the time of the founding of the Mali empire in the 13th century, Mandekalu
horsemen conquered the inhabitants of the sahel and savanna zones and raided along the southward-moving borders of the savanna-woodland zone. Horse-warriors and their retinues followed the caravan routes pioneered by Mande-speaking traders and smiths to raid and to found conquest States with tributary status to Mali. Mande bulking and artisanal centers among West-Atlantic- and Kruan-speaking host communities in the savanna and savanna-woodland zones were especially attractive prizes for Mandekalu warrior groups, which used them as administrative headquarters to rule conquered territories and levy taxes on trading communities.

Mandekalu State-building fostered linguistic, social, and cultural changes among conquered Mande-, West-Atlantic-, and Gur-speaking groups. The Mali empire and other Mandekalu-ruled States were characterized by tripartite stratified societies comprising elites and free persons; *nyamabkalau* (endogamous occupational groups), including smiths, leatherworkers, and bards; and large numbers of slaves, either captured during conquests or obtained through commerce.

Smiths and leatherworkers manufactured the weapons and horse tack required by Mandekalu warriors, while bards exercised a notable role in helping to create and articulate a Mandekalu ‘heroic age’ by the praise poetry and music they composed to celebrate the deeds of Mandekalu elites and to describe and rationalize the social and cultural patterns they imposed on subjugated peoples. Mandekalu conquests, Mandekan languages, and Mande cultural imperialism sustained one another (Brooks 1985: 122-123, 142-149).

**Ca. 1500-1630 A.D.: Brief but Eventful Wet Period**

By the close of the four centuries’ long dry period extending *ca. 1100-1500*, Western Africa’s ecological zones had shifted perhaps several hundred kilometers south of their positions during the *ca. 700-1100* wet period. Beginning *ca. 1500* there was significantly greater rainfall for approximately a century and a third, which in ecological terms is a relatively brief time span. The *ca. 1500-1630* wet period is as yet imperfectly charted, both as for its duration and as for its manifestations in different parts of Western Africa. Nonetheless, it is evident that the short-term climate change had important historical consequences.

The Map depicts projected ecological changes during this wet period. Increased rainfall promoted the northerly advance of the ‘tsetse-fly line’, perhaps by 200 km or more. Presumably the most rapid ecological changes occurred in the northernmost areas of Western Africa, where several years of increased precipitation would have significantly improved grazing areas in the Sahara and sahel and savanna zones, enabling them to support larger numbers of livestock and pastoralists. The conse-
quences of increased rainfall were likely less significant for cultivators in the savanna-woodland zone, and probably of no account for the inhabitants of the forest zone.

For cultivators, increased rainfall meant greater and more dependable crop yields, the higher productivity of which possibly contributed to significant population increases. Available evidence suggests that during the wet period cultivating groups remained where they were living, rather than move northwards in search of ecological conditions similar to those to which they had become accustomed during the preceding dry period. This is indicated by linguistic data compiled from European sources, which show that agricultural groups living along the Atlantic seaboard did not move from the areas where they were first reported by European mariners during the 15th century. Neither did they move during the ensuing ca. 1630-1860 dry period (Hair 1967: 247-257).

Three notable consequences of the northward movement of ecological zones and the 'tsetse-fly line' concern the decline of Mali, the Moroccan invasion of Songhai and its aftermath, and the fragmentation of the Jolof empire. The decline and fragmentation of the Mali empire began during the latter part of the ca. 1100-1500 dry period and extended through much of the ca. 1500-1630 wet period. Mali’s loss of control over its northern territories coincides with the advancing desiccation of the latter part of the preceding dry period which forced pastoralists living in the southern Sahara and sahel to migrate farther and farther southwards.

During the first half of the 15th century, Berbers pressed southwards raiding Malian territory, and Timbuctu came under Berber control. Songhai forces raided westwards from the bend of the Niger, and Mali was invaded from the east by Mosi, which later were able to maintain numerous horses due to the southern advance of the 'tsetse-fly line'. During the latter part of the 15th century, Berber control of Timbuctu was supplanted by that of the Songhai, whose military leaders effectively combined the deployment of cavalry forces with control of the Niger by river craft (Levtzion 1973: 80-84).

Sonni Ali (r. 1464-1492), founder of the Songhai empire, consolidated Songhai control over the interior delta of the Niger, but Malian forces retained control over the southern territories. The onset of the ca. 1500-1630 wet period was an important—perhaps the crucial—factor contributing to Malian resistance during the 16th century, especially with respect to Songhai cavalry deployment. Niani, Mali’s capital, was captured for a brief period in the 1540s, but Songhai forces never again penetrated as far south into the area that now lay along the southern margin of the savanna-woodland zone, hundreds of kilometers south of the 'tsetse-fly line' projected on the Map (ibid.: 89-91).

Just as the ca. 1500-1630 wet period brought both benefits and misfortunes to Mali, such was likewise the case for the Songhai empire.
Increased rainfall in the Sahara enabled Songhai’s forces to prevail over Berber groups far into the desert (Mauny 1961: map facing 514; Kaba 1981: map on 459). Conversely, the unusually favorable conditions along trans-Saharan routes during the latter part of the 16th century made Songhai vulnerable to attack from Morocco.

