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The Great Retreat: Pastoralism in the Arid Tropics

Tirthankar Roy, LSE

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Economic History Department, London School of Economics and Political Science,
Houghton Street, London, WC2A 2AE, London, UK. T: +44 (0) 20 7955 7084.

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Tirthankar Roy, LSE•

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Abstract

The decline of pastoralism in the arid tropics during the twentieth century, generating livelihood stress and violent conflicts, remains an under-researched subject in economic history. Although political stances were sometimes discriminatory towards pastoralists, the decline was largely the unintended consequence of four factors: colonial legacy, property right, development policy, and technological shifts. The paper discusses these four factors and shows that each one of these drivers represented a response to the challenges of development of the world's dry tropics.

Savannas or grasslands cover about twenty percent of the earth's land area, often merging into the desert edge in the world's tropics. Transhumant animal herders populated these lands until recently. From the nineteenth century, pastoralism retreated in Asia and Africa. The retreat connects with colonial legacy and postcolonial developmental activity in Asia and Africa. What is that connection?

The retreat is a puzzle. European colonialists who governed the tropical savanna areas thought transhumant pastoralism was a backward pre-farming activity and needed to be replaced with farming. Later readings saw transhumant pastoralism (in Africa) as an adaptation to the tropical environment, especially where farmlands and grazing lands were unavailable year-round, savanna abounded, and droughts kept checks on herd size (containing the prospect of

• Tirthankar Roy, Department of Economic History, LSE: t.roy@lse.ac.uk.

overgrazing).[1] A "rangeland paradigm" took shape in the late-1990s that saw pastoral mobility "as ecologically rational in an environment characterised by high variability of natural resources."[2] Herding was not only an adaptation to the variability of moisture and the scarcity of wet farmlands but also a sensible choice on the desert edge, where the tsetse fly was not active.

Despite resilience and adaptability, transhumant pastoralism has declined worldwide, and conflicts between herders and farmers have grown more intense. The decline is not in any dispute. "Today," the World Bank wrote in 2008, "mobility of pastoralists is increasingly being constrained, which is causing the effectiveness of the pastoral system to deteriorate fast."[3] Regional historiographies confirm the diminishing capacity of pastoralists to cope with droughts and famines. In the late-1960s, a study of Somalia observed "a strong and persistent tendency for the proportion of the nomads to shrink."[4] "In the latter half of the twentieth century," writes a study on Western Sahara, "traditional nomadic societies have come under increasing pressure to change or adapt their precarious way of life."[5] "Pastoralism in Ethiopia is under increasing pressure, caught in a downward spiral of resource depletion and diminishing resilience against shocks and stresses."[6] A study of Fulani herders in Nigeria observed in 1995 that "only about a third of the Fulbe live a nomadic to semi-nomadic lifestyle at this time."[7] Similar stories are told with Sudan, Kenya, and

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[1] Andrew Warren, "Changing Understandings of African Pastoralism and the Nature of Environmental Paradigms," *Transactions of the Institute of British Geographers*, 20(2), 1995, 193-203.
[2] See discussion in Hanne Kirstine Adriansen, "Understanding Pastoral Mobility: The Case of Senegalese Fulani," *Geographical Journal*, 174(3), 2008, 207-222. Cited text on p. 207.
[3] World Bank, *Sustainable Land Management Sourcebook*, Washington DC: World Bank Publications, 2008, 209.
[4] Z.A. Konczacki, "Nomadism and Economic Development of Somalia: The Position of the Nomads in the Economy of Somalia," *Canadian Journal of African Studies*, 1(2), 1967, 163-175. Cited text on p. 173.
[5] Thomas Arkell, "The Decline of Pastoral Nomadism in the Western Sahara," *Geography*, 76(2), 1991, 162-166. Cited text on p. 162.
[6] Tagesse Melketo, Martin Schmidt, Michelle Bonatti, Stefan Sieber, Klaus Müller, Marcos Lana, "Determinants of Pastoral Household Resilience to Food Insecurity in Afar Region, Northeast Ethiopia," *Journal of Arid Environments*, 188, 2021, 1-11. Cited text on p. 1.
[7] Wendy Wilson, "The Fulani Model of Sustainable Agriculture: Situating Fulbe Nomadism in a Systemic View of Pastoralism and Farming," *Nomadic Peoples*, 1995 (36/37), 35-51. Cited text on p. 37.

the Fulani of Mali.[8] In India, the decline began in the late nineteenth century, when the vast grasslands of Punjab, the bār, were converted into "canal colonies" by engineers working for the British colonial state. In the late twentieth century, "[t]here [was] more than 50 percent decline in the area of commons and grazing pasture lands in the country…"[9]

Throughout this history, conflicts broke out from time to time and took on ethnic tones. Where these groups were distinct, farmers and herders clashed, and herders raided cattle belonging to rival groups. Conflicts like these came under the spotlight when mentions were made of them in the wake of the 2007 Nobel Peace Prize for climate change awareness.[10] However, climate change did not create the conflicts, for some of these conflicts had much older origins than the late twentieth century droughts.

This paper aims to answer why, if pastoralism is suited to the savannas, it declined. History of the tropical regions, where most savannas are, and the theory of property rights suggest four ways of answering the question.[11]

The first holds European colonial rule in Asia and Africa responsible for the decline. Europeans assumed governance of these lands without a deep understanding of the dryland environment so different from western Europe and were often hostile to the nomadic herders because they were difficult to tax and challenging to govern.

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[8] Essays in J. Markakis, ed., *Conflict and the Decline of Pastoralism in the Horn of Africa*, Basingstoke: Palgrave Macmillan, 1993. Also Sara Pantuliano, "Oil, land and conflict: the decline of Misseriyya pastoralism in Sudan," *Review of African Political Economy*, 37(123), 2010, 7-23; Suzette Heald, "Agricultural Intensification and the Decline of Pastoralism: A Case Study from Kenya," *Africa: Journal of the International African Institute*, 69(2), 1999 213-237.

[9] Kanna K. Siripurapu, Sushma Iyengar, Vasant Saberwal and Sabyasachi Das, "An Overview of Mobile Pastoralism in Andhra Pradesh and Telangana States of the Deccan Plateau Region of India," New Delhi: Centre for Pastoralism, 2018, 52.

[10] A. Benjaminsen and Boubacar Ba, "Farmer-Herder Conflicts, Pastoral Marginalisation and Corruption: A Case Study from the Inland Niger Delta of Mali," *Geographical Journal*, 175(1), 2009, 71-81.

[11] I am excluding from this study a certain pattern of attrition of nomadic herding that occurred with the discovery of minerals. Thus, diamonds in Botswana, oil drilling in the Arab Peninsula, phosphate mining in Mauritania and Western Sahara led to either sedentarization of the nomads in the cities, or where herding survived at all, to heavy subsidization of the activity.

