



UNEQUAL ADAPTATIONS

*A history of environmental change in the
Sudan-Eritrea-Ethiopia border region*

Unequal Adaptations:

A history of environmental change in the Sudan-Eritrea-Ethiopia border region

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Cover image: *Unsigned 1868 print titled 'A Native Ploughing in the Province of Tigre' depicts a traditional plough used by cultivators in the Sudan-Eritrea-Ethiopia border region. The plough consists of a yolk, a beam, and a handle. The plough is attached by leather straps to two oxen. This method of tilling the land is still commonly employed in the region.*

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Summary

The Sudan-Eritrea-Ethiopia border region—currently divided between the Sudanese states of al-Qadarif, Kassala, and Red Sea; the Ethiopian regional states of Tigray and Amhara; and the Eritrean regions of Anseba, Gash-Barka, and Northern Red Sea—has long been a place of deep interconnection. Historically, collaboration across ethno-linguistic and religious divides allowed communities to develop life-sustaining complementary strategies for utilizing the region’s natural resources. These traditional patterns of human-environment interaction both offered protection from the region’s normal inter-annual environmental variability and minimized the harmful effects of droughts, locust plagues and other hazards that threatened harvests and pastures.

Man-made climate change is currently disrupting these long-standing patterns, causing widespread hardship, and making adaptation necessary. In many ways, this contemporary crisis echoes the two previous modern periods of profound environmental change in the Sudan-Eritrea-Ethiopia border region—the climatological shift of the Little Ice Age (c1640-c1820) and the transformation of the regional ecosystem following the 1887 introduction of rinderpest.

During past periods of profound environmental change, adaptation was resource intensive because it required access to excess time, money, and other inputs beyond those required for basic subsistence. Unfortunately, the very conditions that rendered these surplus resources necessary also ensured that most cultivators and pastoralists could not acquire them. Changing natural conditions disrupted rural livelihoods and increased structural poverty.

Profound environmental change was not experienced equally by every segment of the population. The wealthy and powerful often did not experience these periods as moments of crisis because they could easily invest in adaptation. This inequality afforded the already wealthy and powerful opportunities for further aggrandizement.

Both the wealthy and the increasingly impoverished turned to political violence to seize the resources needed to adapt during past periods of profound environmental changes. Owing to the limited commercialization of the regional systems of production and consumption, soldiering was a key economic activity. Men who fought for ambitious political leaders were guaranteed provisions while in service and a share of the spoils of war if victorious. Though increasingly impoverished men often invested their earnings from soldiering in developing new economic strategies back home, they could not compete with the powerful men they supported.

The legacies of these past adaptations still impact the region. Unequal adaptations during previous periods of environmental change contributed to the outmigration from

the Sudan-Eritrea-Ethiopia border region. These migrants often settled in impoverished improvised neighborhoods on the outskirts of growing cities elsewhere.

The continued problem of inequality will likely impede ongoing and future efforts to adapt to our current climate crisis. Sustainable, long-term adaptations are necessary. This will require more than just ensuring short term access to basic subsistence. Struggling communities will need additional resources which they can invest in developing sustainable adaptive strategies.

1. Introduction

At the end of the nineteenth century, the border region between Sudan, Eritrea and Ethiopia saw a period of major population decline. This was driven, in large part, by profound environmental change. A sudden transformation of the local ecosystem that disrupted life-sustaining traditional practices made living in the region untenable for most people. The results were devastating—the change precipitated a deadly famine that lasted from 1889 to 1891. By its end, an estimated one-third of all cultivators and two-thirds of all pastoralists had died.¹ Once prosperous villages had become ghost towns. With no one to work the land, fields became grasslands overrun with wild animals.²

Though environmental change is currently associated with shifting rainfall patterns and increasing global temperatures, this transformation was set off by a virus—*Rinderpest morbillivirus*. Not known to infect humans, this virus is both deadly and highly infectious for cattle. The morbidity rate of rinderpest is nearly 100 percent in susceptible cattle populations during outbreaks and the case fatality rate is as high as 90 percent.³

Rinderpest, which had been previously unknown to Sub-Saharan Africa, was likely introduced in 1887 by the Italian colonial military stationed at the Eritrean port of Massawa. From there, the disease spread overland as infected cattle were moved to better pastures, concentrated at wells in more arid areas, and sold from owner to owner. Millions of cattle died in Sudan, Eritrea, and Ethiopia over the next two years.⁴

After its introduction, *R. morbillivirus* took root in the region. Over the following decades, less catastrophic outbreaks occurred every few years.⁵ Cattle that survive rinderpest develop an acquired immunity, which can be passed from a cow to her calf. Though this maternal immunity wanes as the calf matures, it affords some crucial protection to the next generation.⁶ Further protection was afforded by the development of effective

1 Richard Pankhurst, *The Great Ethiopian Famine of 1888-1892: A New Assessment*, Addis Ababa: Haile Sellassie I University, 1964; Steven Serels, 'Famines of War: The Red Sea Grain Market and Famine in Eastern Sudan 1889-1891,' *Northeast African Studies*, 12/1 (2012).

2 James McCann, 'A Dura Revolution and Frontier Agriculture in Northwest Ethiopia, 1898-1920,' *The Journal of African History*, 31/1 (1990): 121; Pankhurst, *The Great Ethiopian Famine*, 36.

3 'Paramyxoviridae and Pneumoviridae,' in *Fenner's Veterinary Virology*, 5th edition, N. James MacLachlan, Edward J. Dubovi, eds., Cambridge, MA: Academic Press, 2017, 343.

4 John Rowe and Kjell Hødnebo, 'Rinderpest in the Sudan 1888-1890: The Mystery of the Missing Panzootic,' *Sudanica Africa*, 5 (1994): 149-79; Serels, *The Impoverishment of the African Red Sea Littoral, 1640-1945*, New York: Palgrave Macmillan, 2018, 94.

