10 January 2008

Dear Agrarian Studies Colloquium Participants:

I'm sending you a short selection from *a very long* manuscript I completed in August that explores the history of scientific fieldwork and state-building in British colonial Africa. To give you a sense of the book as a whole, I've included the table of contents.

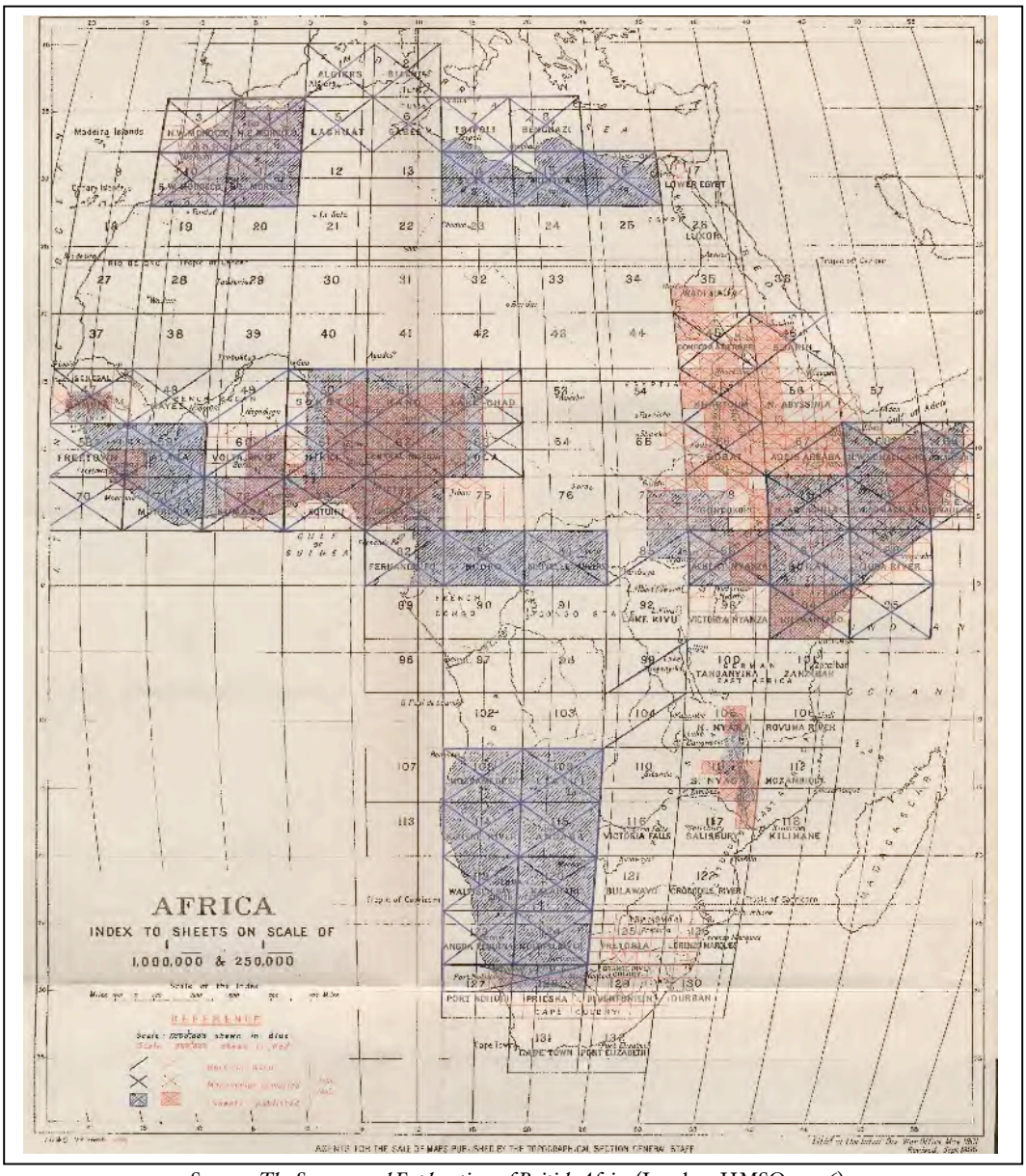
The selection you're receiving is a 30-page introduction to Part III of the book, "Africanizing Science: Epistemologies and Fault Lines of Empire," which is meant to set the stage for chapters 5 through 8 of the book.

In the final manuscript I plan to combine the various introductions to the different parts of the book into one, but for the time-being they're still separate. I would therefore find it very helpful to get some feedback on the "Africanizing Science" selection since it includes a number of ideas that I have never "test-run" with any audiences.

Many thanks for taking the time to read this. I'm really looking forward to our conversation on January 25th.

All the best,
Helen Tilley

Africa as a Living Laboratory



Source: *The Surveys and Explorations of British Africa* (London: HMSO, 1906).

Empire, Development, and the Problem of Scientific Knowledge, 1860-1960

Helen Tilley

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Part III. "Africanizing" Science

Epistemologies and Fault Lines of Empire

[A]LL OUT-DOOR LABORATORIES are of their own local kind.

William Morris Davis, geologist, 1887

MODERN SCIENCE OPENS UP LARGE NEW POSSIBILITIES of mastery in the problems which government has to deal, but the choice of the purposes for which these powers will be used depends on our scale of values . . .We have to make up our minds whether we are to regard the peoples of Africa primarily as instruments of our own advantage or as ends in themselves.

Joseph Oldham, *White and Black in Africa*, 1930

AFRICA MUST EVENTUALLY BECOME self-supporting in laboratory facilities because she has much to teach head-quarters in Europe.

E.B. Worthington, "Food and Nutrition," 1936

A NEW POWER OF SELF-CRITICISM is to be secured by scientific knowledge of the facts and a human sympathy which can see the whole business from the African side.

J.W.C. Dougall, *Africa*, 1938[1]

[1] William Morris Davis, "Instruction in Geological Investigation," *The American Naturalist* v. 21 (1887) pp. 810-825, on p. 810; Oldham, *White and Black in Africa*, p. 70; Worthington, "On the Food and Nutrition of African Natives," *Africa* v. 9 (Apr. 1936), pp. 150-165 on p. 165; J.W.C. Dougall, "Review of *African Dilemma*," *Africa* v. 11 (1938), pp. 251-252, on p. 251.

WHEN ALICE STOPFORD GREEN observed in 1917 that the imperial conquest of Africa was Europe's opening "experiment" in its gambit for world power, she might have added that it was also a watershed moment for geopolitical and scientific transformations.[2] Could we explain, for instance, the emergence of international law or the rise of multinational institutions of governance without being forced to account for the effects of Africa's partition?[3] Would it be possible to tell the story of the codification of tropical medicine or of social anthropology unless we considered the ways its promoters used Africa as a justification for their endeavors? Certainly, no analysis of the history of racial theories or of human origins would be complete without describing the effects of African research. Pick up any book on the history of international conservation efforts and African experiences and precedents loom large.[4] Consider the legacies of the colonial state and of colonial development and it would be difficult to do justice to this topic if one ignored African cases. In all of these examples, the continent of Africa and its peoples have been far more than an incidental backdrop: they provided the bricks and mortar of disciplines, theories, institutions, and even laws.

A study of science, empire, and development in British Africa can thus shed new light on Africa's role in defining and shaping what it meant to be modern. It also

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[2] Green, comments in "The Annual General Meeting," *Journal of the Royal African Society* v. 16 (1917), pp. 155-164, on p. 156; see chapter 1 for full quotation. There are interesting parallels between Stopford Green's views and those of Hannah Arendt in her volume on *Imperialism*. While Arendt was clearly making unique and original theoretical contributions, Stopford Green arguably had a better understanding of African colonial history.