The Moroccan expeditionary force equipped with firearms which crossed the Sahara in 1590-91 defeated the Songhai army and occupied territory along the bend of the Niger river. However, the Moroccans were unable to conquer Songhai lands to the south, due to Songhai resistance and to disastrous losses of horses and men to trypanosomiasis, malaria, and other diseases endemic along the river valley and in the advancing savanna-woodland zone (see Map) (Kaba 1981: 469; Cissoko 1968).

The consequences of climate change during the ca. 1500-1630 wet period were no less significant for Senegambia and the Guinea-Bissau region. The northward movement of tsetse flies during the 16th century decimated the cavalry forces of the Mandinka-ruled States of the Guinea-Bissau region and the Jolof empire, which had purchased large numbers of horses from Portuguese traders during the latter part of the 15th century, and by the beginning of the 16th century reputedly possessed 10,000 mounts. Regardless of adverse ecological circumstances during the wet period, Mandinka and Wolof elites strove to maintain their status as cavaliers, which obsession redounded to the profit of Portuguese traders and horse breeders in the Cape Verde islands. During the mid-16th century, the Jolof empire fragmented into its constituent parts. The revolt was led by Cayor during the 1540s; and it is noteworthy that Cayor’s territory was located north of the ‘tsetse-fly line’ (see Map) (Brooks 1985: 164).


Around 1630 there began a long dry period which extended until ca. 1860. The renewed desiccation of Western Africa, compounded by overgrazing and deleterious cultivating practices, contributed to extensive environmental degradation and human deprivation.

The amount of rainfall diminished and was unpredictable: there were periods of severe drought and famine conditions interspersed with periods of relatively abundant rainfall. The effects of drought were likely exacerbated by population increases among cultivators and pastoralists and their herds of domestic animals during the preceding wet period. Fortuitously, this dry period coincided with rapidly growing European demand for captive labor on American plantations, and estimates for the trans-Saharan slave trade also indicate significantly increased numbers.
Tragically for millions of people in Western Africa, the ‘pull’ of European and North African demand for captives coincided with the ‘push’ of worsening economic and social circumstances in many parts of Western Africa, the consequences of which made African groups more willing than otherwise to sell war captives, domestic slaves, and criminals and social deviants, however defined.

There were drought and famine conditions in Senegambia and in the area of the Niger bend during the 1640s, several years of drought around the Niger bend towards 1670, and drought conditions in Senegambia in the 1670s. During drought conditions in the 1680s, people sold themselves into slavery to avoid death by famine, and Europeans were informed that conditions during the 1640s had been even worse. There were droughts in Senegambia in each decade from the 1710s to the 1750s, in the 1770s and 1780s, and frequent times of famine during the period from 1790 to 1840 (Nicholson 1979: 44-46; Curtin 1975: 110, appendix I; Becker 1985).

Many periods of drought and food shortages doubtless went unrecorded by African and European chroniclers. Human misery and social dislocation resulting from such circumstances contributed to the phenomenal growth of the Atlantic slave trade during this period, and likewise to the increased numbers of captives crossing the Sahara (Curtin 1969: 266, fig. 26; Lovejoy 1982: 497; Austen 1979: 66, table 2.8).

The ca. 1630-1860 dry period also marked an era of Fula ascendancy in Western Africa, inasmuch as Fula warrior groups associated with torodbe clerics espousing militant Islam achieved notable successes across the sahel, savanna and savanna-woodland zones. The progressive desiccation of Western Africa compelled southward migration of Fula herders, who in many areas became increasingly interspersed with Mande-speaking cultivators. The southward movement of the ‘tsetse-fly line’ promoted the expansion of cavalry warfare across vast areas of Western Africa, as had been the case during the ca. 1100-1500 dry period. During the first part of the ca. 1630-1860 dry period, Mandekalu comprised the ascendant horse-warrior groups engaged in raiding and slaving, but as the desiccation continued Fula military forces came increasingly to dominate the savanna and savanna-woodland zones, as Fula war leaders and marabouts combined forces.

Fula almamates, i.e. States founded on Islamic principles, included Bundu (from the 1690s on), Futa Jallon (from the 1720s on), Futa Toro (from the 1770s on), and the empire created by al-Hajj Umar in the wake of the jihad he initiated in 1852. Many Fula successes were at the expense of Mande-speaking cultivators, indicating that the progressive desiccation and ecological degradation of Western Africa were more advantageous for pastoralists than for cultivators. Had colonial powers not intervened during the last quarter of the 19th century, Muslim Fula might have consolidated their rule over the peoples of Western Africa.
Developments in Futa Jallon provide a remarkable case study of the interaction of ecological change and social conflict. The ongoing deforestation of the massif by smiths and cultivators became increasingly destructive during the dry period as desiccation slowed the growth of vegetation (Goucher 1981: 181-183; Church 1974: 66-67, 292). Moreover, land clearing opened the way to stock rearing, and what had probably been only a trickle of Fula migrants with ndama cattle during the previous dry period now became a flood as Fula herders abandoned arid pasture-lands north of the massif.