5 Serels, *The Impoverishment of the African Red Sea Littoral*, 101-2.

6 P. Murcia, W. Donachie, and M. Palmarini, 'Viral Pathogens of Domestic Animals and Their Impact on Biology, Medicine and Agriculture,' in *Encyclopaedia of Microbiology*, 3rd edition, Moselio Schaechter, ed., Cambridge, MA: Academic Press, 2009, 814.

veterinary services that implemented quarantining programs.⁷ Nonetheless, the disease remained a hazard in the region until the development of an effective vaccine in 1960 and the subsequent implementation of mass-vaccination programs.



Image 1. This August 1889 picture is captioned in Italian 'Occupation of Asmara – Artillery Commanded by Captains Bottego and Ciccodicola.' The Italian conquest of the Eritrean highlands occurred during the initial rinderpest outbreak and the subsequent famine. The regular Italian soldiers were joined in battle by locally enlisted mercenaries seen in this picture.

With rinderpest a continuous threat, change was necessary. The survivors of the 1889 to 1891 famine could not simply revive traditional practices after the acute crisis had ended. Older farming techniques and herd management strategies failed during the initial rinderpest outbreak and were likely to fail again in subsequent ones because the disease remained a threat. Reconstruction meant adapting to a changed environment.

The introduction of rinderpest was not the first nor, tragically, the last period of profound environmental change in the Sudan-Eritrea-Ethiopia border region. Over the past four centuries, there have been three such periods. The other two were the Little Ice Age dry period (c1640-c1820) and our current period of man-made climate change. These other two resemble each other, in the sense that they both were shifts in the global climate that systemically altered local conditions.

Much of what is known about the effects of environmental change on the Sudan-Eritrea-Ethiopia border region has been derived from studying current dynamics. There is

7 J. D. M. Jack, 'The Sudan,' in *A History of the Overseas Veterinary Services, Part 1*, edited by G. P. West, London: British Veterinary Association, 1961.

a general academic consensus that man-made climate change is already increasing the variability of rainfall and decreasing the growing season.⁸ Several studies have shown that local communities have responded to these challenges by peacefully adapting their practices. They have modified cropping strategies and farming techniques, adjusted gendered divisions of labor, and taken on new forms of supplemental work, amongst other tactics.⁹

There is a widespread fear especially amongst the public policy community that climate change is precipitating political violence. Recently, United Nations Secretary General António Guterres stated that ‘climate disruption is a crisis amplifier and multiplier.’ By enhancing high levels of inequality in already impoverished regions such as the Horn of Africa, Guterres averred that climate change ‘can weaken social cohesion and lead to discrimination, scapegoating, rising tensions and unrest, increasing the risk of conflict.’¹⁰ However, several recently published meta-analysis studies have failed to find a direct causal link between recent armed conflicts in the Global South and climate phenomena.¹¹

Examining past periods of profound environmental change illuminates the dynamics around adoptive responses and harm mitigation strategies currently being pursued by communities in the region. In the past, adaptation was expensive because it was resource intensive. It required access to excess time, money, and other inputs beyond what was needed to secure basic subsistence. While the wealthy were able to muster these resources, the poor often could not. Inequality further complicated local responses because environmental change disrupted traditional practices and, in the process, increased the extent and depth of poverty in affected areas.¹²

8 Dereje Ayalew, et al., eds., ‘Variability of Rainfall and Its Current Trend in Amhara Region, Ethiopia,’ *African Journal of Agricultural Research*, 7/10 (2012); H. M. Sulieman and N. A. Elagib, ‘Implications of Climate, Land-Use and Land-Cover Changes for Pastoralism in Eastern Sudan,’ *Journal of Arid Environments*, 85 (2012); Mike Hulme, ‘The Changing Rainfall Resources of Sudan,’ *Transactions of the Institute of British Geographers*, 15/1 (1990).

9 Dejene K. Mengistu, ‘Farmers’ Perception and Knowledge of Climate Change and their Coping Strategies to the Related Hazards: Case Study from Adiha, Central Tigray, Ethiopia,’ *Agricultural Sciences* 2/2 (2011); Yordanos Tesfamariam, and Margot Hurlbert, ‘Gendered Adaptation of Eritrean Dryland Farmers,’ *International Journal of Climate Change Strategies and Management*, 9/2 (2017); Yasin Abdalla Eltayeb El Hadary and Narimah Samat, ‘Managing Scarcity in the Dryland of the Eastern Sudan: the Role of Pastoralists’ Local Knowledge in Rangeland Management,’ *Resources and Environment* 2/1 (2012).

10 António Guterres, ‘Remarks to the Security Council - On Addressing Climate-Related Security Risks to International Peace and Security through Mitigation and Resilience Building,’ 23 February 2021. (<https://www.un.org/sg/en/content/sg/speeches/2021-02-23/addressing-climate-related-security-risks-international-peace-and-security-through-mitigation-and-resilience-building-remarks-security-council>)

11 Ole Magnus Theisen, ‘Climate Change and Violence: Insights from Political Science,’ *Current Climate Change Reports*, 3 (2017); Eran Feitelson and Amit Tubi, ‘A Main Driver or an Intermediate Variable? Climate Change, Water and Security in the Middle East,’ *Global Environmental Change*, 44 (2017); Kendra Sakaguchi, Anil Varughese and Graeme Auld, ‘Climate Wars? A Systematic Review of Empirical Analyses on the Links between Climate Change and Violent Conflict,’ *International Studies Review*, 19/4 (December 2017).