The second explanation comes from the economic theory of property rights, which says that pastures are open access property not protected by property rights. The theory does not do history. But unprecedented population growth of animals and humans predicts overgrazing and a Malthusian crisis if the extra numbers find it easy to move into open access lands. The theory says that the conversion of open access to a common pool is the ideal response to this prospect.

The third explanation is not a well-articulated position as in the first two cases. Many historical studies, and interpretive works like that of the anthropologist Mark Moritz, tell us that pastures are not property like any other. They differ from farmland not just by openness of access but in other ways. Pastures are not fixed in space and are often used seasonally. Farmers and herders would share the same patch of grassland in different seasons. No modern property rights regime was designed to handle impermanence and sharing. If the creation of strong ownership rights biased one type of usage (like farming) over others, the sharing would end. The historiography of some of the driest savannas in the world, like Somalia, also tells us that nomadic herding and strong territorial states cannot go together. The two types of claims to territory would clash, because pastures are not fixed on space, but states need to fix boundaries. Further nomadic herding never paid much money for the states. It was not a good predictor for the emergence of fiscally robust states. As I show later, all that was a part of the colonial syndrome.

A fourth explanation builds on technology that had the potential to convert seasonally usable land into land usable year-round for a single purpose, like a dam that could supply irrigation water to what were once pastures. Most habitable arid tropical lands were habitable because of the seasonal influx of moisture, and pastoralism suited seasonality. If technology broke the seasonal cycle, pastoralism would become vulnerable. The second half of the twentieth century saw a revolution in water sourcing in Asia and Africa with that effect.

My purpose in this paper is not to uphold one causal model over the other three. I wish to show that the first two approaches are more problematical than their practitioners imagine, and the third and the fourth remain under-explored. A secondary aim of the paper is to suggest that each one of these drivers was a valid response to the challenge of tropical development. A third subsidiary aim is to show that what we may think is a decline is, in fact, a transformation of the livelihood. As it changed, there was divergence between the sedentary and the nomadic pastoral.

This paper is a survey, but it is not the survey of a ready field of study. I am trying to reconstruct an analytical narrative based on a diverse set of scholarly works by geographers, environmental studies experts, historians, specialists on pastoralism-hydroengineering-development, and climate history experts. The story that emerges from this experiment is a bit of a patchwork, certainly not a smooth chronological story of any of the regions of interest, but I believe it provides enough illustrations to support my central claims. And given the scope and implications of the subject, the project is worth doing.

It is appropriate to start a piece on the fall of pastoralism with a brief account of its rise.

The arid tropics and the rise of pastoralism

I use the words "tropical" and arid tropics in a precise sense. The Köppen climate classification system identifies two distinct climatic regions that are both extremely arid (BWh and BSh). Both lie within a few hundred miles of the 23°27′ north and south latitudes. One of these receives some rainfall or floods due to intertropical convergence, and the other little rainfall. Aridity means a high evapotranspiration rate and the scarcity of surface water for a long stretch of the year. Seasonal rainfall eases that condition for the rest of the year and makes cultivation possible. Tropical for the paper is this combination of aridity and

seasonality. The two things make sustainable economic growth a challenging task and contingent on investment in recyclable water. [12]

Tropicality matters here for a different reason. Over a part of the intertropical area, the heat-rain balance creates savanna, sustaining herding but not agriculture. A rainfall level of 250 mm is considered the minimum necessary for any farming to exist at all.[13] Most of North Africa and the Middle East, the Horn of Africa, and Namibia, has less; other tropical countries have extensive areas with less rainfall than that. But even low levels of seasonal moisture influx can create grasslands, making it possible for livestock to survive, provided they move to moist areas in the dry season. Transhumant pastoralism for this reason was extensive and well adapted to the tropical environment for much of the Holocene when the present-day pattern of seasonal precipitation is believed to have emerged, at least in Asia.

Climatic conditions during the Holocene were not stable. There were episodes of "savannization." There is some scope for debate on whether the process was anthropogenic or climatic. Current research suggests that it was the latter in the neolithic periods. Warming and cooling of climate happened in the past, though evidence does not show that these occurred synchronously throughout the earth.[14] Based on lake sediments from Lonar Crater in peninsular India, a study reconstructs climate history in the recent millennia.[15] In South Asia, the Holocene warming and cooling episodes are interesting because the impact depended largely on the effects upon snowmelt and the summer monsoon, factors not present (as prominently) elsewhere in the tropical world. But conditions in

[12] Tirthankar Roy, "The Development of the Arid Tropics: Lessons for Economic History," forthcoming in the *Economic History of Developing Regions*, explores the issue.
[13] Thomas Vettera and Anna-Katharina Rieger, "Ancient Water Harvesting in the Old World Dry Belt – Synopsis and Outlook," *Journal of Arid Environments*169, 2019, 42-53.
[14] Raphael Neukom, Nathan Steiger, Juan José Gómez-Navarro, Jianghao Wang, and Johannes P. Werner, "No Evidence for Globally Coherent Warm and Cold Periods over the Preindustrial Common Era," *Nature*, 571, 2019, 550-554.
[15] Nils Riedel, Dorian Q. Fuller, Norbert Marwan3, Constantin Poretschkin, Nathani Basavaiah, Philip Menzel, Jayashree Ratnam, Sushma Prasad, Dirk Sachse, Mahesh Sankaran, Saswati Sarkar, Martina Stebich, "Monsoon Forced Evolution of Savanna and the Spread of Agro-Pastoralism in Peninsular India," *Scientific Reports*, 11, 2021, 1-13.

South Asia were not similar. The riparian north that received meltwater from the Himalayan mountains and the dry rainfed peninsula would differ in human response to climate change.

A warming early-to-mid-Holocene (8-5,000 years before present or 8-5 kybp) raised insolation, the summer monsoon strengthened, and meltwater levels rose. The urban-riparian Indus Valley settlements emerged in this phase. First farming villages in the north appeared in 5-4 kybp, and in the Deccan after four kybp, though these were probably agropastoral in nature. A subsequent cooling (4-3.3 kybp) reduced monsoon strength and meltwater levels. The Harappan settlements declined. In riparian Indo-Gangetic Basin, farming continued. In the rain-dependent Deccan Plateau, savannization caused the abandonment of settlements for mobile herding.