[3] T.O. Elias, *Africa and the Development of International Law* (Dortrecht: Martinus Nijhoff, 1988); J. Fisch, "Africa as terra nullius: The Berlin Conference and International Law," pp. 347-375; Antony Anghie, "Colonialism and the Birth of International Institutions: Sovereignty, Economy, and the Mandate System of the League of Nations," pp. 513-633; Wm. Roger Louis, "African Origins of the Mandates Idea," *International Organization* v. 19 (1965), pp. 20-36.

[4] William Adams, *Against Extinction: the Story of Conservation* (London: Earthscan, 2004); P. van Heijnsbergen, *International Legal Protection of Wild Fauna and Flora* (Amsterdam: Ohmsha Press, 1997); Sherman Strong Hayden, *The International Protection of Wild Life* (New York: Columbia University Press, 1942); my thanks to D.G. Burnett for pointing me towards the first reference. Historical treatments include Roderick Neumann, "The Post-War Conservation Boom in British Africa," *Environmental History* v. 7 (2002), pp. 22-47; MacKenzie, *Empire of Nature*; Anderson and Grove, *Conservation in Africa*; Jane Carruthers, *The Kruger National Park: a Social and Political History* (Natal: University of Natal Press, 1995).

helps to explain how an entire continent could be the focus of considerable attention, yet simultaneously seem to be irrelevant or even invisible; a place for widespread experimentation, but where it was very difficult to hold anyone accountable for the results of such experiments. Enrique Dussel has recently argued that "[m]odernity is not a phenomenon of Europe as an *independent* system, but of Europe as center."[5] Much recent imperial history has taken this point even farther: key elements of ostensibly "modern" phenomena originated not in Europe, but elsewhere, so much so that a number of scholars have taken to seeing colonies as "laboratories of modernity." This new angle of analysis has stemmed in part from a desire to unsettle Eurocentric and metropolitan biases in earlier historiography and has challenged narratives that see European developments as taking place either in a vacuum or in a linear pattern of diffusion from center to periphery. If colonial cities, for instance, were a venue to work out new techniques of surveillance and hygiene; if tropical islands helped cement new kinds of commodification, labor management, and conservation; if territorial conquest generated the phenomena of "concentration camps" and genocide; if the tenets of liberalism and nationalism could not be imagined without experiences in extra-European contexts; and if imperial expansion enabled new understandings of self and identity to emerge, then such evidence forces scholars to resist arguments that assume that developments in European countries were hermetically sealed.[6] To understand these patterns, we must study not only

[5] Enrique Dussel, "Beyond Eurocentrism: the World-System and the Limits of Modernity," in Frederic Jameson and Masao Miyoshi, eds., *The Cultures of Globalization* (Durham: Duke University Press, 1998), pp. 3-31, on p. 4.

[6] The authors who first began to take up these questions explicitly include, Paul Rabinow, *French Modern: Norms and Forms of the Social Environment* (Cambridge: MIT Press, 1989); Gwendolyn Wright, *The Politics of Design in French Colonial Urbanism* (Chicago: University of Chicago Press, 1991); and Ann Stoler, *Race and the Education of Desire: Foucault's History of Sexuality and the Colonial Order of Things* (Durham: Duke University Press, 1995); more recent contributions include Gyan Prakash, *Another Reason*; Stoler and Cooper, *Tensions of Empire*; Chandak Sengoopta, *Imprint of the Raj: How Fingerprinting was Born in Colonial India* (London: Pan, 2004). Not surprisingly, a number of scholars have begun to challenge some of the characterizations of colonialism in these arguments, but their objections rarely undermine the idea that colonialism had profound effects on European institutions and ideas; see, for instance, Peter Zinoman, *The Colonial Bastille: A History of Imprisonment in Vietnam* (Berkeley: University of California Press, 2001); a similar challenge to the idea that colonial structures were all-pervasive or all-powerful can be found in Vaughan, *Curing Their Ills*.

connections and networks that have tied European nations to the rest of the world, but also those circulations and developments elsewhere that differed from and influenced trajectories within Europe itself.

Decentering Europe: Vernacular and Patriotic Sciences

This kind of close examination reveals four trends that the next several chapters consider more carefully. First, we find that the very actors engaged in creating and maintaining structures of imperial domination in Africa, were ironically among those who shared with post-colonial scholars a desire to "provincialize Europe."[7] In spite of their different motives and ideologies, it was they who began to question Europe's epistemic authority, challenging truth claims that accepted European examples and standards as the norm. One of the most overt expressions of these sentiments was made by South African statesman and naturalist, Jan Smuts, who in 1925 gave the presidential address to the South African Association for the Advancement of Science. Smuts spoke of the dangers of developing scientific theories only in Europe: "The European situation is best known, it is the classic ground of science. No wonder that it has come to be considered the centre of the world." As scientists undertook research in other continents, Smuts felt sure the picture would change.

> While for the statesmen the problems of the African continent may become all-important during [the twentieth] century, it is more than probable that for the scientist also this continent will assume a position of quite outstanding importance. From many points of view, Africa occupies a key position among the continents of the world . . . In many ways Africa is the great "scientific divide" . . . where future prospectors of science may yet find the most precious and richest veins of knowledge.[8]

[7] Dipesh Chakrabarty, *Provincializing Europe: Postcolonial Thought and Historical Difference* (Princeton: Princeton University Press, 2000).

[8] J.C. Smuts, "South Africa in Science," *South African Journal of Science* v. 22 (1925), pp. 1-19, on pp. 3-4; this speech was also excerpted in J.C. Smuts, "Science in South Africa," *Nature* v. 116 (1925), pp. 245-249. Smuts' lecture began with an analysis of Alfred Wegener's hypothesis of continental drift.

These provincializing ambitions were echoed in Jan Hofmeyr's 1929 address when he put out a call to "*Africanise*" science[9], strangely anticipating remarks made by Thabo Mbeki, the President of South Africa, nearly seventy years later.[10] Not only did Smuts and Hofmeyr, and many of their contemporaries, wish to decenter Europe, they also wished to challenge the supremacy of scientific perspectives developed in the Northern Hemisphere, something a number of technical officers and fieldworkers in colonial Africa increasingly reinforced in the interwar period. E.B. Worthington's book, *Science in Africa*, was in fact grounded in this premise: as he put it, Africa had much to teach Europe. The most important difference between the past and the present, however, was that many of these authors wanted to "Africanize" science without involving Africans as decision-makers, a pattern of exclusion that had both significant and subtle ramifications. The laboratory motif remains apt: if you deny people autonomy and equality, but depend on them for instruction and wisdom, the results are bound to distort social realities even if scholars intended otherwise. As long as people of European descent retained power over scientific and state institutions and wrote, not for Africans, but for themselves, their attempts to "Africanize" science would inevitably be partial and incomplete. Yet they would also have lasting epistemic effects, not least to stimulate a growing interest in subaltern knowledge within the continent itself.

The push to decenter Europe was, paradoxically, an enduring feature of overseas empire-building and often included a turn towards *patriotic* and *vernacular* science.[11] The former suggests connections to nation-building while the latter implies

[9] His exact words (p. 9): "In the period that followed the first visit of the British Association [1905] we South Africanised Science in South Africa. Is it too much to hope that in the next we shall Africanise it?"

[10] Illinois Senator Barak Obama's response to Mbeki's stance draws attention to an enduring theme of this book: "There should not be a conflict or contradiction between traditional values and modern science. It's not an issue of Western science versus African science. It's just science." Obama quoted in Jeff Zeleny and Laurie Goering, "Obama Challenges South Africa to Face AIDS Crisis," *Chicago Tribune*, 22 August 2006.