12 Emanuel Skoufias, et al. ‘The Poverty Impacts of Climate Change,’ *Economic Premise* 51 (March 2011). <https://openknowledge.worldbank.org/bitstream/handle/10986/10102/600730BRI0EP511v40BOX358307B001PUBLIC1.pdf?sequence=1&isAllowed=y>; Kempe Ronald Hope Sr, ‘Climate Change and Poverty in Africa,’ *International Journal of Sustainable Development and World Ecology*, 16/6 (2009).

In the Sudan-Eritrea-Ethiopia border region, the strategies that protected pastoralists and cultivators from normal environmental variation broke down during periods of profound change. Many were pushed into a poverty so deep that they became severely food insecure and susceptible to deadly famines. Unable to rely on past practices, cultivators and pastoralists sought out new sources of material support.

Until the twentieth century, there were few alternative avenues for earning an income. There was only a limited penetration of the market into systems of production and consumption. Long distance trade was narrowly focused primarily on luxury goods consumed by political leaders, though this opened slightly during periods of profound environmental change. Since there was little demand for wage labour, the only available alternative for many men in the border region was soldiering.

Men who fought for ambitious political leaders were guaranteed provisions while in service and a share of the spoils of war if victorious. These men often used the cattle, slaves, money, grain, etc. seized through combat to develop new economic strategies back home. As a result, peaceful adaptation was historically linked to political violence.

Since the spoils of war and the power accrued in battle were not equally distributed, the adaptation strategies available to the poor were often more improvised and less robust than those of the wealthy and powerful. This uneven adaptation to past environmental changes reinforced socio-economic divisions in ways that continue to reverberate to this day. Adaptations made in response to the introduction of rinderpest made it impossible for many impoverished cultivators and pastoralists to survive and thrive on the land. This has led large numbers of people to migrate over the past century within and out of the border region in search of alternative forms of work.

2. Living with normal environmental variability

The Sudan-Eritrea-Ethiopia border region is currently divided between the Sudanese states of al-Qadarif, Kassala, and Red Sea; the Ethiopian regional states of Tigray and Amhara; and the Eritrean regions of Anseba, Gash-Barka, and Northern Red Sea. Though the modern international boundary dividing these countries is relatively new and incompletely demarcated, this area's status as a border region dates back centuries.

The region has long sat between an Ethiopian state based in the highlands and a Sudanese state centred on the Nile, though the nature of these states has changed over time. Rule over the Sudanese Nile and its surroundings passed from the Funj Sultanate of Sennar to an Egyptian colonial government in 1821 then to an independent Mahdist Islamic state in 1885 then to a British-dominated colonial government in 1898 and finally to an independent state in 1956. The Ethiopian highlands were ruled by the Solomonic Dynasty from the thirteenth century with a few notable interruptions until the 1974 revolution that brought the Derg to power, which in turn was toppled and replaced in the 1991. Eritrea is a more recent invention. It was established as an Italian colony at the end of the nineteenth century and then was ruled by Britain then Ethiopia before achieving independence with the fall of the Derg regime.

Despite these political changes, the border region has been and continues to be a place of deep interconnection. The patterns of human-environment interaction that allowed communities to live in and around the border region were predicated on collaboration across ethno-linguistic and religious divides. Christians and Muslims, settled cultivators and nomadic pastoralists had to work together to survive and thrive in this variable environment.

Before the technological revolution of the twentieth century, permanent human settlement in the Sudan-Eritrea-Ethiopia border region was possible only on land that was watered sufficiently to allow for cultivation. Rain generally decreases northward across this region, making much of the region unsuitable for farming without modern irrigation technologies. There are limited notable exceptions in the north, including the Gash and Tokar deltas. However, all the arable land in this region is primarily fed by torrential rivers that flow down during the highland rainy season.

On the rainfed farms of the highlands and the southern plains, the traditional unit of agricultural production was the household. Each member of the household worked in the field, though often with age and gender defined tasks.¹³ Subsistence production was

¹³ James McCann, *From Poverty to Famine in Northeast Ethiopia: A Rural History 1900-1935*, Philadelphia: University of Pennsylvania Press, 1987, 23.

not possible with human labour alone. For millennia, cultivators have relied on oxen-driven ploughs to prepare enough land to produce sufficient grain harvests.¹⁴

Though a household farm needed only two oxen at a time, it needed quite a few more to ensure a continuous supply of animal labour. Each farm required a stud bull and some cows to propagate the next generation, as well as two apprentice steers.¹⁵ Such a herd could not be kept on a farm for lack of sufficient fodder. Additionally, they could not be grazed nearby. Though the Sudan-Eritrea-Ethiopia border region contains large pastures, they are generally located at some distance from agricultural regions in areas that receive enough rain to allow for grasses but not grains to grow.

The pastoralists who lived on these pastures had their own problem. Maintaining their herds required that they eat meat sparingly.¹⁶ But, they had few other food options. Grain was too heavy and too cheap to be traded over long distances. At the same time, pastures have a limited productivity. Cultivation was possible in and along the torrential rivers that flow through this area during the highland rainy season. However, working this land alone would not produce enough grain. Recently it was estimated that a household plot watered by these rivers produces only two to four months of food during a good year.¹⁷ As a result, survival necessitated securing another food source.¹⁸

Pastoralists and cultivators each had what the other needed and needed what the other had. This misalignment of wants and resources was solved through peaceful collaboration. Members of these two groups traditionally entered into long-term agreements, under which pastoralists committed to looking after cultivators' excess cattle in exchange for a fixed annual payment of grain.¹⁹

While this collaborative strategy allowed communities to thrive in the border region's various ecological zones, complimentary patterns of human-environment interaction were required to survive normal climatological variability. Droughts were and continue to be common to the area. Survival has always meant developing strategies to prevent routine droughts from becoming devastating famines.

Determining the historical periodicity of droughts is complicated by a lack of direct data. Rainfall was not systematically measured and recorded in most parts of the world before the twentieth century, by which time anthropogenic climate change was already

¹⁴ James McCann, *People of the Plow: An Agricultural History of Ethiopia, 1800-1990*, Madison, WI: University of Wisconsin Press, 1995, 40.