The puzzle is the Minoan Warming. During the Minoan Warming, the average temperature in peninsular India was 3^0 higher than in the late-twentieth century and about 2^0 higher than 4000 before present (4 kybp). The warming peaked around 3.3-3 kybp. By the previous logic, the summer monsoon was stronger. Archaeological evidence from the Deccan Plateau shows that early farmers abandoned sedentary lives and took to pastoralism in many "southern-neolithic" sites. Archaeologists attributed the shift to pastoralism to increased aridity, pointing at another effect of warming, evaporation of surface water.[16] I read the evidence to mean that farming was not abandoned, but the population adapted to agropastoralism. In the Indo-Gangetic Basin, the farming and cattle-based settlements spread, turned political (the rise of the Mauryan Empire began around this time).[17]

[16] M.K. Dhavalikar, "Farming to Pastoralism: Effects of Climatic Change in the Deccan," in Juliet Clutton-Brock, ed., *The Walking Larder. Patterns of Domestication, Pastoralism, and Predation*, London: Unwin Hyman, 1989, 156-168.
[17] Gayatri Kathayat, Hai Cheng, Ashish Sinha, Liang Yi, Xianglei Li, Haiwei Zhang, Hangying Li, Youfeng Ning, R. Lawrence Edwards, "The Indian Monsoon Variability and Civilization Changes in the Indian Subcontinent," *Science Advances*, 3, 2017, 1-8.

There were subsequent cooling and warming episodes, but the entrenchment of agriculture, which also stabilized the grazing zones, and adoption of dry crops, may have moderated the impact on livelihoods. It is safe to speculate that in the Common Era, climate changes were regional (see above), and local anthropogenic forces operated more strongly behind livelihood modulations. Pollen data analysis suggests that agriculture (and pastoralism) was stable in the Common Era in peninsular India.

These patterns of change cannot be generalized to all of the tropical world. One thing seems certain. The fall in the recent decades was definitely anthropogenic and an outcome of institutional, technological, and demographic variables.

The fall: Four theories

Colonial rule was responsible

European colonialists did not have direct experience of the tropical savanna. Because tropical pastoralism was an adaptation to a geographical condition, it embodied distinct forms of knowledge. Colonial administrators thought they knew how to farm better than the indigenous peoples and made that knowledge obscure. The colonial bias for farms stood also on a misreading of aridity as a product of human action that could be reversed or mitigated by scientific practices.[18] There was another reason why the states did not like the herders. Whereas the states tried to collect taxes from the herders, it was not a significant source of state income nor a secure one against the risk of cattle disease and droughts. An unfamiliarity with what the nomadic mode of life meant hardened the distance. The colonizers were instead "brought up in an old foodgrain civilisation" that was alien to the pattern of resource use prevalent in the tropics.[19]

[18] Diana Davis, *The Arid Lands*, Cambridge, Mass.: MIT Press, 2018.
[19] Jacques Pouchepadass, "Colonialism and Environment in India: Comparative Perspective," *Economic and Political Weekly*, 30(33), 1995, 2059-2067. Cited text on p. 2065.

Social purpose joined the scientific ambition. A pattern of "privileging settled cultivating areas over unsettled pastoral areas repeatedly appeared throughout northern and central India" and paralleled a hardening division between peasant castes, who deserved state support, and pastoralist and mobile tribes, who invited regulation and restraint.[20] Distrust of the transhumant pastoralists as an ungovernable entity reinforced the bias. "To the British," a study of Punjab says, "seemingly fluid landscapes and shifting habitations connoted anarchy. Keen to incorporate pastoral spaces within the settled agrarian order, the British officials moved vigorously to map them as village spaces."[21] Most historians of early British rule in India agree about "the Company's repugnance for mobile social groups."[22] The eighteenth-century political turmoil drew the Indian pastoralist groups into a new set of political relationships and pushed them more than before to take up arms.[23] A fear of rootless mercenaries may have hardened the sentiment.

Accounts like these culled from India suggest that the decline of pastoralism was a by-product of a European colonial attitude, fed by anxiety, inapt science, and property law (below). That argument finds support among Africanists. "[T]he colonial period was, for nomads, one of diminished opportunities. Even when they did settle permanently, they did it as a response to restricted freedom of movement and an inability to maintain their traditional livelihood."[24]

This interpretation is not quite sound, for three reasons. It overstates the European influence in local history; wrongly suggests that a bias toward

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[20] Brian Caton "Social Categories and Colonisation in Panjab, 1849-1920," *Indian Economic and Social History Review*, 41(1), 2004, 33-50, cited text on p. 50.
[21] Neeladri Bhattacharya, *The Great Agrarian Conquest: The Colonial Reshaping of a Rural World*, Ranikhet: Permanent Black, 2019, 87.
[22] Seema Alavi, "The Makings of Company Power: James Skinner in the Ceded and Conquered Provinces, 1802-1840," *Indian Economic and Social History Review*, 30(4), 1993, 437-466. Cited text on p. 454.
[23] Around 1800, Begum Samru's army of several thousand soldiers "became the vehicle for the upward social mobility of the semi-pastoral and herdsmen communities .. who had so far remained on the fringe of the Mughal political tradition." Alavi, "The Makings of Company Power."
[24] Victor Azarya, "Pastoralism and the state in Africa: Marginality or incorporation?" *Nomadic Peoples*, 38, 1996, 11-36. Cited text on p. 23.

sedentary lives or sedentarization was a colonial import, and it ignores the "agropastoralist," implying that herders and farmers were distinct people with rival interests.

The colonialists may have wanted to develop taxpaying farmlands in all colonies, but geography was against them. As a recent economic history scholarship has shown, the tropical colonial states did not possess the fiscal capacity to act on the impulse. There were exceptions, no doubt. In Punjab, canals drawn from the Himalayan rivers altered land use and marginalized the nomads. "Pastoral nomads were of little consequence in a plan as unique as the one laid out for Punjab..."[25] But nowhere else was there a conversion process of comparable scale in the nineteenth century tropics.

Sedentarization, however, present without colonial agency. In West Africa and West Asia, nomads lived in the cities, specialized as bankers and merchants, and settled down on land when that option seemed sensible (during a famine) or feasible (when open access land was available for farming). "A process of continuous sedentarization," writes a history of nomadism in the long run, "has to be recognised as a normal aspect of nomadism. The richest and the poorest among the nomads tend to sedentarize: the richest, when the size of their flocks exceeds the capacity of the grazing land available to the tribe; the poorest, when loss of livestock reduces their flock below the minimum need ."[26] Sedentarization as a permanent move towards plough agriculture was also an older thing. D.D. Kosambi, a historian of India in the *longue durée*, believed that pastoralism and slash-and-burn agriculture represented a primitive production system compared with settled agriculture and that "[t]heir decay followed the spread of a superior production complex (or mode of production), based on plough agriculture."[27]

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[25] Indu Agnihotri, "Ecology, Land Use and Colonisation: The Canal Colonies of Punjab," *Indian Economic and Social History Review*, 33(1), 1996, 37-58, Cited text on p. 43.
[26] M. B. Rowton, "Autonomy and Nomadism in Western Asia," Orientalia, 42, 1973, 247-258. Cited text on p. 254.
[27] Sumit Guha, "States, Tribes, Castes: A Historical Re-exploration in Comparative Perspective," *Economic and Political Weekly*, 50(46-47), 2015, 50-57. Cited text on p. 52. Kosambi was voicing an Indianist impulse to explain how castes became distinct from tribes. Plough agriculture was associated with castes, and pastoralism with tribes. The impulse to divide ancient societies into

Pastoralists and farmers had never been entirely distinct. Nor were they rivals. Transhumance was a strategy for maintaining cattle stock that suited the seasonality of the tropical climate. As transhumant groups cultivated on the side, sedentary farming communities raised cattle if they could. In Western Sahara, pastoralists had access to rock salt layers that met the sedentary peoples' demand for salt. The presence of sedentary people among their kind provided the purely transhumant people with better access to pastures than when the farmers represented other ethnic groups.[28]

What, then, was distinctly colonial that might explain the fall? Colonialism was unique in its faith in property law. The legal definition of private property was a work in progress. But pastoralist rights were outside the law almost everywhere. Therefore, allocation of private rights sometimes took away land used by the herders. This storyline has been used to explain virtually every famine in Africa since the nineteenth century.