[11] To the best of my knowledge, not much has been written on vernacular sciences, but there is a growing interest in linking the concept of vernacular with cosmopolitanism; see, for instance, Homi

an emphasis on local knowledge and interaction. By the early twentieth century, theorists' loyalties to the sites in which they produced knowledge could make them insist that Africa, that "enchanting abstraction", was a unique and important place in its own right.[12] Some of these patriots could be exclusionary, settlers and officers who wanted to use the material of science to help their communities cohere, usually around a presumed racial identity. While others were nascent cosmopolitans, who wished to level the playing field and ensure that European perspectives and evidence were not given unwarranted privilege. Many displayed a mixture of these qualities. To pursue vernacular science was to emphasize ethnography and draw attention to existing relations of power. Its proponents reflected an interest, in other words, to connect everyday forms of expertise to formal scientific systems. Both tendencies were evident in the archaeologist, Louis Leakey's research and writings from the nineteen-twenties and thirties. Joining a number of scientists who had first-hand experience in the field, Leakey emphasized vernacular science when he chose to align himself with defenders of Africans' "magical" and agricultural knowledge.[13] Not everything European scientists wished to introduce to Kenya, Leakey argued, was either accurate or sound. Africans had their own systems of knowledge that were worthy of defense. As a patriot, Leakey also enjoyed turning the tables on his European audiences, calling himself "more a Kikuyu than an Englishman," since he was born and raised in Kenya. He thought it important to highlight that colonial laws and administration were at times "irrational" and "grossly unjust and unfair."[14]

Bhaba, ; and Pnina Werbner, "Vernacular Cosmopolitanism," *Theory, Culture, and Society* v. 23 (2006), pp. 496-498.

[12] The "enchanting" quote is from Kwame Anthony Appiah, "Cosmopolitan Patriots," *Critical Inquiry* v. 23 (1997), pp. 617-639, on p. 617; for this pattern in seventeenth century Spanish America see Jorge Canizares Esquerra, "New World, New Stars: Patriotic Astrology and the Invention of Indian and Creole Bodies in Colonial Spanish America, 1600-1650," *American Historical Review* v. 104 (1999), pp. 33-68. Canizares Esquerra also engages with the "laboratories of modernity" literature.

[13] See, for instance, Louis Leakey, *Kenya: Contrasts and Problems* (London: Methuen, 1936), especially chapter 8, "Science and the African"; I address Leakey's perspectives on magic in chapter 8.

[14] L.S.B. Leakey, "Comparative Methods of Colonial Administration," [a talk delivered at a meeting at Chatham House December 10, 1930, which was marked "Not for publication"], Rhodes House

Indeed his fieldwork in East Africa led him to put forward the provocative hypothesis that Africa might be "the cradle of modern man."[15] Nothing could subvert Europeans' complacent sense of their own history so much as suggesting that *homo sapiens* originated in Africa. Leakey's counterpart in South Africa, Raymond Dart, a patriot himself, expressed similar frustration with people's "false love of European literature, culture, prehistory and politics. The consequences of this misplaced policy have been fatal to African philology, African ethnology, African archaeology and African anthropology."[16] Patriotic and vernacular sciences could often cut many ways, undermining European hegemony, reinforcing "white" control, and even promoting "indigenous" perspectives. This helps to explain why, as African nationalists and social critics joined debates about the substance and consequences of scientific theories and redirected their arguments away from European and towards African audiences, that they could produce patriotic science of their own. This would include Jomo Kenyatta's ethnographic defense of "African medicine" in the 1930s and Nnamdi Azikiwe's critical analysis of "African super-science" the same decade: Kenyatta would later become the first President of Kenya, Azikiwe the first president of Nigeria.[17] If they shared nothing else, Smuts, Hofmeyr, Kenyatta, Azikiwe, and even Thabo Mbeki at least had one thing in common: they all considered African experiences to be central to the process of knowledge production and state-building.

An analysis of networks and intellectual exchange during the colonial period reveals a second, equally important pattern: tropical Africa has served as a key site in

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Library; also see Leakey, *White African: An Early Autobiography* (London: Hodder and Stoughton, 1937).

[15] "The Cradle of Man. Kenya's Claim: An Expedition and Its Finds," *The Times* 1 August, 1928, p. 15, col G; L.S.B. Leakey, "The Cradle of Man. More Evidence from Kenya: Elmenteita Finds," *The Times* 7 March 1929, p. 15, col G; "The Cradle of Modern Man. Evidence from Africa: Mr. Leakey on Finds in Kenya," *The Times* 8 September 1930, p. 7, col C; L.S.B. Leakey, "East Africa Past and Present," *Geographical Journal* v. 76 (1930), pp. 494-500.

[16] Raymond Dart, "The Present Position of Anthropology in South Africa, [Presidential Address to Section E, S.A. Association for Advancement of Science, 1925,]" quoted in Saul Dubow, "Human Origins, Race Typology, and the Other Raymond Dart," *African Studies* v. 55 (1996), pp. 1-30, on p. 7.

[17] I discuss these examples briefly in chapter 8.

which to work out a scientific discourse of complexity, interrelations, and interdependence, concepts that were often at the heart of governmental and development interventions. This emphasis emerged as much from the interplay between field and laboratory sciences as it did from the transnational task of managing colonial states and directing the flow of information within and across African territories. The reason scholars have largely missed these patterns is that they are most visible only when one examines the interstitial spaces that linked Africa and Europe: in other words, through the apparatus of science and empire. What might seem marginal to a single territory, such as Kenya, Nigeria, or the Sudan, appears central when examined in the context of inter-territorial networks, which were attempting to coordinate the circulation of ideas and methods. The sciences of geography, anthropology, and ecology were most significant to this process, but so too were field epidemiology, tropical medicine, nutritional science, psychology, demography, and even archaeology.

By the early twentieth century, the African continent was the largest *colonial* landmass in the world and its tropical states were also, on average, the youngest. While some colonial sites, such as British India or the Dutch East Indies had comparatively well-established networks of laboratory facilities by this point, this was less true in British tropical Africa. That meant that field and laboratory sciences existed on a par and, in many locations, field sciences were actually, conceptually, more important to scientific research. In epistemic terms, because field sciences and fieldwork were so central, approaches that stressed interactions and integrated analyses achieved supremacy. Of course, laboratory approaches in the life sciences had once emphasized much the same thing. One need only look at Claude Bernard's *Introduction to the Study of Experimental Medicine* (1865) to see how important a relational analysis of the whole organism was to Bernard. These traditions within the life sciences were kept alive well into the twentieth century – achieving a noteworthy

resurgence especially in the interwar period – and remain present to this day.[18] Yet in metropolitan centers researchers increasingly had to confront reductive tendencies in laboratory methods and scientific reasoning, which privileged parts over wholes and drew conclusions about organisms in the absence of an analysis of wider interactions. It would be wrong to draw too sharp a dichotomy between laboratory and field methods since many disciplines relied on both techniques, but it is certainly the case that in British tropical Africa no matter which method individuals identified with more, the sites in which they produced knowledge went well beyond the boundaries of any institutional lab. The "field" in this sense was essential to everyone.

A third pattern the following chapters explore is the imperial imperative to *localize* knowledge. This feature, coupled with the relative weakness of colonial states and the flexibility of Africans' cosmologies, has meant that epistemic (and therapeutic) *pluralism* remained a norm rather than an exception across much of colonial Africa. It also meant that many field analysts were careful to distinguish the particular from the universal, or the local from the general. Site specificity of phenomena – whether it concerned soil fertility, disease distribution, sanitation practices, climatic patterns, zones of flora and fauna, geological strata, or even land tenure and witchcraft beliefs – forced this task upon them. To claim that scientific practitioners could only think in terms of universals or "one size fits all solutions" is wrong and misleading. (This is a critique that appears in much of the literature concerned with "colonial science," a conceptually problematic phrase, which I discussed in the introduction to Part II.) Both field scientists and laboratory experts were evaluated by their peers in how well they were able to disaggregate specifics of place and people; most could not afford, in other words, the over-simplified

[18] See, for instance, Christopher Lawrence and George Weisz, eds., *Greater Than the Parts: Holism in Biomedicine, 1920-1950* (London, 1998); Richard Levins and Richard Lewontin, *The Dialectical Biologist* (Cambridge: Harvard University Press, 1985); Lynn Margulis, *Symbiotic Planet: A New Look at Evolution* (New York: Basic Books, 1998).

cognitive frameworks that scholars sometimes attribute to them. Their emphasis on site specificity, however, did not mean that their interpretations were correct or even good in a normative sense. Nor did it mean that they easily accommodated competing epistemologies, but we should not assign all their "mistakes" to an ostensibly narrow and exclusive definition of science's universality since this argument rarely holds up under scrutiny.