¹⁵ McCann, *From Poverty to Famine in Northeast Ethiopia*, 76.

¹⁶ Leif Manger. *Survival on Meagre Resources: Hadendowa Pastoralism in the Red Sea Hills*, Uppsala: Nordiska Afrikainstitutet, 1996, 87.

¹⁷ Famine Early Warning Systems Network. *Livelihoods Zoning 'Plus' Activity in Sudan*, August 2011: 5-6, 34-5. Accessed 14 March 2021, <https://documents.wfp.org/stellent/groups/public/documents/ena/wfp239943.pdf>.

¹⁸ Isaia Baldrati, *Le Condizioni agricole della valle del Barca*, Florence: Edizioni dell'Istituto agricolo coloniale italiano, 1911.

¹⁹ Mansiefl Parkyns, *Life in Abyssinia: Being Notes Collected during Three Years' Residence and Travels in that Country*, New York: D. Appleton and Co, 1854, 116; Ezio Marchi, *Studi sulla Pastorizia della Colonia Eritrea*, 2nd Edition, Florence: Istituto Agricolo Coloniale Italiano, 1929, 81.

beginning. To overcome this hurdle, scholars have identified several analysable proxies for past rainfall, including lake sediment, coral reefs, and tree rings.²⁰

For the Sudan-Eritrea-Ethiopia border region, the best proxy has been shown to be the records of the Nile flood.²¹ The annual rise and fall of the Nile is primarily regulated by the ebb and flow of two of its tributaries—the Blue Nile and Atbara River—the catchment basin of which are located primarily in the Sudan-Eritrea-Ethiopia border region.²²

The start and end date, as well as the amplitude of the annual Nile flood at Cairo has been preserved going back to the seventh century CE. These records show that, for centuries prior to the onset of anthropogenic climate change, one out of every five Nile floods, and by extension the rains in the Sudan-Eritrea-Ethiopia border region, was poor.²³

Cultivators protected themselves from these routine droughts by working as much land as possible every year. During periods of sufficient rain, this produced a surplus beyond what was needed to feed their household, discharge their tax obligations, and pay the pastoralists who watched their cattle. This surplus was then stored in specially prepared covered pits.²⁴ If the following year turned out to be a lean one, cultivators could live off their stores.

Pastoralists had a more reactive approach. If the rains failed in a particular region, they moved their herds to better grasslands. Sometimes, this required paying for the right to pasture on land claimed by other pastoralist groups.²⁵ In especially dry years, pastoralists treated torrential rivers and the land they watered as drought pasture reserves. By driving their cattle onto their limited grain fields, pastoralists sacrificed their harvests to ensure the health of their herds. In so doing, they maintained their claim to collect grain from cultivators.²⁶

These flexible tactics ensured that one-to-two-year-long droughts were at most periods of hardship and not life-threatening catastrophes. They also protected against the effects of other environmental hazards that threatened harvests and pastures, such as the regularly forming locust swarms indigenous to the area.

20 Benjamin I. Cook, Justin S. Mankin and Kevin J. Anchukaitis, 'Climate Change and Drought: From Past to Future,' *Current Climate Change Reports*, 12 May 2018. (<https://doi.org/10.1007/s40641-018-0093-2>)

21 Fekri A. Hassan, 'Nile Flood Discharge during the Medieval Climate Anomaly,' *PAGES*, 19/1 (2011): 30-1.

22 D. Conway and M. Hulme, 'Recent Fluctuations in Precipitation and Runoff over the Nile Sub-Basins and their Impact on Main Nile Discharge,' *Climatic Change*, 25 (1993).

23 W. H. Quinn, 'A Study of Southern Oscillation-Related Climatic Activity for AD 622-1900 Incorporating Nile River Flood Data,' in *El Niño, Historical and Paleoclimatic Aspects of the Southern Oscillation*, H. F. Diaz and V. Markgraf, eds., Cambridge: Cambridge University Press, 1992.

24 Nathaniel Pearce, *The Life and Adventures of Nathaniel Pearce*, Volume 1, London: Henry Colburn and Richard Bentley, 1831, 183-4.

25 Serels, *The Impoverishment of the African Red Sea Littoral*, 20.

26 John Morton, 'Pastoral Decline and Famine; The Beja Case' in *Conflict and the Decline of Pastoralism in the Horn of Africa*, John Markakis, ed., London, Macmillan Press, 1993; Muneera Salem-Murdock, 'The Impact of Agricultural Development on a Pastoral Society: the Shukriya of the Eastern Sudan; A Report Submitted to the Agency for International Development,' New York: Institute for Development Anthropology, 1979.

Longer periods of bad harvests and poor pastures occurred less often. During longer environmental crises, drought pasture reserves would become exhausted and grain stores would empty. When normal hardship turned into a food crisis, state officials and other traditional elites such as pastoralist *shaykhs* would offer aid in the form of direct handouts of food. This assistance reflected the reciprocal relations of mutual dependence that structured social and political hierarchies in the Sudan-Eritrea-Ethiopia border region. In good years, state officials and traditional elites demanded taxes, tribute, labour, and gifts from their dependents. In return, they were expected to deliver food aid during periods of acute shortage.²⁷

Unfortunately, this traditional social safety net had its limitations. Assistance was often offered only after people had begun to visibly starve. At times, it would come too late or be too little to prevent some people from dying during the famine. Nonetheless, it was life saving for many.²⁸

The origins of this social safety net and intercommunal collaborative strategies are unclear from the archival and archeological record. There is irrefutable evidence that nearly three millennia ago cultivators in the highlands were using ox-pulled ploughs and pastoralists in the lowlands had large cattle herds. Nonetheless, there are too few ancient sources to pinpoint the early development of the regional social structures that supported life in the Sudan-Eritrea-Ethiopia border region.²⁹ It is clear that these structures were fully in place by the beginning of the modern era. Though they offered protection from normal variability, they failed during periods of profound environmental change that have repeatedly plagued the region since the seventeenth century.