Fula herders were accompanied by torodbe clerics who actively proselytized both recent migrants and, less successfully, Fula long-settled in the massif. Increases both of human population and of the number of livestock living in Futa Jallon combined with climate desiccation to accelerate degradation of the environment. Charcoal-making for smelting iron, improvident slash-and-burn cultivation, erosion, overgrazing, and twice-annual burning-off of pasturelands transformed more and more of the land in the highlands into infertile laterite crust (bowal) almost bare of soil or vegetation. Concomitantly, competition for remaining lands exacerbated frictions between Susu-Jallonke-Yalunka landlords and Fula strangers, particularly the more assertive recent immigrants.

Social tensions and growing enmities between landlords and strangers were skillfully exploited by militant torodbe marabouts who forged alliances between Muslim Fula, members of the Mande-speaking trading community, and some of the cultivators. During the 1720s, a torodbe-led jihad succeeded in gaining control over the highlands surrounding Labe and Timbo. With the founding of the almamate, Futa Jallon became the lodestar for Muslims all over Western Africa and a base of operations for new initiatives elsewhere (Suret-Canale & Barry 1976: 490-499; Levitzion 1971; Rodney 1968: 277-282).

Alienated by these developments, some non-Muslim Fula migrated northwest from Futa Jallon into the Guinea-Bissau region, joining other Fula herders who had come from the north. Ongoing desiccation made the territory of the Kaabu empire increasingly suited to pastoralism, and Mandinka landlords found it to their advantage to entrust cattle to the expert care of Fula herders. However, landlord-stranger relations became increasingly strained during the long conflict between Kaabu and the Fula almamate, which began in the last quarter of the 18th century and continued until Kaabu's destruction in the 1860s. Fula living in the Kaabu empire came to be regarded as a 'fifth column' by Mandinka, a threat the latter did much to promote by extortionate taxation and arbitrary and cruel treatment of defenseless Fula herders, who revenged themselves by assisting Fula raiding parties dispatched from the Futa Jallon almamate.

By the mid-19th century, Fula controlled extensive territory in the Guinea-Bissau region, and Kaabu's resistance was weakened by inter-
necine conflicts. A measure of the Fula triumph and of Fula domination in the savanna and savanna-woodland zones is that in 1865, during the final battle for Kansala, Kaabu's capital, the remaining Mandinka warriors fought dismounted from behind defensive positions (Sidibe 1974, ch. I: 15-16, ch. II: 15-19).

There are a number of issues concerning the commercialization of agricultural and sylvan commodities during the latter part of the ca. 1630-1860 dry period that merit systematic study with respect to climate and ecological factors. Timber cutting during the 19th century, when climate desiccation inhibited the growth of new trees, is one such example. Besides changes in land use and other ecological consequences of unrestricted timber cutting, there may have been less obvious consequences with respect to the distribution of tree species and other flora and fauna, and the spread of trypanosomiasis, malaria and other diseases in modified habitats.

Yet to be investigated systematically are the inter-relationships between climate factors and the commercialization of palm oil, peanuts, coffee, and other sylvan and agricultural commodities. It is noteworthy, for example, that during the 1830s and 1840s the growth of peanuts for export rapidly spread southwards as far as the Kolente river in Sierra Leone, but not farther south into higher-rainfall areas (Brooks 1975). Circumstances changed with the end of the dry period, for with increasing rainfall in the 1870s peanuts ceased to be exported in significant quantities from areas south of the Casamance river. Statistics on peanut exports from the Rivières du Sud-Guinea area are unavailable for previous decades, but those compiled for the period from the 1860s onwards show a dramatic decline from the mid-1870s: a range of 8,000 to 12,000 tons from 1867 to 1875; incomplete statistics from 1876 to 1883; about 3,000 tons in 1884; and from 1885 to 1900, exports never attained more than 2,000 tons (1890) and dropped as low as about 21 tons in 1887 (Goerg 1986; Nicholson 1979: 47-48).

Various causes can be attributed to the decline in peanut exports from the Guinea area during the last quarter of the 19th century, e.g. lower market prices and the profits of rubber exports as an alternative involvement for traders, but the principal factor would seem to be that increased rainfall diminished both the productivity and the quality of peanut crops. A French administrator noted that mold in the wet clayey soils of Guinea had such a degenerating effect on peanuts that new seeds had to be imported every two or three years (Famechon 1900: 98-99). The possible effects of changes in rainfall on other agricultural and sylvan commodities remain to be studied.

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There is need for much additional work on climate changes in West Africa, and the rainfall projections and historical periods presented in
this paper may be modified by further research. However, as the foregoing discussion demonstrates, changing rainfall patterns had profound consequences for the peoples of Western Africa. Historical periodizations based on climate changes offer significant insights concerning a wide range of developments and suggest new lines of inquiry regarding a number of topics. I look forward to future contributions by interested scholars.

*Indiana University, Bloomington, December 1985.*

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