That said, the process of localizing knowledge was not without a paradox: as insights derived from African experiences were folded into the fabric of scientific disciplines, as well as the policies of colonial states, Africans themselves were rarely at the helm of decision-making. While there was much give and take in epistemic terms, there was almost never social parity. This meant that while colonial states and scientific projects might privilege "indigenous knowledge", often calling into question any simple dichotomy between "Western" and non-Western science, empires in Africa could not escape this dichotomy entirely.[19] Lurking in the background were always other questions: could one Africanize science without African scientists?[20] And just what counted as science and who would decide?

Epistemic and therapeutic pluralism produced an enduring ambivalence in the minds of many – African and non-African – about what would be considered authentic and legitimate forms of knowledge within the continent. The proliferation of studies of "indigenous" and "endogenous" knowledge systems since independence

[19] Grove, *Green Imperialism*, especially chapter 2, "Indigenous Knowledge and the Significance of South-West India for Portuguese and Dutch Constructions of Tropical Nature," pp. 16-72; Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge: Harvard University Press, 1999), especially chapters 3 and 6, "'The Lapp Is Our Teacher': Medicine and Ethnography," and "'Should Coconuts Chance to Come into My Hands': Acclimatization Experiments," pp. 56-81 and pp. 113-139; Patrick Harries, "Field Sciences in scientific fields: entomology, botany and the early ethnographic monograph in the work of H.A. Junod," in Saul Dubow, ed., *Science and Society in Southern Africa* (Manchester: University of Manchester Press, 2000), pp. 11-41; Roberto Gonzalez, Laura Nader, and Jay Ou, "Between Two Poles: Bronislaw Malinowski, Ludwik Fleck, and the Anthropology of Science," *Current Anthropology*, v. 36 (1995), pp. 866-869.

[20] I am indebted to the late Archie Mafeje for this question, which he raised in the context of a critique of anthropology.

reflects one part of this legacy.[21] A tacit reluctance to accept African scientists as viable and powerful actors in their own right forms another part.[22] To drive home the point: for every scholarly study of African contributions to scientific debates – and there are, in fact, only a handful – one can find dozens of examples that focus on "indigenous knowledge," "witchcraft," African philosophy, "traditional medicine," "survival strategies," "prophet movements," "ethnoscience," and "medical pluralism." There are very good reasons for this emphasis, but they often leave a range of unsettled questions in their wake. Anyone who unproblematically promotes "science," at least in humanist as opposed to policy circles, runs the risk of being characterized as naive and unsophisticated at best and neocolonial at worst. On the other hand, advocates of science in policy circles, while sometimes sensitive to questions of "indigenous knowledge", rarely grapple explicitly with the challenges of a pluralistic approach.[23]

For those who remain dubious about modes of reasoning and interventions that they label "science", their main alternative is to suggest that other kinds of knowledge, experience, and logic are more legitimately *African*. That "there are [currently] more African scientists and engineers working in the U.S.A. than there are in Africa" only feeds into these patterns since the "brain drain" itself deprives the continent of a critical mass of scholars.[24] Needless to say, taken to extremes, an

[21] For an excellent example see Paulin Houtondji, ed., *Endogenous Knowledge: Research Trails* (Dakar: CODESRIA, 1997); for a different kind of example (on mathematics) see Helen Verran, *Science and an African Logic* (Chicago: University of Chicago Press, 2001). Also see Gloria Thomas-Emeagwali, ed., *African Systems of Science, Technology, and Art: the Nigerian Experience* (London: Frontline International, 1993). For an example emphasizing legal and political institutions see George Ayittey, *Indigenous African Institutions* (Ardsley, NY: Transnational Publishers, 2006). Most authors who contribute to these important genres, however, tend to have a limited grasp of the history of scientific debates in and on colonial Africa and sometimes make misleading generalizations about the effects of colonialism and the nature of science and knowledge.

[22] This comes across vividly in the over-simplified and ahistorical analysis offered by Harriet Washington e.g. "Op-Ed: Why Africa Fears Western Medicine," *The New York Times* July 31, 2007.

[23] For a recent example of policy discussions, which makes only passing mention of "indigenous knowledge", see the special issue edited by Calestous Juma on "Science and Innovation in Africa," *International Journal of Technology and Globalization* v. 2 (2006), especially Calestous Juma, "Reinventing Growth: Science, Technology and Innovation in Africa," pp. 323-339.

[24] Sir David King, "Governing Technology and Growth," in C. Juma, ed., *Going for Growth: Science, Technology, and Innovation in Africa* (London: Smith Institute, 2005), p. 117.

emphasis only on "ethnoscience," which is itself a construct of colonial relations, can lead down a *cul de sac* where people search in vain for essential insights that only Africans might possess. Ironically a South African historian active in many of these debates in the interwar period, William Macmillan, pointed out a pitfall of this approach in a critique of anthropology in 1938. The problem with anthropologists, in his view, was that they "end [their studies] by pronouncing in effect that whatever is essentially African is right."[25] Macmillan was not being entirely fair to anthropology nor did he have a complete understanding of the ongoing struggles around knowledge in colonial Africa, but he did manage to put his finger on a dilemma that remains salient even to this day.

Finally, the very process of producing new knowledge and synthesizing its results often had the unexpected and unintended effect of prompting epistemic *decolonization*. This trend should not be elided with political change: however weak colonial states were, they often clung to their existence powerfully and, when necessary, with brutal force. Nor should the protagonists responsible for producing this knowledge be characterized as somehow more enlightened or less culpable than their compatriots, although, in truth, many of them do seem to have been extraordinarily committed to the places in which they worked and the people they knew along the way. (Seeking moral culpability can lead us astray from genuine understanding.) Epistemic decolonization, however, did weaken the rationale for empire and had lasting indirect effects on the political will to maintain colonial structures of rule.

At least some of the research sanctioned by Britain's "imperial organism" and its subsidiary colonial states following the Second World War bears greater resemblance to existing research priorities in African Studies today (in European and

[25] William Macmillan, *Africa Emergent*, p. 375.

North American institutions, that is[26]) than critics would lead us to believe.[27] If we focus less on anomalies, exceptions, and egregious examples – studies that admittedly stand out and demand attention – and more on the quotidian and mundane priorities of British Africa's research institutes and technical departments, a different picture emerges.[28] This allows us to acknowledge decolonizing impulses that were present in tropical Africa long before the political "winds of change" swept across the continent. There is no question that an analysis of egregious examples has a lot to teach us about the nature of colonial power and its attendant ideologies.[29] They can also reveal important insights about the objectifying drive that underpins many scientific disciplines and activities. Yet such examples must always be situated alongside the vast body of scientific literature produced in the colonial period – in and on Africa – that did *not* fall into such patterns. Only then can we fully appreciate the norms and standards, both explicit and unstated, which guided research in the human, environmental, and medical sciences in tropical Africa. Much of this research of course bears the mark of the era in which it was produced, and all of it is open to critical analysis, but if we wish to make claims about its specifically *colonial* nature it helps to have a sound overview of just what projects were supported in the various African empires and how influential they really were. The challenge scholars

[26] These research priorities are, of course, open to criticisms themselves; see, for instance, Paul Tiyambe Zileza, *Manufacturing African Studies and Crises* (Dakar: CODESRIA, 1997).

[27] I am thinking here, for instance, of the projects supported by the Colonial Research Council, the Colonial Social Science Research Council, and the Scientific Council for Africa South of the Sahara, which were all funded through grants from Britain's Colonial Development and Welfare Acts. See, for instance, the seventy-five page report published in 1954 by the Scientific Council for Africa South of the Sahara, reviewing research in human geography, demography, anthropology, psychology, prehistory, economics, political science, and medicine, *Research in the Social Sciences in Africa South of the Sahara* (Bukavu: Conseil Scientifique pour l'Afrique au Sud du Sahara, 1954).