27 Serels, *The Impoverishment of the African Red Sea Littoral*: 21-22.

28 Richard Pankhurst, *The History of Famine and Epidemics in Ethiopia Prior to the Twentieth Century*, Addis Ababa: Relief and Rehabilitation Commission, 1985: 51-5.

29 McCann, *People of the Plow*, 39-40; Gudrun Dahl and Anders Hjort af Ornäs, 'Precolonial Beja: A Periphery at the Crossroads,' *Nordic Journal of African Studies*, 15/4 (2006): 475.

3. Responding to slow climatological change

The traditional social safety net was of central importance to the relations of dependence that structured communities in the Sudan-Eritrea-Ethiopia border region. State officials and traditional elites were expected to ensure that each of their dependents had a minimum amount of food during periods of acute crisis. Failure to meet this obligation was a major abrogation of duty that could lead to rebellion and/or communal cleavage.

This is exactly what happened during the Little Ice Age, a period of global climate change between the seventeenth and nineteenth centuries. Though it is associated with an increase in multi-year cold periods in Europe, the Little Ice Age was experienced differently elsewhere in the world.³⁰ In the Sudan-Eritrea-Ethiopia border region, it was associated with a decrease in mean annual rainfall and an increase in the frequency and intensity of annual droughts.³¹

Since the drying of the land occurred progressively, communities had the opportunity to evolve their practices across generations. During the Little Ice Age, cultivators slowly migrated to higher elevations that were still wet enough to support grain cultivation. They turned previously marginal land into fields and allowed no longer suitable land to become pastures.³² This process relieved pressure on pastoralist communities, whose transhumance patterns slowly shifted southward and towards the foothills as more northern grasslands turned to desert.³³

Highland communities also largely abandoned growing cotton in response to changing climatic conditions. With traditional methods, cotton could be grown on farms located between 900 and 1800m above sea level and that received at least 600mm of rain per year.³⁴ Cotton yields were generally spun into thread used to make the clothes worn by members of the household. Any excess was traditionally marketed.³⁵

30 Michael Mann, 'Little Ice Age,' in *Encyclopedia of Global Environmental Change, Volume 1: The Earth System: Physical and Chemical Dimensions of Global Environmental Change*, Michael MacCracken and John Perry, eds., Chichester: John Wiley and Sons, 2002, 504-9.

31 Steven Serels, 'Food Insecurity and Political Instability in the Southern Red Sea Region during the 'Little Ice Age,' 1650-1840,' in *Famines during the 'Little Ice Age' (1300-1800)*, Dominik Collet and Maximilian Schuh, eds., New York: Springer Science, 2018..

32 Maria J Machado, Alferdo Pérez-González and Gerardo Benito, 'Paleoenvironmental Changes during the Last 4000 yr in the Tigray, Northern Ethiopia,' *Quaternary Research*, 49 (1998), 319.

33 T.R.H. Owen, 'The Hadendowa,' *Sudan Notes and Records*, 20/2 (1937) 188-9; Anders Hjort af Ornäs and Gudrun Dahl, *Responsible Man: The Atmaan Beja of North-Eastern Sudan*, Uppsala: Stockholm Studies in Social Anthropology, 1991, 30.

34 Guido Mangano, *La Cotonicoltura e le Iniziative Cotoniere nell'Eritrea* (Rome: 1945) FASC2435, Istituto Agrinomio per l'Oltremare, Florence.

35 Renato Paoli, *Le Condizioni Commerciali dell'Eritrea*, Novara: Istituto Geografico de Agostini, 1913, 37-9.

The decline of cotton cultivation in the highlands opened new commercial opportunities for immigrants settling in the lowlands around the border towns of Gallabat and Metema, which straddle the contemporary Sudan-Ethiopia border. West Africans, mainly from present day northern Nigeria and southern Niger, who had made the pilgrimage to Mecca on foot began to permanently settle in this area in the middle of the eighteenth century. By the middle of the nineteenth century, there were over 30,000 West Africans and their descendants living in 24 towns near Gallabat/Metema, according to the estimate of the French explorer and diplomat Guillaume Lejan who passed through the region. These immigrants brought with them their own traditional cultivation practices, including the cultivation of cotton on lowland rainfed farms. They weaved some of their harvests into clothes for themselves and for sale to neighbouring communities. The rest they sold to nearby highland communities for their own home production.³⁶

This peaceful adaptation created new patterns of human-environment interaction that, like the old ones, were robust enough to withstand short term droughts. Unfortunately, from the middle of the eighteenth century on, multi-year droughts became more common in the Sudan-Eritrea-Ethiopia border region. The Nile record shows that there were severe droughts from 1762 to 1766, 1782 to 1785, 1791 to 1797, 1803 to 1807, 1824 to 1828, and 1833 to 1839.³⁷

Emerging new patterns of human-environment interaction were not robust enough to deal with this protracted crisis. The result was a series of famines in rapid succession. Ethiopian court records and other historical sources contain references to especially devastating famines in Sudan and Ethiopia in 1770-73, 1788-89, 1791-2, 1796, 1812-3, 1828-29 and 1834-37. Since these records are partial, there were likely more that have remained unrecorded.³⁸

Communities became increasingly reliant on state officials and traditional elites for assistance. They depended on this social safety net for their survival. Unfortunately, it failed. As grain yields declined, political leaders diverted the grain collected through taxes towards feeding commercially important towns. They increasingly sold their grain to merchants who exported it out of the region to neighbouring parts of Sudan, Ethiopia, and the Red Sea basin.³⁹ Without substantial grain stores, political leaders could not provide enough assistance to meaningfully protect everyone from this protracted crisis. As a result, the reciprocal bonds of mutual dependence that structured communal life broke, and pastoralists and cultivators sought out new leaders who could provide this protection.