There was more than blind faith in private property here. The colonial states had an intuitive sense that pastures were not fit for legislation. "The notion of pastoral land rights was considered an oxymoron" in the early stages of colonialism in Africa.[29] Herders practiced inclusive management of pastures. But they did not identify one bounded and defined land and waterbodies as their property. Doing so would go against the logic of herding, which involved moving from dry-season pasture to wet-season pasture, the precise location of which was never known long in advance. Therefore, pastoralists refused "to embrace a bounded, alienable and exclusionary notion of landed property ..."[30] Occasional attempts notwithstanding, colonial authorities did not legislate on pastures.

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two types, one built around lineages like family and clan and another with a weak sense of lineage, commonly called tribal, reappears in other places, the tribal being identified with nomadic herding. See Daniel T. Potts, *Nomadism in Iran: From Antiquity to the Modern Era*, Oxford: Oxford University Press, 2014.

[28] Wilson, "The Fulani Model of Sustainable Agriculture."

[29] John G. Galaty, "Land Grabbing in the Eastern African Rangelands," in Andy Catley, Jeremy Lind, Ian Scoones, and Jeremy Lindeck, eds., *Pastoralism and Development in Africa: Dynamic Change at the Margins*, Abingdon: Routledge, 2012, 143-153. Cited text on p. 144.

[30] Ibid.

Besides Punjab and the settler estates, nowhere else did colonial states actively drive out the pastoralists. In West Africa, the pastoralists were left alone. Occasional conflicts gave way to indirect rule, but no land grab or sedentarization occurred on a large scale in the colonial times. Repression of the herder was not in their economic interest. European rule overlapped with the nineteenth-century globalization. Trade was a key priority for these states. Many administrators valued the growing meat trade. Others understood herding as an adaptation to the tropical savanna geography.

The reference to property rights and underlegislation of pastures leads to the second broad theory of the fall.

The tragedy of open access pastures

Economists distinguish between "open access" and "common pool." A fundamental claim of the economic theory of property is that a legally secure right ensures efficient use of assets. The open-access natural resources are not protected by any recognized and/or enforceable property rights.[31] Since no user can legally exclude competing users of the same asset, they fight it out, or overuse and degrade the property. In short, open access entails the risk of conflict, capture, and decline.[32] A stylized history of conflict follows. In the beginning, most pastoral property was open access. Open access is environmentally detrimental because it has no safeguard against overuse. Garrett Hardin's tragedy of the commons statement was the first concise summing up of the possibility. Open access is also exposed to capture by politically backed private entrepreneurs, like European settlers in a colonial regime. Hence the crisis of pastoralism.

[31] Vincent Ostrom and Elinor Ostrom, "Public Goods and Public Choices," in E.S. Savas, ed., *Alternatives for Delivering Public Services: Toward Improved Performance*, Boulder, Colorado: Westview Press, 1977.
[32] Dean Lueck and Thomas J. Miceli, "Property Law," in A. Mitchell Polinsky and Steven Shavell, eds., *Handbook of Law and Economics*, Amsterdam: Elsevier, 2007, 186-257.

Commons, by contrast, are a field where an identified user group or a government working for them has an enforceable legal right. That right mimics private property rights in that it can exclude those outside the designated group. The group in question or the government can also contract away the management to reduce conflicts, for example, a contract permitting one group to assert exclusive use rights and a fair distribution of access rights within that group. An example is a company negotiating with indigenous people to access animal fur in a hunting ground and do so sustainably. The shared feature between these systems is legally enforceable excludability. Both contract and ownership presuppose the state as the legislator and enforcer.

The property right approach connects with history via overgrazing, And the worry that it caused desertification.[33] Colonial authorities often campaigned that this was happening. There is no dispute that herd sizes grew from the turn of the twentieth century. The growing livestock trade as transportation cost fell and consumption levels increased encouraged herd sizes beyond the carrying capacity of the pastures. The control of cattle disease led to expansion in herds even as pastures shrank in quantity and quality. This was the case in East Africa and Sudan.[34] Weak states with an overdependence on pastures had an incentive to permit overgrazing. In British Baluchistan in the interwar years, in a move to raise finances, the government permitted migratory herds from Afghanistan to graze the pastures. "The vegetation of the pastures has everywhere received a setback owing to the increased numbers of animals," a 1945 account reported.[35]

Syndromes like these could happen because pastures were open access. The property rights approach is attractive also because it offers a solution: the conversion of open access to a common pool under certain agreed rules that

[33] The Otterman cycle: Overgrazing leads to a rise in surface albedo (a measure of diffuse reflection in total solar radiation) and reduced convection.
[34] Harold F. Heady, "Rangeland Development in East Africa," in David Brokensha, ed., *Ecology and Economic Development in Tropical Africa*, Berkeley: University of California Press, 1965, 73-82. J.H.G. Lebon, "Rural Water Supplies and the Development of Economy in the Central Sudan," *Geografiska Annaler*, 38(1), 1956, 78-101. Cited text on p. 101.
[35] Harold Glover, "Soil Erosion In Baluchistan," *Empire Forestry Journal*, 24(1), 1945, 21-32. Cited text on p. 23.

Elinor Ostrom called design principles. The move would return the lost pastures to the old user groups but in a sustainable way. Studies in the 1990s elaborated on the preconditions. Emphasis fell on the small size of groups and homogeneity among the members. In a 2003 review of the field, Arun Agarwal criticized the property rights paradigm for its inattention to external forces like "demographic change, market penetration, and state policies."[36] One other missing element is technological change (like the Punjab canals). Anthropologists stress that culture matters. Collective action to conserve and sometimes recapture open access lands draw on identities and a sense of sharing, besides property rights. Changing beliefs can bring about a new type of action.

The property right approach is one-dimensional. It recognizes access as the main feature of any property. Open access was quite diverse within.