[28] This applies to all the European powers active in Africa; I'm stressing the British case because it's the one I know best.

[29] See, for instance, the work of J.C. Carothers, whose reports on psychiatry and psychology are often presented in African Studies courses as examples of egregious colonial and racist ideology; J.C. Carothers, *The African Mind in Health and Disease* (Geneva: World Health Organization, 1953); J.C. Carothers, *The Psychology of Mau Mau* (Nairobi: Government Printer, 1954). Interestingly, Carothers' viewpoints played a rather minor role in scientific networks in British colonial Africa outside Kenya. The forthcoming work of Sloan Mahone will help to place this research in its wider context; also see Jock McCulloch, *Colonial Psychiatry and "the African Mind"* (Cambridge: Cambridge University Press, 1995). I address research in the human sciences in the conclusion to chapter 8.

(and social critics) face is to explain the coexistence of radically different points of view within scientific debates, some of which fed into a kind of colonial status quo, while others transformed and undermined it.

Auto-Critique and the Exigencies of Rule

In nineteenth and twentieth century intellectual traditions *praxis* was often taken to be essential in order to generate accurate depictions of social, political, and economic forces. Friedrich Engels' experience of industrialization in Manchester or Max Horkheimer's reaction to the Third Reich helped produce, respectively, *The Condition of the Working Class in England* (1844) and the contours of "Traditional and Critical Theory" (1937). While it would be impossible to characterize most participants in the colonizing project as "radical" in this sense, it was the case that their emphasis on analysis and interventions encouraged them to produce *auto-critique*. Although this never resulted in the kind of masterful syntheses of the sort written by Frantz Fanon or Hannah Arendt, it did generate criticisms that were often empirically more precise.[30] Very few ever became strident colonial critics and even fewer recognized how damaging colonialism could be to the psyche, but many were willing to express doubt, dissent, and opposition. It has always been interesting to me that Norman Leys and William McGregor Ross, two of the more vocal critics of colonial policies in Kenya in the 1920s, were respectively a physician and an engineer. Each had been employed in colonial Kenya, the former as a medical officer (1905-1913) and the latter ultimately as director of the Public Works department (1900-1922).[31] One wonders how, if at all, their scientific affinities affected their social critiques.

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[30] Hannah Arendt, *The Origins of Totalitarianism* (New York: Harcourt, Brace, 1951); and Frantz Fanon, *The Wretched of the Earth* (New York: Grove Press, 1963),

[31] Diana Wylie, "Norman Leys and McGregor Ross: A Case Study in the Conscience of African Empire 1900-1939," *Journal of Imperial and Commonwealth History*, v. 5 (1976-77), pp. 294-309; and Wylie, "Confrontation over Kenya: the Colonial Office and Its Critics, 1918-1940," *Journal of African History* v. 18 (1977), pp. 427-447.

Cedric Dover, a South Asian zoologist and an important actor in British debates during the interwar period on the subject of miscegenation and racial hybridity, wrote a tongue-in-cheek poem in which he declared, "(The reely scientific view, you know, Is palsy-walsy with the status quo.)"[32] Dover had a point, but ironically it was one that scientists and administrators in Britain increasingly shared. Their "self-criticism" not only transformed their own disciplines, but also exposed chinks in the armor of the empire. By revealing these cracks, small and large, they played an important role in drawing attention to what was untenable or contradictory about colonialism itself.

The exigencies of imperialism, on the other hand, could also affect the production of knowledge and shape disciplinary boundaries and priorities. Paradoxically this relationship could sometimes temper scientists' objectifying impulses. Officials were not always sympathetic, for instance, to the instrumental logic that guided scientific research and they sometimes had to confront this issue directly. In the negotiations and conflicts between administrators and scientists both parties expressed moral concerns over the means versus the ends of each endeavor. Joseph Oldham raised a question that was on many people's minds in the nineteen-twenties: were Africans to be "instruments" of Europeans' interests – "specimens" for study and manipulation – or were they to be regarded as autonomous human beings?[33] That he could even pose such a question reveals just how deeply colonial relations could dehumanize subject populations. Yet empire was ostensibly about improvements, which meant that certain types of research met its needs more directly than others. Many scholars have elected to see this emphasis as part of empire's "governmentality," which is one way of looking at it, but it was also responsible for reining in scientific tendencies that turned subjects into objects. A

[32] Cedric Dover, 'Foreword,' to his collection of poems, *Brown Phoenix* (London: The College Press, 1950); and also Cedric Dover, *Half-Caste* (London: Martin Secker & Warburg, 1937).
[33] I use this quotation at the beginning of this section.

study of the reasons the British Government rejected using intelligence tests in its African dependencies helps shed light on this pattern. Likewise, an analysis of the resurgence of scientific interest in such tests, as well as in other physiological research priorities, within the Scientific Council for Africa South of the Sahara following WWII, demonstrates the resiliency of objectifying tendencies within certain disciplines. Nation-states, which tended to allow greater autonomy to scientific institutions often ceded their authority to scientists and, as a consequence, experienced a broader spectrum of symbiotic and antagonistic relationships between scientific research and state governance than one often sees in colonies. If we juxtapose scientific developments in Egypt and South Africa with those in the dependencies of tropical Africa, these patterns come into sharper relief. The Empire's leaders, perversely, could at times take a stronger stand against objectifying practices in the dependent territories than their counterparts responsible for building nation-states. This is another facet of the relationship between science and empire that needs much more careful examination.

Africanizing Science: Multiple Vantage Points

The following chapters explore these issues by tracing many of the behind the scenes debates that were taking place both in the halls of power and the halls of science, even when those "halls" were in the field. This approach retains a focus on elites and consequently pays less attention to social history, whether in Britain or the various African colonies. In this sense, these chapters are meant to complement the many excellent territory-specific, regional, and ethnographically driven narratives that a number of Africanists have recently produced.[34] There is indeed a tension between following elites, who often traveled widely and intervened in many places,

[34] For a handful of examples see Diana Jeater, *Law, Language, and Science: the Invention of the "Native Mind" in Southern Rhodesia, 1890-1930* (Portsmouth, NH: Heinemann, 2007); Saul Dubow, *The Commonwealth of Science*; Schumaker, *Africanizing Anthropology*; Hunt, *A Colonial Lexicon*; Patrick Harries, *Butterflies and Barbarians*; and Omnia el Shakry, *The Great Social Laboratory: Reformers and Utopians in Twentieth Century Egypt*.

and explaining their impact and interactions in specific locations. There is also a tension between showing "big picture" dynamics in the relationship between science and empire in tropical Africa and offering nuanced micro-histories that provide texture and voice to what might otherwise seem rather abstract processes. To truly do justice to the historical record would require a second and perhaps even a third volume in which many of the same events and issues are taken up and addressed not only from the vantage point of African social history, but also from the vantage of the social history of science.[35] Such a task becomes easier, I would argue, once people understand the phenomenal intricacies and contortions involved in "thinking like an empire." No less than any other facet of African history, imperial and scientific machinations need to be depicted in three-dimensions or else we run the risk of offering inadequate and misleading interpretations of colonialism's ethos and legacies.

Since we know that Africans were often excluded from the upper echelons of all kinds of decision-making, one of the points of the following chapters is to explore how these exclusions, as well as selective and planned inclusions, affected scientific and imperial debates. This means paying close attention to *ethnographic* interests, methods, and rhetoric. When practitioners of different field sciences, for instance, did oral interviews or worked with research assistants, what effect did these interactions have on their ideas and interventions? What kind of information did they seek and how did they speak about Africans' knowledge and their reliability as informants? How, in turn, did officials pursue bringing Africans into medical, environmental, and anthropological projects; what roles were they meant to play and what kinds of concerns did such inclusion raise?