36 Arthur E. Robinson, 'The Tekruri Sheikhs of Gallabat (S E Sudan),' *Journal of the Royal African Society* 26/101 (October 1926): 49-51; Peter P. Garretson, 'Frontier Feudalism in Northwest Ethiopia: Shaykh al-Imam 'Abd Allah of Nuqara, 1901-1923,' *The International Journal of African Historical Studies*, 15/2 (1982), 26.

37 Quinn, 'A Study of Southern Oscillation-Related Climatic Activity'.

38 P. M. Holt. *The Sudan of the Three Niles: The Funj Chronicles 910-1288/1504-1871*, Leiden: Brill, 1999, 20, 32, 63; Pankhurst, *The History of Famine and Epidemics in Ethiopia Prior to the Twentieth Century*: 52-3.

39 Spaulding, *The Heroic Age in Sinnār*, 200-201.

Pastoralists found this new leadership within Sufi brotherhoods. At the end of the eighteenth century, these religious orders sent missionaries from their bases in Mecca to the Sudan-Eritrea-Ethiopia border region to find new adherents. Representatives of the Khatmiyya and Majdhubiya orders were especially successful because they claimed the ability to channel divine intervention in this world. By offering spiritual protection from a harsh environment, these representatives inspired pastoralist communities throughout the region to convert *en masse*.⁴⁰

While the rise to prominence of new religious leaders was largely a peaceful process, the emergence of new political leaders was a violent one. As the central Ethiopian and Sudanese states proved unable to cope with the crisis, cultivators increasingly allied themselves with emerging local political leaders. The resulting tensions ultimately led to armed conflict. New political leaders led rebellions against the Ethiopian and Sudanese states. In Ethiopia, increasing political violence led to the collapse of the power of the *negus* (emperor) in the mid-eighteenth century and ushered in the *Zemene Mesafint* (the time of the princes). In Sudan, the Sultanate of Sennar lost control over its outlying territories, which left it unable to mount an effective defense when the Egyptian army invaded in 1821.

Political instability in Sudan and Ethiopia transformed the politics of the border region. *Shaykh* Miri, who had long established himself as the leader of the West African community centered around Gallabat/Metema, allied himself with the advancing Egyptian army and participated in the raid on the Ethiopian capital of Gondar in 1832. Though this raid was routed, the new colonial rulers of Sudan recognized Miri as the semi-autonomous ruler of the border region.⁴¹ The rulers of Ethiopia refused to recognize Egyptian claims to suzerainty in the area. Instead, they appointed *Mek* Nimr as the local administrator under their protection. *Mek* Nimr had been the leader of the Ja'alin based at Shendi on the Sudanese Nile until the Egyptian conquest. In 1822, he and thousands of mainly Ja'alin refugees fled to al-Fashaga/Nuqara.⁴² Upon arrival, Nimr had placed himself and his followers under the protection of neighbouring Ethiopian rulers.⁴³

Miri, Nimr, their patrons, and the other political leaders that vied for power in the border region during this period relied primarily on irregular militias. This made them different from the warlords who gained control over much of the rest of Sudan in the eighteenth century using large standing armies of slave soldiers.⁴⁴ On the Sudan-Eritrea-Ethiopia border region, competing leaders frequently called on their male followers to fight on their behalf. In exchange, these competing political leaders offered a share of the spoils of war. This was an especially attractive offer for those cultivators and pastoralists who were struggling to adapt to the changing environment. The spoils of war could be rein-

⁴⁰ Serels, *The Impoverishment of the African Red Sea Littoral*: 43-53.

⁴¹ Robinson, 'The Tekruri Sheikhs of Gallabat,' 49.

⁴² Arthur E. Robinson, 'Nimr, the Last King of Shendi,' *Sudan Notes and Records*, 8 (1925), 9.

⁴³ Garretson, 'Frontier Feudalism in Northwest Ethiopia: Shaykh al-Imam 'Abd Allah of Nuqara, 1901-1923,' 263.

⁴⁴ Jay Spaulding, *The Heroic Age in Sinnār*, East Lansing, MI: African Studies Center, Michigan State University, 1985, 204-8.

vested in adapting their practices. In addition, fighting solidified emerging relations of dependence with powerful men who were potentially wealthy enough to provide for their followers in times of extreme hardship.⁴⁵

⁴⁵ R A Caulk, 'Soldiers and Peasants in Ethiopia c.1850-1935,' *The International Journal of African Historical Studies*. 11/3 (1978): 461-6.

4. The tragedy of rapid ecological change

The return of wetter more propitious conditions in the first half of the nineteenth century contributed to an increase in prosperity and security in the Sudan-Eritrea-Ethiopia border region. Though there were still occasional battles between increasingly powerful centralized states in Sudan and Ethiopia, communities in the border region enjoyed a level of prosperity not seen in nearly two centuries owing to increasing trade and more predictable, better harvests. The surplus resources this produced allowed pastoralists and cultivators to rebuild the systems that had protected them from the region's normal environmental variability.

Unfortunately, this economic boom proved short lived. The introduction of rinderpest in 1887 disrupted the patterns of human-environment interaction that underpinned local communities' ways of life. As nearly all of the cattle died over the next two years, milk, butter, meat, and grain became in short supply. Without oxen to pull the ploughs, most farmland fell out of cultivation and yields collapsed. After stored supplies were exhausted, there was almost nothing left to eat in the region.



Image 2. After having been introduced via the Eritrean port of Massawa in 1887, rinderpest spread quickly overland across Sub-Saharan Africa. During the panzootic, an estimated 90 percent of all infected cattle died. This famous picture shows the devastation caused by the disease when it first arrived in South Africa in 1896.