Pastures are different

A whole class of property rights are non-possessory and approximate easements. These rights involve private counterparties, not the state though the state may be a third-party enforcer. If the parties' interests or situations change, pastoralism can be under threat. That threat has nothing to do with access. Further, the geography of pastoralism tells us that open access is a necessary condition for nomadic herding to survive at all. The move from open access to a common property then would not save pastoralism.

Some land is usable as farm or pasture in different seasons. In these cases, seasonality brought the farmers' and the herders' interests into compatibility. Property rights and contracts were immaterial, and seasonality ensured harmonious use of the asset between two parties. This kind of cooperation did exist, but was not as stable the description makes it out to be. Herder groups fought over pastures all the time, and these battles intensified during droughts. But with the high mortality of herds during droughts, there was little prospect of

[36] Arun Agrawal, "Sustainable Governance of Common-Pool Resources: Contexts, Methods, Politics," *Annual Review of Anthropology*, 32, 2003, 243-262, Cited text on p. .

a permanent loss of pastures. From this baseline, any external push to change the land use from seasonal to year-round would threaten these arrangements, as in recent times.

If, in this case, open access is irrelevant, in another case, it is necessary. In drier savannas, "grazing resources .. are highly variable in space and time."[37] The pastoralists do not know where the best land is available in a certain season. To illustrate using a 1971 study of pastoralist society in Baluchistan, the potential grazing lands in a region formed the "macro pastoral orbit."[38] During a year of a severe drought, the orbit expanded to become almost a thousand square miles. Access to the orbit was not a legal right, but a social-cultural one, strengthened by rituals and symbols. The study found that most marriages were contracted between groups within the orbit. "[A]rid lands are typically unstable," and pastoralist practices are a response to that geographical instability.[39]

Premodern and colonial states understood that a claim to an undefined territory was a problem for any state. It was a problem for taxation, which cannot be imposed on a property that had no fixed character. A crude poll tax or tribute was often the only option. But these rarely yielded money. Further, any state that wanted to fix its territorial boundary would encounter difficulties with the pastoralists. What kind of politics would this dilemma predict?

There is a model of an interventionist state, Mongolia (where only one percent of the land is agricultural; it is not a tropical region), from the thirteenth century. "Pastoralism was a central element of .. political legitimacy."[40] Under Qing rule, governance from the top became more elaborate. From an economic standpoint, governance would mean allocation of territorial-cum-grazing rights. The local

[37] M. Moritz, "Open Property Regimes," *International Journal of the Commons*, 10(2), 2016, 688-708. Cited text on p. 689.
[38] Stephen Pastner, "Ideological Aspects of Nomad-Sedentary Contact: A Case from Southern Baluchistan," *Anthropological Quarterly*, 44(3), 1971, 173-184.
[39] Elliot Fratkin, "East African Pastoralism in Transition: Maasai, Boran, and Rendille Cases," *African Studies Review*, 44(3), 2001, 1-25. Cited text on p. 7.
[40] Ariell Ahearn, "A Condensed History of the Public Administration of Pastoralism in Mongolia," *Nomadic Peoples*, 22(2), 2018, 282-303. Cited text on p. 286.

political power of clans and families mediated the allocation process. A 1960s study called this system "feudalism," a term that rarely occurs in the historiography of pastoralism in the tropics.[41]

At another extreme, near the desert edge, "states" were missing altogether. "Societies where states do not fit well" or "economy without states" are phrases used to describe the pastoralist past in the Horn of Africa, for example.[42] In the Horn, before colonial rule, the state-like authorities were clans that emerged from the herder groups themselves. Some, like the Majeerteen, were known as sultanates, but with few accessories of a state. Pastoralism did not pay, and these clans relied on piracy, raids, and trade.

Once again, we have the hint of a theory of fall – the emergence of capitalism and colonialism feeding conflicts over grazing land. To illustrate, in the second half of the nineteenth century, the growing meat trade on the Somalian coast induced the Majeerteen clans to expand flocks and use pastures more intensively. Gum and livestock trade involved merchants who traded in the Arabian Sea and grew rich. Ships from Bombay and Aden brought tobacco, rice, textiles, and iron. Their control over the trade cut the herders from the spot markets where earlier they sold their goods. In one reading, they were "infinitely more vulnerable to any variability in their natural resources, especially water."[43] In the twentieth century, the meat trade often made pastoralists money while overgrazing more likely.[44]

The fourth theory applies more forcefully to the postcolonial developmental phase in Asia and Africa.

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[41] Academician Sh. Natsagdorj, "The Economic Basis of Feudalism in Mongolia," *Modern Asian Studies*, 1(3), 1967, 265-281.
[42] William Reno, review of Peter D. Little, *Somalia: Economy without State*, Bloomington, IN: Indiana University Press, 2003, in *Journal of Modern African Studies*, 42(3), 2004, 474-5.
[43] Ibid., 301.
[44] See contributions in Markakis, ed., *Conflict and the Decline of Pastoralism in the Horn of Africa*.

Hydraulic developmentalism was responsible

The colonial states may have wanted more farming, but they had limited means to implement that plan. Postcolonial states took the ambition much further, reinforcing it with dams and canals that converted some seasonal farmlands into year-round farmlands. As a by-product, they also enabled private (nonseasonal and not shared) property to exist in the modern sense. They worked under three assumptions, none of which was wrong: that poverty owed to dependence on rainfed occupations; that population growth had made this dependence a disaster in the making; and that a state that wished to lead economic development must lay claim on all resources available.

Farmers and herders could co-exist in the past because of non-rivalry, their lands being either distinct types or variable between seasons. That unity of interests broke down if the seasonality of moisture inflow changed because of a dam nearby. At this point, rivalry emerged, and the missing property right kicked in. "In all cases," says a study of the Fulani in northern Nigeria, "the question of land ownership looms on the horizon, but in all places, people are afraid to discuss it. The result has been clashes between pastoralists and their hosts whenever animals stray into standing crops."[45]

While the stage was set for conflicts, droughts broke out. Droughts in the past generated bitter struggles over pastures. From the late 1960s, a prolonged drought situation permanently reduced pastures in the Sahel, opening many fronts in a similar conflict. The reservation of forests and forest fringe areas for tourist purposes or to protect biodiversity curtailed the herders' capacity to survive droughts.[46] The drought drove more people into agropastoralism, whereas in an earlier era, these episodes drove them to the areas where moist pastures was available.

[45] A.G. Adebayo, "Of Man and Cattle: A Reconsideration of the Traditions of Origin of Pastoral Fulani of Nigeria," *History in Africa*, 18, 1991, 1-21. Cited text on p. 16.
[46] Bilal Butt, Ashton Shortridge and Antoinette M. G. A. WinklerPrins, "Pastoral Herd Management, Drought Coping Strategies, and Cattle Mobility in Southern Kenya," *Annals of the Association of American Geographers*, 99(2), 2009, 309-334.