[35] This kind of social and scientific specificity is something I hope to explore in my next project, which will concentrate on intersections between law – international, colonial, and customary – and science.

Africanists still lack an adequate vocabulary to deal with these interactions. Some authors have borrowed the insights of Steven Shapin and called Africans "invisible technicians" in the knowledge production process.[36] This draws attention to colonizers' dependence on Africans as they constructed their sciences. To take an example from the nineteenth century we might consider the fortunes of a guide known as "Bombay" (c. 1820-1885) who took part in many of the East African and equatorial geographical expeditions between 1857 and 1876.[37] James Grant, whose travels in East Africa were a precursor to the flurry of expeditions in the 1870s, recognized the importance of these guides and not only drew the Royal Geographical Society's attention to their role, but also asked the participants at the 1876 Geographical Conference in Brussels to acknowledge their debt to them. Grant singled out Bombay for his highest praise. The latter had already received the RGS's Bronze medal, but Grant felt he deserved a pension as well for his "services rendered to Geography." He had, after all, accompanied the expeditions of Richard Burton and John Speke, of Speke and Grant himself, of Stanley (in 1871), and of Cameron (1873-76): "'Bombay' in making the four above journeys," Grant wrote to the RGS Executive Council, "has walked some twelve thousand miles, seeing and doing as much as all these travellers put together."[38] As a result, he was granted a pension by the RGS for the remainder of his life. There is little question that during these journeys Bombay served as the eyes and ears for his geographers, guiding them literally towards some places and people and away from others, showing them things that they would later take credit for as "discoverers." There is also little question that

[36] Steven Shapin, *The Social History of Truth: Civility and Science in Seventeenth Century England* (Chicago: University of Chicago Press, 1994), chapter 8; this is something I did myself in my dissertation.
[37] "Bombay" was the name the explorers used for him since at a young age he had been sold into slavery and taken to India; when he was released, he returned to East Africa. For his and others' histories see Donald Simpson, *Dark Companions: the African contribution to the European Exploration of East Africa* (London: Paul Elek, 1976); also see C. Barnett, "Impure and Worldly Geography: the Africanist Discourse of the Royal Geographical Society, 1831-1873," *Transactions of the Institute of British Geographers*, v. 23 (1998), pp. 239-251.
[38] James Grant to Sir Henry Rawlinson 13 April 1876, James A. Grant, RGS Correspondence Block 1871-80, RGS Archives.

he had hundreds of counterparts who received fewer rewards and less recognition for their troubles. And like Shapin's "invisible technicians," these guides received most notice when they made mistakes or proved to be wrong, when they seemed to be, in other words, *untrustworthy* and *unreliable* sources.[39]

Yet it is important to ask just how apt the analogy really is between seventeenth century laboratory assistants and instrument makers and late nineteenth and twentieth century African informants, translators, research assistants, interview subjects, and subordinate staff. The difference in scale alone should make us hesitate to see these as entirely parallel cases. History from below places great stress on recovering unacknowledged, but necessary actors in scientific and imperial processes. Without the technicians Shapin describes certain truth claims in experimental science could not have been established.[40] It was the social hierarchies of knowledge production that relegated these contributors to the sidelines. If we step back and examine Shapin's historical canvas, however, we see that many of these technicians were themselves part of the social economy of science from the outset. In fact, the very act of defining experimental natural philosophy in the sixteenth and seventeenth centuries included debates about just how central or marginal these experts were. Moving away from the "ancients" and towards the "moderns" meant embracing new kinds of experience and empirical evidence that stemmed from *doing* and *intervening* rather than just observing and thinking. This was something Edgar Zilsel argued in his contributions on "the sociological roots of science" in the nineteen-forties: artisans, equipment makers, and technicians with tacit "practical"

[39] Lawrence Dritsas's forthcoming work on Livingstone and Kirk's Zambezi Expedition (1858-1864) is likely to shed more light on these interactions.

[40] Unlike many Africanists, Shapin is less interested in "history from below" and more interested in the way social status operated as a means to gauge trustworthiness and produce standards of rationality.

knowledge, he believed, had been integral to the social and epistemic dynamics that precipitated the so-called "scientific revolution."[41]

By the early nineteen-hundreds many of these patterns had been in place for centuries. Scientific research even today is still grounded in elaborate social hierarchies and relationships of trust. Yet producing knowledge in colonial contexts drew attention less to these hierarchies, which were present everywhere, and more to *definitions of science itself*. Seventeenth century debates, we might say, had almost come full circle during the colonial period in tropical Africa. Struggles over scientific knowledge in the early twentieth century were intimately connected to struggles over power. Given that this period came in the wake of an era of "high imperialism" it should come as little surprise that colonialism played an important role in putting back on the table key questions for debate, including, once again, an interest in rationality and the boundaries of science itself. This was in many respects a global story, but for the purposes of this book, the analysis is limited to tropical Africa and to the debates taking place largely in the Anglophone world. Some individuals involved in colonial rule turned a blind eye to these dynamics and chose to deny their significance. These were the people who claimed there was no such thing as real "science" or true knowledge among sub-Saharan African societies. But others, including and especially those influenced by anthropology and ethnographic research, began to speak in terms of "African science," "African therapeutics," and "indigenous knowledge." These were also the people who would pronounce, with

[41] Edgar Zilsel, "The Sociological Roots of Science," *American Journal of Sociology* v. 47 (1942), pp. 544-562; also see Zilsel, "The Genesis of the Concept of Physical Law," *The Philosophical Review* v. 51 (1942), pp. 245-279. For a brief recent analysis see Wolfgang Krohn and Diederick Raven, "The 'Zilsel Thesis' in the Context of Edgar Zilsel's Research Programme," *Social Studies of Science* v. 30 (2000), pp. 925-933; and for a compilation of many of Zilsel's papers, some of which had never been published, see Edgar Zilsel, *The Social Origins of Modern Science,* Diederick Raven, Wolfgang Krohn, and Robert S. Cohen, eds., (Boston: Kluwer Academic Publishers, 2000). To the best of my knowledge Zilsel did not use the phrase "scientific revolution."

respect to key areas of expertise, that "it is probably fair to say that the native can teach us more than we can teach him."[42]

There is a profound need to analyze the myriad ways Africans participated in scientific work, but this has to be done judiciously and without exaggeration. A thoughtful recent example is an article by Nancy Jacobs on the relationship between ornithologists and research assistants, in which she concentrates on their intimate interactions.[43] Another is Patrick Harries' extraordinarily detailed study of the fieldwork of the Swiss missionary ethnographer, Henri Junod.[44] To refer to Africans as "invisible technicians" in every situation could limit our understanding of these exchanges and runs the risk of overstating patterns of interdependence. Some disciplines and scientific problems lent themselves more easily than others to conceptual interchange, borrowing, and appropriation. The same is also true of individuals: some professionally trained scientists (as well as colonial administrators) were simply more open and accommodating to different points of view and cultural influences than others, for reasons that need to be carefully explored. If we look only for evidence that shows epistemic and practical influences between Africans and outsiders – or for exclusions and pejorative attitudes – we might end up collapsing significant differences in epistemic cultures that ought to be interrogated. (This is of course something Africanist scholars have been preoccupied with for decades.) When European actors boasted of the special tools "science" gave them, they may have been intoxicated and deluded by their own hubris, but they were not entirely wrong. There were many European arenas of expertise, which had no parallels in African societies and vice versa. The areas where there were the greatest degree of

[42] H.R. Hosking, "The Improvement of Native Food Crop Production by Selection and Breeding in Uganda," *East African Agricultural Journal*, v. 4 (1938), pp. 84-88, quotation on p. 84.
[43] Nancy Jacobs, "The Intimate Politics of Ornithology in Colonial Africa," *Comparative Studies in Society and History* v. 48 (2006), pp. 564-603.
[44] Harries, *Butterflies and Barbarians*.

exchange and conflict were in the environmental, medical, and human sciences, which is what makes these fields so appropriate for further analysis.