The resulting food crisis was so severe that local leaders did not have enough to provide for themselves and their dependents. In 1889, the traditional social safety net broke down, and starvation set in. The ties that bound communities together snapped. Men, women, and children abandoned their families and began to migrate out of the border region in search of food. On the way to large towns in Sudan and Ethiopia or to port cities on the Red Sea, many died. The roads became strewn with unburied bodies. Those that made it to their destinations, often arrived alone and emaciated. They settled in makeshift camps, where they resorted to eating taboo foods, including the rotting flesh of dead animals, cooked leather, and animal feces. Tragically this too was not enough to ensure survival and people died in large numbers.⁴⁶

Though the acute crisis subsided in 1891, its effects lasted for generations. So many people had died or migrated during the famine that the border region had become nearly completely depopulated. The few people that survived either at home or in refugee camps were impoverished. They barely had enough to eat, let alone additional resources to invest in rebuilding what they had lost. For many men, the only way to provide for themselves and their families was to fight on behalf of politically ambitious leaders.

The rinderpest outbreak and subsequent famine occurred as European imperial powers were seeking to divide Africa amongst themselves. This 'Scramble for Africa' was largely contested by local rulers, who both sought to defend their independence and expand the territory under their command. For the Sudan-Eritrea-Ethiopia border region this translated into a multi-lateral war that lasted decades.

In the years after the famine, men from the border region routinely served in militias supporting British, Italian, Ethiopian, and Sudanese armies. In exchange, they received provisions while in the field and an income. Members of local militias that helped Britain conquer Sudan and Italy conquer Eritrea were paid a fixed salary.⁴⁷ Men who fought for Sudan or Ethiopia were often granted a share in the spoils of war.⁴⁸

Soldiering was crucial to the resumption of rainfed agriculture in the border region. During the initial rinderpest outbreak, cultivators in the region had sought out substitutes for their dying cattle. They hooked their ploughs to donkeys, horses, and mules. They also attempted to pull the ploughs themselves. When this did not work, cultivators started using hoes and spades, a practice common in the parts of the lowlands where farming depended upon torrential rivers.⁴⁹ Unfortunately, these adaptations failed,

⁴⁶ Pankhurst, *The Great Ethiopian Famine of 1888-1892*; Serels, 'Famines of War: The Red Sea Grain Market and Famine in Eastern Sudan 1889-1891'.

⁴⁷ Steven Serels, 'The Circulation of Modern Currencies and the Impoverishment of the Red Sea World, 1882-2010,' in *Currencies of the Indian Ocean World*, edited by Steven Serels and Gwyn Campbell, New York: Palgrave Macmillan, 2019, 156.

⁴⁸ Iris Seri-Hersch, "'Transborder' Exchanges of People, Things and Representations: Revisiting the Conflict between Mahdist Sudan and Christian Ethiopia, 1885-1889,' *The International Journal of African Historical Studies* 43:1 (2010), 13.

⁴⁹ James McCann, 'A Dura Revolution and Frontier Agriculture in Northwest Ethiopia, 1898-1920,' *The Journal of African History*, 31:1 (1990), 126.

and the devastating famine set in.⁵⁰ In the years that followed, rinderpest remained a continuous threat. As a result, the reoccupation of rainfed farms required the steady importation of cattle. This was provided for by participating in raids.⁵¹

Pastoralists also adapted their practices after the famine. In the years that followed, they invested their income from soldiering back into growing their herds.⁵² Since many pastoralists were poor, they also developed new herd-owning cooperatives that allowed the pooling of resources towards this end.⁵³ Rather than focus primarily on raising cattle, they started to intensively breed sheep and goats. These animals were less valuable and depleted pastures faster than cattle, but they were not susceptible to rinderpest.

In addition, pastoralists sought to make themselves more food self-sufficient. They dedicated more and more of their time and resources into cultivation because they could no longer depend on receiving payments of grain. Many groups adopted more labour intensive farming methods, including hand sowing and weeding.⁵⁴ Some even settled along torrential rivers and dedicated themselves exclusively to farming.⁵⁵

For many pastoralists and cultivators, the process of rebuilding was only partially successful because it was articulated with longstanding class divisions. Wealthy merchants, ambitious political leaders, pastoralists shaykhs and religious men with large followings were better positioned to negotiate with the British, Italian, and Ethiopian imperial states that divided the region after the defeat of Mahdist Sudan at the end of the nineteenth century. These emerging colonial elites received a larger share of the spoils of war. In addition, some of these elites were provided with a salary or other perks in exchange for continued loyalty.

In rainfed areas, this resulted in an uneven distribution of oxen. Since the spoils of war were not divided evenly amongst all soldiers, elite households often amassed a surplus of oxen while many cultivators had too few to work the land. Cultivators often had to rent oxen from the wealthy at rates that were too high to ensure subsistence. Many farms failed in the first quarter of the twentieth century, allowing elites to amass large estates. Once independent cultivators were reduced to being the impoverished tenants or labourers working land belonging to the increasingly wealthy.⁵⁶

The intensification of cultivation on land watered by torrential rivers similarly contributed to the setting in of structural poverty. Here too, a small number of wealthy, state-connected households were able to amass large estates. For example, al-Imam Abdullahi was able to use his position as *balambaras* (Ethiopian commander of a fortress) to

⁵⁰ Pankhurst, *The Great Ethiopian Famine of 1888-1892*, 29.

⁵¹ Caulk, 'Soldiers and Peasants in Ethiopia c.1850-1935', 466.

⁵² Marchi, *Studi sulla pastorizia della Colonia Eritrea*, 16.

⁵³ Serels, *The Impoverishment of the African Red Sea Littoral*, 103.