In the late twentieth century, more pastoralists took up farming while not giving up herding, a move that can be understood as insurance against climate shocks. Population rising at unprecedented rates created a "competition between the demand for land for the production of foodgrains to feed the human population, and for the natural production of grass to feed animals."[47] But land with limited irrigation was not a secure means of livelihood. Therefore, farmers diversified into livestock rearing where they could. Agropastoralism grew by absorbing grazing lands into farmlands if politics backed the move.

The next part of the paper discusses a set of cases, which show how these four processes unfolded.

Case studies

Western Sahel

Large pastoralist groups are diverse. One trajectory in this diverse experience that dominates recent discourses on global terror in Sub-Saharan Africa occurs in the northern half of Mali. The territory of Mali can be divided into a northern nomadic and a southern farming region. The division based on livelihood was reinforced by the penetration of the governmental institutions of the south into the north. The northern part belonged to the French colonial empire. The colonialists governed at arm's length by negotiating with nomadic groups their independence in exchange for recognition of formal French authority. That type of peace also meant that the government under-invested in these areas compared to the farmland areas. Few colonial officers lived in the north. The arm's length relationship continued after independence. Government officers were reluctant to go on postings to the north, investment in communication was limited, and attempts to reclaim power provoked rebellion.

[47] Sunil Ray, "Declining Production Conditions of Raw Wool: Analysis of Emerging Conflicts in Sheep Husbandry in Rajasthan," *Economic and Political Weekly*, 34(2), 1999, 1209-1214. Cited text on 1212.

The nomadic herders in these desert fringe areas have traditionally been only pastoralists, exchanging goods with farmers and taxing them but rarely engaging in farming. They also felt little in common with the agricultural southern half of Mali that held political power since independence. The Tuareg rebellions of the 1960s were a reaction to this divergence, deepened by socialist economic policies that made little accommodation to pastoralism. The drought of 1968-74 hit the nomads of Malian Sahel hard. Many left for city jobs, moved into refugee camps, left the country, and took up agriculture. The sense that the government did not see the pastoral nomad as either a political ally or an economic asset remained. Tuareg communities became a recruitment ground for a variety of rebel groups in the region.[48] In turn, the communal element made alliances more fractious.

In relatively water-rich Niger, also home to a significant Tuareg population, the government invested money in the 1960s and the 1970s on water schemes for the pastoral nomads, and more Tuareg joined the administration and the army. Still, a sense of "homeland" prevailed, and attempts to retain control over it led to conflicts. From the late-twentieth century, uranium mining in this homeland complicated the scenario.

In the Inland Niger delta, the nature of pastoralism and the groups involved are different. In the inland Niger delta, a land almost 30,000 square kilometres in extent, a land use pattern had come into existence centuries ago that became exposed to a variety of external forces from the late nineteenth century. Rainfall is seasonal. The wetlands in the delta enabled rice farming during and after the rains, and dry-season pasture in the rest of the year.

The Fulani herders were the political and military elite before French colonial rule was established here in 1892. Expansion of colonial rule made inter-regional

[48] David Michel, "Case Study: Mali," in US Institute of Peace, *Water Conflict Pathways and Peacebuilding Strategies*, Washington DC: US Institute of Peace, 2020, 14-17, cited text on p. 17.

migration and dispersal of the pastoralists easier than before.[49] Some of these groups settled elsewhere as farmers. In the early twentieth century, areas bordering the Sahel developed close cooperation between settled groups and migrant herders, secured by their shared interest in animals as a productive resource and as an article of growing trade. A cattle tax encouraged the colonial authorities to take an interest.

The 1970s drought and the Niger dam projects permanently shrank this active delta. At the same time, the drought encouraged agropastoralism to diversify risk. The reliance upon artificial irrigation systems increased. In the 1970s, the World Bank funded the reconstruction of dykes used in lowland rice cultivation. Canals and dykes empowered some communities with access to these technologies, while the environmental challenges proved too formidable for most facing "an inexorable process of erosion and desertification."[50] Over almost a century, in the inland Niger delta, there was a gradual shift away from pastoralism towards agropastoralism.

The spread of colonial rule also encouraged the dispersal of the pastoralist groups. For several decades after the end of World War I, the grassland of northwest Cameroon received Fulani herders. German colonial rule had ended in Cameroon in 1916, and the new regime welcomed cross-border migration of the herders. The farmers in this relatively green plateau benefited from the presence of the herders because cultivation was seasonal, and much land lay either permanently or seasonally fallow. The herders also paid a lot of the taxes. With continued migration, overgrazing and conflict emerged as serious issues. The administration intervened via demarcation of lands, private leasing, and ideas of stock management.[51]

[49] Adebayo, "Of Man and Cattle."
[50] Derrick J. Thom and John C. C. Wells, "Farming Systems in the Niger Inland Delta, Mali," *Geographical Review*, 77(3), 1987, 328-42.
[51] Martin Z. Njeuma and Nicodemus F. Awasom, "The Fulani and the Political Economy of the Bamenda Grasslands, 1940-1960," *Paideuma: Mitteilungen zur Kulturkunde*, 36, 1990, 217-233.

Closer to the wetter regions, transhumant pastoralists and sedentary cereal farmers converged. Each depended on the other via "an unspoken contract involving the exchange of dung for [millet] stubble" in the dry season.[52] "[T]he town and cattle Fulani," wrote a 1991 study of the group in Nigeria, "are half-brothers."[53] But with the relentless conversion of grazing lands into lands suitable for year-round farming and changes in feeds and fertilizers, the interdependence reduced all the time. Droughts decimated herds. Thus, when crops stood on farmlands late in the wet season, herders sometimes used pastures next to these lands. This was a perennial source of conflict when farms and pastures stood too close and a pattern that seemingly became more common than before.

Sudan

Before the colonial schemes like Gezira began in Sudan, pastoralism prevailed as one of the main livelihoods away from the Nile and its tributaries. As in French West Africa, the British in Sudan dealt with the pastoralists marginally, not quite knowing what to do about them. The British, however, believed in property rights and initiated a drive to reform property rights. That drive theoretically extended both to agricultural lands and common lands. Practice was another matter. Administrative capacity and information on pre-existing rights being limited, one reformer (Herbert Kitchener) left titling common lands in British Sudan entirely out of the scope of legislation. His successor (George Wingate) engaged with it, but only when he tried to offer land to an American business to develop cotton plantations and discovered that he lacked the legal means to do this. The officer in charge believed that documentary evidence put forward to support claims of collective use was unreliable, and no other form of evidence was available.[54]

[52] M.O. Awogbade, "Fulani Pastoralism and the Problems of the Nigerian Veterinary Service," *African Affairs*, 78 (313), 1979, 493-506. Cited text on p. 502.
[53] Adebayo, "Of Man and Cattle."
[54] Steven Serels, "Political Landscaping: Land Registration, the Definition of Ownership and the Evolution of Colonial Objectives in the Anglo-Egyptian Sudan, 1899-1924," *African Economic History*, 35, 2007, 59-75.