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The idea of Africanizing science, however, has other connotations, which Part III also explores. For the purposes of this book, it means considering the disciplines and professions that were deemed most appropriate for African "development" and state-building. Prior to the Second World War, for example, there were not many specialists in the physical sciences employed by British colonial states in tropical Africa.[45] Nor were many institutes that specialized in the study of astronomy, physics, or even engineering drawn into the process, although such experts clearly took advantage of colonial arrangements to pursue their theories.[46] When a hydroelectric engineer, Douglas Spencer, approached the Colonial Office in 1927 with a proposal to form "an 'Institution of Imperial Development'" comprised of the six leading engineering societies in the country, in order to "to see on what lines the various forms of Engineering can co-operate with Science towards a speedier Imperial Development," no one seemed to know how to reply.[47] Although engineering societies had yet to unite around the question of Africa *or* development, the staff saw no need to encourage the undertaking. "I don't think it is an engineering problem," wrote one official, "but an economic one that Mr. Spencer is

[45] To be clear, this does not include South Africa or Egypt; I do not know whether this claim holds true for Francophone or Lusophone Africa during the same period.

[46] See the brief discussion of French West Africa in the development of theories of simultaneity in Peter Galison, *Einstein's Clocks and Poincaré's Maps: Empires of Time* (New York: Norton, 2003), pp. 175-180; mapping, telegraphy, and railway construction clearly required expertise in the physical sciences, but the point I'm making here is that metropolitan societies and institutes in these fields did not join the "mission civilisatrice" in the African colonies to the extent that other specialists did. The Royal Society and the RGS did, however, sponsor a Cambridge University geophysicist, E.C. Bullard, to undertake gravity measurements along the Rift Valley in the mid-1930s; see E.C. Bullard, "Gravity Measurements in East Africa," *Philosophical Transactions of the Royal Society of London Series A* v. 235 (1936), pp. 445-531.

[47] This language stems from two different letters; see Douglas Spencer to Secretary of State for the Colonies and Dominions, 20 July 1927; and Spencer to Under Secretary of State, 19 Dec 1927, CO 323/983/8 – "Electricity and Colonial Development, 1927," BNA; the institutions Spencer mentioned by name were "The Institution of Civil Engineers; the Institution of Electrical Engineers; the Institution of Mechanical Engineers; the Institution of Mining Engineers; the Institution of Chemical Engineers; and the British Electrical and Allied Manufacturers Association."

proposing to find a means of solving." "The scheme is most wooly," agreed another, "and I should have thought that we have a sufficient number of organisations already for boosting Imperial Development." In the end, William Ormsby-Gore, then Under-Secretary of State for the Colonies, agreed with these assessments and the matter was allowed to drop.[48] This helps to explain why the African Research Survey never took up the question of engineering despite the fact that there were hundreds of engineers employed in the colonial territories.[49] (Appendix I) It also places in a new light the comment made by British soil specialists Jacks and Whyte in their influential book, *The Rape of the Earth*, that "mastery over tropical soils must be secured with the help of the ecologist rather than of the engineer or chemist."[50] Not until 1945 was a unified Colonial Engineering Service established and only after the Second World War did large-scale hydroelectric and "development engineering" projects of the sort Spencer proposed come to pass.[51] The question the following chapters examine is just why and how such fields as ecology, anthropology, demography, nutrition, geography, and epidemiology, among others, came to be seen as so crucial for British colonial development in tropical Africa. This disciplinary nexus was by no means a foregone conclusion as those with experience in or familiarity with other colonized regions of the world could attest.

The phrase "Africanizing science" also draws attention to the ways the African continent itself was turned into an object of scientific analysis. Forests, soils, rivers, lakes, mountains, deserts, and even the climate itself all underwent scientific

[48] O.C.R. Williams minute 11 August, 1927; C.S. minute, 12 August, 1927; Ormsby-Gore minute 19 August, 1927, CO 323/983/8.

[49] One of the reviewers of E.B. Worthington's early drafts of *Science in Africa* did comment that he "miss[ed] a chapter on Engineering Works for Water Supply, Irrigation, Harbours or Water-power which seems to me to have as close a bearing on Science as has, for instance, Fisheries and Food preservation," but this was never included. Dr. Hugh Robert Mill, excerpt of comments, no date, LP, GD40/17/127.

[50] G.V. Jacks and R.O. Whyte, *The Rape of the Earth: a World Survey of Soil Erosion* (London: Faber and Faber, 1939), p. 250.

[51] One of these was the Kariba Dam project on the Zambezi River (affecting both Zimbabwe and Zambia), built between 1955 and 1959; it remains the largest dam, in terms of reservoir capacity, in all of Africa. Social and environmental historian, JoAnn McGregor, is currently writing a book on this history.

scrutiny during the colonial period to varying degrees. While the research might have left a light footprint in terms of its intensity – there were far more scientists active in South Africa, for instance, than there were across *all* of British tropical Africa – it still had lasting effects on how people thought about these physical features. "Forests in Africa," Julian Huxley wrote in a report prepared for UNESCO in 1961, "should be conserved not merely for timber-production and watershed protection, but as being among the chief attractions of a National Park system, as well as providing natural laboratories for ecological study."[52] The Albert National Park, founded in the Belgian Congo in 1925, was an exemplary manifestation of what Huxley envisaged. It was also, as it happens, an illustration of the transnational tendencies in colonial management: its 18 member scientific commission included representatives from Britain, France, Belgium, the Netherlands, Sweden, and the United States. The Belgian Ambassador to the U.S. described it, in 1925, as a "new experiment – the first of its kind in Central Africa." The Park would be "a sanctuary where both animals and plants and natural scenery may be preserved and where scientists from all over the world may eventually come to study the flora and fauna of Africa in their original and natural surroundings."[53]

This kind of thinking had expected precedents in Europe and North America, yet there were also important differences. Fifty years earlier, for instance, very similar language was used to describe the importance of Yellowstone National Park, which was presented as a "valuable laboratory and conservatory of science." Its founders were less concerned with "world" access, however, and more concerned with the needs of their own nationals. They also included a wider spectrum of

[52] Julian Huxley, *The Conservation of wild life and natural habitats in Central and East Africa* (Paris: UNESCO, 1961), p. 54.
[53] Baron Cartier de Marchienne, Belgian Ambassador, to President of Carnegie Institution and Vice President of National Academy of Sciences, Dr. Merriam, April 23 1925 quoted in "A National Park in the Belgian Congo," *Science* v. 61 (Jun 1925), pp. 623-624, on p. 623.

disciplines that would be relevant to the Park. Besides offering opportunities for research in zoology, botany, geology, and meteorology, Yellowstone would also be:

> a laboratory of physics in which [the scientist] may observe on a large scale the action of the various forces of attraction and repulsion and new illustrations of the correlation and conservation of energy . . . He will find the laws of crystallization exemplified in forms novel and instructive, and will doubtless witness many new and varied phenomena of heat, light, and electricity. The chemist [too] will interest himself in problems of analysis and synthesis, in the processes of evaporation, condensation and solution, and the chemical changes incident thereto.[54]

There were not many laboratories in the United States in the last third of the nineteenth century that could facilitate this kind of transdisciplinary and comprehensive research. Field sites, such as Yellowstone, were therefore promoted in these terms.

As we have seen in Parts I and II, however, the bulk of tropical Africa had been characterized as an arena for transdisciplinary research and supranational coordination even before the European partition of Africa was complete. When game reserves and national parks began to be established at the turn of the twentieth century, imperial coordinators often saw them as just one piece of this larger puzzle.[55] A key issue that underpinned their foundation was a widespread concern with species extinction: it is very difficult to explain the enduring interest in creating such reserves unless we also understand the specialist debates taking place in metropolitan centers on just this subject.[56] That helps to account for why the Colonial Secretary, Lord Crewe, declared after receiving a deputation from the British Society for the Preservation of the Wild Fauna of the Empire in 1909, that

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[54] Theo Comstock, "The Yellowstone National Park," *The American Naturalist* v. 8 (Feb., 1874), pp. 65-79, on p. 71.