⁵⁴ Steven Serels, 'Small-Scale Farmers, Foreign Experts and the Dynamics of Agricultural Change in Sudan, Eritrea, and Djibouti before the Second World War,' *International Journal of African Historical Studies*, 52/2 (2019): 228-9.

⁵⁵ S. F. Nadel, *Races and Tribes of Eritrea*, Asmara: British Military Administration, 1944, 41.

⁵⁶ McCann, *From Poverty to Famine in Northeast Ethiopia*, 177-181.

acquire much of the land around Nuqara. He then established a large sorghum farm worked primarily by slaves and West African immigrants.⁵⁷ Similarly, a small number of Beja pastoralist shaykhs used their relationship with the new British-led colonial government of Sudan to establish themselves as the owners of much of the Gash and Tokar Deltas.⁵⁸

The enclosure of land watered by torrential rivers disrupted herd management strategies. Pastoralists had previously used this land as drought pasture reserves. Without access to this land, these herds became vulnerable to routine periods of poor pastures. The normal range of environmental conditions became a problem for which many pastoralists had no available solution.⁵⁹

Despite their best efforts, the men, women, and children that returned to the region after the famine could not adapt to the new conditions. The small-scale farms they established and the herds they raised failed to thrive for want of adequate resources. Even those that did not fail outright, were often too small and unprofitable to support a household.⁶⁰ As a result, structural poverty took root in the countryside.

Men and, to a lesser extent, women were increasingly compelled to seek out other sources of income. Some migrated seasonally to large agricultural estates to work as cotton pickers or grain harvesters. Others moved to cities to seek out wage labour. Unfortunately, the growth in the labour supply outstripped the growth in demand throughout the twentieth century. Poor wages and high unemployment prevented labour migrants from remitting money back home. Circular migrations shifted over time as impoverished workers settled in improvised neighbourhoods on the edges of ever-growing cities.⁶¹

57 McCann, 'A Dura Revolution and Frontier Agriculture in Northwest Ethiopia': 128-32.

58 Steven Serels, *Starvation and the State: Famine, Slavery and Power in Sudan 1885-1956*, New York: Palgrave Macmillan, 2013, 94-5; R E H Baily, *The Baraka Delta*, 1932 SAD989/7/1-22.

59 Serels, *The Impoverishment of the African Red Sea Littoral*, 149-5.

60 McCann, *From Poverty to Famine in Northeast Ethiopia*, 180.

61 Janet Milne, 'The Impact of Labour Migration on the Amarar in Port Sudan,' *Sudan Notes and Records*, 15 (1974); Barney Cohen and William J. House, 'Labor Market Choices, Earnings, and Informal Networks in Khartoum, Sudan', *Economic Development and Cultural Change*, 44/3 (1996); Matteo Sisti, *Lotte sociali in Eritrea: dall'Occupazione di Massawa alla costituzione della National Confederation of Eritrean Workers*, Rome: Ediesse, 2010.

5. Conclusion

Communities in the Sudan-Eritrea-Ethiopia border region are confronting yet again the challenges posed by profound environmental change. The global climate is warming, causing local conditions to shift. Adaptation has already become necessary. Further adaptation will be required unless man-made climate change is reversed.

The present moment is echoing the past. In the seventeenth century, rainfall patterns began to change. The region became and remained drier for generations. After wetter conditions returned at the start of the nineteenth century, a novel disease fundamentally transformed the regional biome. The introduction of rinderpest in 1887 decreased harvests and impeded pastoralist practices for decades.

These past crises disrupted long-standing patterns of human-environment interaction. Cultivators and pastoralists lost the ability to grow enough to eat and to earn enough to survive. The result was extreme suffering and the death of untold numbers of men, women, and children from starvation. Communities responded to these crises by adjusted their practices to better align them with new environmental conditions. They moved their farms, modified their pasturing strategies, reworked their herd compositions, and formed cooperatives.

In the past, peaceful adaptation was a slow process that occurred against the backdrop of increased political violence. In many instances, political violence made peaceful adaptation possible. Fighting on behalf of established leaders or their upstart rivals gave suffering communities access to both aid in times of extreme need and an investible income. For the victors, political violence was at times life sustaining in moments of extreme hardship.

The key role that political violence played in peaceful adaptation reveals that the latter was not an even process. The wealthy and powerful men that could call up, provide for, and reward a large armed force were also better positioned to adapt to a changing environment than those who fought to survive. In the wake of the introduction of rinderpest in 1887, these elites used their position to seize valuable resources from poor households who were struggling to adapt. After the acute crisis abated, many cultivators and pastoralists were unable to find sustainable ways to live on the land. As a result, many chose to migrate to find work elsewhere.

The uneven distribution of resources in the Sudan-Eritrea-Ethiopia border region will likely impede efforts to adapt to our current climate crisis. To survive and thrive over the long-term, communities require more than just their subsistence. They need to be able to invest in adapting their practices. Inequality will likely prevent many from developing new ways to survive and thrive in a changing environment.

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The Sudan-Eritrea-Ethiopia border region has long been a place of deep interconnection. Historically, collaboration across ethno-linguistic and religious divides allowed communities to develop life-sustaining complementary strategies for utilizing the region's natural resources. These traditional patterns of human-environment interaction both offered protection from the region's normal inter-annual environmental variability and minimized the harmful effects of droughts, locust plagues and other hazards that threatened harvests and pastures.

Man-made climate change is currently disrupting these long-standing patterns, causing widespread hardship, and making adaptation necessary. In many ways, this contemporary crisis echoes the two previous modern periods of profound environmental change in the region—the climatological shift of the Little Ice Age (c1640-c1820) and the transformation of the regional ecosystem following the 1887 introduction of rinderpest.

Unequal Adaptations reflects on these two historical events and considers how they can help us understand the region's current adaptation to the urgent challenges posed by environmental change.