After independence, the national government added a powerful new element to the reform programme, "[t]he assumption that all nomads have to proceed to higher standards of living through settlement and adoption of agriculture."[55] The instrument was clear at hand, investment in water projects. In parallel, a reluctance to intervene in pastoralist lives persisted, to the extent that the administration had little reliable data on how many nomads there were.[56]
The Gezira Scheme was for farmers long settled in the area. But other plans taken up after independence, using the waters of the Atbara in the far east of the country and a small tributary to the Blue Nile, the Rahad, appeared in areas where nomadism was one of the main livelihoods before. Around 1970, "recently sedentarized" nomadic groups near the Nile floodplains practiced some flush cultivation.[57] Droughts in the 1970s pushed many of them deeper into agriculture.

Decades into their operation, the irrigation projects had divided up the nomadic herder peoples into several groups. There were still many who developed no ties with farmland. But a substantial number also held tenancies in the irrigated area. In short, in the river valley the herders adapted to farmland development by diversifying or even becoming sedentary. What about the specialists further away? Little was known on them until the Darfur conflict of 2003 revealed the presence of Arabic-speaking herders dispersed over a large region. They came under attention being caught up in the conflict between the Arabic militia and the farmers.

Southern Africa

In the southern African drylands, under-legislation of the pastoral property was less of a problem than an outright competition for limited pasture between

[55] Salih A. El-Arifi, "A Regional Approach to Planning and Development of Pastoral Nomads in the Sudan," *Sudan Notes and Records*, 56, 1975, 147-159. Cited text on p. 148.
[56] "Basically you were recorded as 'nomadic' only when the enumerator could not put you in another category!" Sameer Alredaisy, Abdel Aziem Tinier and Jack Davies, "Farming, Herding, Water and Rangeland in the Butana," *Sudan Studies*, 44, 2011, 57-69. Cited text on p. 64.
[57] David R. Lee, "The Location of Land Use Types: The Nile Valley in Northern Sudan," *Economic Geography*, 46(1), 1970, 53-62. Cited text on p. 57.

different groups. The formation of the Basotho nation in the 1820s set the stage for a conflict over scarce land between the Boer herders and the agropastoral population of the region. The highlands received enough rains to sustain farmlands, good pastures, and a cattle population. Milk and stored grain provided insurance against frequent droughts. The white settler areas were too dry to sustain intensive farming and depended on herding. Cattle did not adapt easily to the pasture available. Sheep could. Boers who had migrated from the Cape Colony saw a potential to export wool and specialized in raising wool-bearing sheep. A policy to offer land grants at cheap rates encouraged land speculation, driving the Boers further into pastoralism.

From the 1830s, droughts exposed the settlers to considerable stress. Settlers in the coastal areas were better off being able to access the seaborne trade in foodgrains. Those in the interior lived with a non-existent trade and transport system and unreliable pastures. Trade in grain relied on draught oxen. Droughts made it impossible to feed the animals on the move and stopped the caravan trade.[58] The rivers were not navigable. The first railways were built in the 1880s. The switch to wool-bearing sheep had reduced meat supply. Droughts, therefore, affected society badly and affected both the wealthier and poorer sections in it. "The Boers .. experienced famine for the first time in 1863."[59]

Raiding the dry-season pasture lands was an inevitable response to stress. Such raids had happened before. In the 1860s, it led to the transfer of control over a large part of the king's territory to the settler-pastoralists. At the same time, population growth, immigration of refugees, the disappearance of wildlife, and the loss of cattle, exposed the king's territory to the threat of famines. Arable land continued to expand at the expense of the pastures in response to the opportunity to export grain. That commercialization reduced grain stocks. "By

[58] Elizabeth A. Eldredge, "Drought, Famine and Disease in Nineteenth-Century Lesotho," *African Economic History*, 16, 1987, 61-93.

the end of the nineteenth century, the Basotho had lost their capacity to withstand periods of food scarcity."[60]

This story is unique in the tropical world because of the high proportion of European farmers and herders in South Africa (more than a third of the population in the early twentieth century). Pastoralism was present almost everywhere along the desert fringe. But the history was rather different. Botswana is an interesting example.

About five percent of the land area in the country is suitable for cultivation. High temperatures and low rainfall make surface water scarce and unstable, even in the floodplains of the two main rivers. Botswana remained free of contests for land of the kind that happened in South Africa. From the 1960s, the economy came to become dependent on export-driven diamond mining and cattle farming. In the 1970s and 1980s, as famines raged in northern and central Africa, the Botswanan government used its "very favourable foreign exchange position" to build a rural drilling programme for small settlements. "Basically all the population, except nomads, has been able to obtain enough water for human consumption on a regular basis."[61] The programme could not cover all nomadic herders because some lived in areas where drilling would not succeed. But overall, pastoralism received help and survived. Thanks to diamonds, pastoralism could remain an economic mainstream. Oil and phosphate mining near the Sahara produced a somewhat similar pattern, subsidization of nomadism. "[A] discriminatory [government] expenditure pattern, wrote a study of drought response, "favouring livestock development over arable production. serves to facilitate the transition by a traditional dominant group of cattle owners to a contemporary capitalist class of commercial farmers and industrialists."[62]

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[60] Ibid., 85.
[61] John D. Holm and Richard G. Morgan, "Coping with Drought in Botswana: An African Success," *Journal of Modern African Studies*, 23(3), 1985, 463-482. Cited text on p. 468.
[62] Roy Love, "Drought, Dutch Disease and Controlled Transition in Botswana Agriculture," *Journal of Southern African Studies*, 20(1), 1994, 71-83. Also, Kwaku Osei-Hwedie, "Food Policy: Managing Drought and the Environment in Botswana," *Africa Development*, 23(2), 1998, 61-83.

East Africa

Unlike the driest pastures of Somalia or the Sahel desert edge, the Rift Valley grasslands are moist and the soil potentially high yield if converted into farmlands. Considerable cultivation existed before European rule. Possibly from the seventeenth century, Maasai agropastoralists began to give up mixed occupations and specialize as nomadic herders, even as they maintained close economic ties with cereal farmers.[63] British and German rules created a border between two large rangelands in a region that did not have a political border before. British rule in Kenya at first led to conflicts between the colonizer and the pastoralists, whom the former saw as a warlike exclusive group fiercely attached to their homeland. At the turn of the twentieth century, the two had found a way to live in peace. In Tanganyika, by contrast, conflicts continued. Partly as a result of continuing hostility and partly, the expansion of European settler farming, in the first half of the twentieth century, pastoralists in Kenya, Tanganyika, and Uganda were confined to reserves, which restricted their economic opportunities, but protected their access to the now more limited land available as pastures.

The farming bias continued after independence in government policy, now reinforced by fear that pastoralists could potentially reduce the quality of land via overgrazing. At the same time, new initiatives on herd and pasture management and promotion of commercial ranching took shape. The pastoralists adapted by joining land when possible and by joining the livestock trade more heavily than before. Their exclusive territory, however, shrank greatly. The overall outcome was not just decline, but inequality. Whereas the process of continuous land loss in evidence elsewhere affected the East African pastoralists, the forces leading to land loss also made the groups more unequal. “Increased commoditization of the livestock economy,” for example, “has led to a growing

[63] Thomas Spear and Richard Waller, eds., *Being Maasai: Ethnicity and Identity in East Africa*, Athens: Ohio University Press, 1993.

polarization of pastoralists into haves and have-nots, particularly in Maasai areas that are close to urban markets."[64]

Ethiopia

In Ethiopia, which has a mixed geography, land conversion and capitalist farming developed together. After the end of World War II, the government of Haile Selassie offered land on concession to large plantation companies to grow commercial products. One of the biggest of these came up in the dry-tropical Afar region. The Tendahao plantation company with British capital in 1895 diversified from mining and engineering interests in South Africa to cotton in Ethiopia. The plantation came up by the offer a large chunk of Afar grazing land to it. The imperial state made that offer, creating a conflict of interest for the Sultan of Awsa, a minority shareholder and controller of farmland in the area. The Sultan acquired lands bordering the plantation to pre-empt further offers.[65] Thus, Afar farming was sheltered in this area, but herding came under pressure.

The pressure grew after World War II, when the discourse on development picked up. By default, the idea was that resettlement of herders on farmlands held the best prospect for all. Which land? The state stepped in around 1955 with a revised constitution that declared grazing lands to be state property, denying legal status to the user rights the Afar had depended on. The state collected a cattle tax from the herders. Therefore, no public possession followed. Afar rights to "possess" but not own was implicitly recognized. But the state had asserted a territorial claim that could now be used to reallocate land for developmental uses. The Marxist regime went much further along that road, with damaging consequences.

[64] Fratkin, "East African Pastoralism in Transition." Cited text on p. 9.
[65] John H. Harbeson, "Territorial and Development Policies in the Horn of Africa: The Afar of the Awash Valley," *African Affairs*, 77(309), 1978, 479-498.

Madagascar

Madagascar illustrates the retreat of pastoralism and expansion of commercial cultivation in a different way. Ecological regions were sharply divided here during colonial rule. French colonialism led to the growth of export crop cultivation (rice and coffee). This expansion happened in the wetter highlands and eastern plains. Hydraulic projects such as marshland conversion and dams and canals (in the Lake Alaotra in the northeast) aided intensive cultivation. French settlers cultivated these lands until independence in 1960.

In colonial times, the pastoralist areas were spared because these were too distant from the core farming zones and too unsuitable for conversion into arable lands. "[T]he arid south became a labor reserve" Instead.[66] In the long run, the development of commercial agriculture did not leave the arid southwest untouched. The demographic transition started in the early twentieth century and picked up from the 1950s. The shift towards agropastoralism, especially in the available river basins, accelerated.[67] More accurately, the retreat of the spiny thickets, an ecological zone for which Madagascar is famous, placed pastoralist groups under pressure in the late twentieth century.[68]

India

Pastoralism was once extensive in India. The history of its decline in the Indo-Gangetic Basin was linked to population growth and expansion of agriculture. British colonial reforms pushed that tendency. The case of Punjab was mentioned before. Canals also came up in the western Gangetic Basin. Conditions resembling that of precolonial Punjab persisted in western Rajasthan (Rajputana earlier), where nomadic groups reared sheep and camel. Many of

[66] Lucy Jarosz, "Defining and Explaining Tropical Deforestation: Shifting Cultivation and Population Growth in Colonial Madagascar (1896-1940)," *Economic Geography*, 69(4), 1993, 366-379, cited text on p. 370.

[67] The Linta basin in the south-west is an example, studied in Jeffrey C. Kaufmann and Sylvestre Tsirahamba, "Forests and Thorns: Conditions of Change Affecting Mahafale Pastoralists in Southwestern Madagascar," *Conservation and Society*, 4(2), 2006, 231-261.

these groups continue to exist, but material to write a continuous history of these regions and livelihoods is scarce.

For one subregion, sources (literary and archival) are adequate to suggest a long-run pattern of change. The Kangayam grasslands in South India stretch over 1500 square miles in the central part of the Tamil Nadu state. Arid and with limited scope for rainfed agriculture, the area had an extensive savanna. Until the twentieth century, the grasslands were thinly populated, with few towns. The low density had owed in part to repeated famines in the region. Literary sources suggest that the influx of cattle-raising pastoral people from outside the region led to conflict and competition for pasture in the first millennium of the Common Era.[69] During the second millennia, there was a slow expansion of cultivation in the river valleys even as pastoralism remained a significant livelihood.

In the late-eighteenth century, when the East India Company took over the administration of this region, records still described it as a land of shrubs and bushes. But the river valleys had received migrants from a long time past. In the nineteenth century, there was a significant expansion of cultivation and population. The expansion did not happen at the pastoralists' expense but by allocating grazing lands to the farmers, many of whom had received canal water procured from the Kaveri River. In this way, agropastoralism expanded. Pastures were first taken over by the government and then privatized, and the nomadic herders were pushed to marginal lands, becoming increasingly obscure in the records.

[69] Anil Kumar, S Natarajan, Nagaratna B Biradar, and Brij K Trivedi, "Evolution of Sedentary Pastoralism in South India: Case study of the Kangayam Grassland," *Pastoralism*, 1(7), 2011, 1-18.

Conclusion

In the language of economics, open access pastures were once rival but non-excludable, which was their "tragedy." This intuition does not square with historians' accounts of why pastoralism declined in the last century. These accounts tell us that access had to be open because the pastoral property was not fixed on space and was seasonal. Seasonal usage made it non-rival. As modern states emerged in the tropics, preference for intensive agriculture pushed back against pastoral land use. Colonialism added to the tension with its bias toward secure private titles and preference for boundaries. Still, most colonial states were not strong enough to alter livelihoods drastically. Their main concern was defence; if the nomads agreed to a peace deal, they were left alone.

Postcolonial hydraulic developmentalism was a more intrusive force. Every irrigation dam changed mixed land-use patterns towards year-round cultivation. Doing so in any land usable as a pasture would remove the herder from the picture and make more land entitled or potentially entitled. In this way, excludability gathered strength. The great drought of the 1960s extending to the 1970s dislocated the nomadic herders of Africa as no other crises in living memory did. Yet, "crisis" can be a misleading word. Herding did retreat. But also, herders diversified to make use of new opportunities. The prospect of combining farms and herding provided needed insurance, and communities hit by the extended drought moved closer to that mixed model.

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