[55] The first volume of the *Journal of the Society for the Preservation of Wild Fauna of the Empire* (JSPWFE) founded in 1904, was devoted to British African game reserves.

[56] Chapter 2 included some examples of these concerns; for three others see E. North Buxton, "The Preservation of Big Game in Africa," *Journal of the Society of Arts* v. 51 (1903), pp. 566-578; P.L. Sclater, "On the Best Mode for Preserving the Existence of the Larger Mammals of Africa for Future Ages," *JSPWFA* v. 2 (1905), pp. 46-50; Edward North Buxton, "The Preservation of Species in Africa," *African Affairs* v. 20 (1920-21), pp. 279-283 and [discussion] 287-298. For the broader context and background, see MacKenzie, *Empire of Nature*.

> I quite understand, of course, that your Society is in effect a scientific Society. It is not with you simply a question of preserving game for sportsmen, although that is a side of the matter in which many members no doubt take interest; but you are here, as I say, as a scientific Society, in the main, and it is on those lines and in those interests that you wish us to help you.[57]

He might have added that it was also an African society since its members were initially most interested in that part of the world.[58] Without doubt, aristocratic sportsmen could use scientific arguments to serve their social and economic interests. As Roderick Neumann has argued, this allowed them to set-up veritable playgrounds for the rich in tropical Africa in ways that were becoming increasingly difficult in Britain itself.[59] Yet, as Lord Crewe recognized, this was not all they were doing, nor was it their only motive.

By 1933, the year statesmen negotiated a second significant international "Agreement on the Preservation of the Flora and Fauna of Africa" in London, more than one hundred reserves and parks had been established across the tropical African territories.[60] Many of these were sparsely staffed and, in places, barely worthy of the name. In fact, several historians of African conservation efforts have recently noted that not much systematic scientific research was even taking place in (British) Africa's parks and reserves before the Second World War.[61] While this is an empirically true observation, if we are concerned only with counting actual scientific staff allocated to the reserves, it overlooks the fact that colonial states and their imperial masters were coordinating research from a distance. Albert National Park

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[57] "Minutes of a Deputation from the Society for the Preservation of the Wild Fauna of the Empire to Lord Crewe, February 26, 1909," *Further Correspondence relating to the Preservation of Wild Animals* (London: HMSO, 1910) [Cd. 5136], p. 21.

[58] See, for instance, the numerous articles on Africa (as well as medicine, disease, and extinction) in the first five volumes of the *Journal of the Society for the Preservation of the Wild Fauna of the Empire* (1904-1909).

[59] Roderick P. Neumann, "Dukes, Earls, and Ersatz Edens: Aristocratic Nature Preservationists in Colonial Africa," *Society and Space* 14 (1989): 79-98.

[60] This includes French and Belgian territories as well; Elisabeth Hone, *African Game Protection: An outline of the existing game reserves and national parks of Africa* (American Committee for International Wild Life Protection, 1933); this number does not include the 16 reserves and parks located in South and South West Africa, which would bring the sub-Saharan total to 117.

[61] Neumann, "The Post-War Conservation Boom in British Africa"; Carothers, forthcoming article.

was one such large-scale, supranational "experiment," but so too were the international agreements themselves. As Article 2 of the 1933 Convention spelled it out, African national parks would be

> set aside for the propagation, protection and preservation of wild animal life and wild vegetation, and for the preservation of objects of aesthetic, geological, prehistoric, historical, archeological, or other scientific interest for the benefit, advantage, and enjoyment of the general public, in which the hunting, killing or capturing of fauna and the destruction or collection of flora is prohibited except by or under the direction or control of the park authorities.[62]

Africa had already been set-up to be its own virtual scientific laboratory: the reserves and parks fed into and perpetuated this tradition. Indeed their existence drew outsiders' attention to the continent's unique flora and fauna and helped to ensure that its primates, including chimpanzees, gorillas, and bonobos, as well as crocodiles, giraffes, elephants, lions, hippos, zebras, and rhinos became iconic symbols of sub-Saharan Africa to the rest of the world. This was by no means a benign legacy, as studies of the human consequences of conservation have shown, but for anyone who takes extinction seriously it at least brought into policy circles the "wicked problem" of species coexistence.[63] The British Government, in fact, was fully aware – at least on paper – of the challenges it faced in balancing preservation needs with "the increasing needs of the native populations for agricultural land, especially in the more densely populated territories," which is why it decided to "proceed more slowly" in creating national parks until "careful study [had been] given to the best means of overcoming certain difficulties which arise."[64]

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[62] *International Convention for the Protection of Fauna and Flora [in Africa], London, November 8, 1933* (London: HMSO, 1936) [Cmd. 5280], p. 6; the Convention was effective as of the 14th January 1936.

[63] Roderick Neumann, *Imposing Wilderness: Struggles over Livelihood and Nature Preservation* (Berkeley: University of California Press, 1998); Dan Brockington, *Fortress Conservation: the Preservation of the Mkomazi Game Reserve, Tanzania* (Oxford: International African Institute, 2002); the concept of "wicked problems," which includes the precept that they has no definitive solution, comes from Horst Rittel and M. Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences* v. 4 (1973), pp. 155-169; Jeffrey Conklin, *Dialogue Mapping: Building Shared Understanding of Wicked Problems* (Hoboken, NJ: Wiley, 2006); my thanks to Arnold Schultz at UC-Berkeley for first introducing me to this literature when I served as his teaching assistant in 1995 and 1996.

[64] "Memoranda submitted by the Government of the United Kingdom of Great Britain and Ireland on the Action Taken By Them to Give Effect to the Provisions of the Convention," Annex 4 in *Second*

In much the same vein, geological formations including the Rift Valleys and Mount Kilimanjaro not only became tourist destinations during the colonial period, but also points of scientific interest. Harry Johnston's and John Gregory's research in these areas in the eighteen-eighties and nineties, respectively, started a long-standing tradition of scientific fieldwork.[65] Kilimanjaro, and the arc of mountains to which it is connected, was recently called by conservation scientists a "biological hot spot" which contained "the highest density of endangered animals anywhere on earth," while the Rift System was recently referred to as "Africa's most interesting continental-scale land-form" in which "research methods . . . [and] modern team projects are multidisciplinary in their approach."[66] With the ascendancy of plate tectonic theories, which had originally inspired Jan Smuts to call Africa the great continental divide, geophysicists have also recently noted that "Africa has become something of a test-bed for tectonic and geomorphic models over the past decade or so."[67] Even its human populations, considered *en masse*, encouraged demographers to question the underlying methods and assumptions of their discipline in new ways. As historical demographer John Caldwell noted when he reviewed the effects colonialism had on population levels: "From the mid-1950s large-scale demographic surveys were carried out in greater numbers in Africa than anywhere else in the world

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International Conference for the Protection of the Fauna and Flora of Africa London, May, 1938, Final Act (London: HMSO, 1938), pp. 128-135, on p. 129. The Government also declared that it was not opposed to the idea (p. 130) "that a national park should be inhabited by natives," but that habitation "should not be such as on the one hand to interfere with the general policy of game preservation within that area or on the other hand to necessitate serious interference with the rights of these natives in the interests of game preservation."

[65] It was well-known at the time of Johnston's 1885-86 expedition that German naturalists were also prominent in this work and continued it once Germany took possession of Tanganyika (German East Africa). See Harry H. Johnston, *The Kilima-Njaro Expedition: a Record of Scientific Exploration in Eastern Equatorial Africa* (London: Paul, Trench and Co, 1886); JohnWalter Gregory, *The Great Rift Valley: Being a Narrative of a Journey to Mount Kenya and Lake Baringo, with some account of the geology, natural history, anthropology and future prospects of British East Africa* (London: J. Murray, 1896).

[66] Carl Zimmer, "A Biological Hot Spot in Africa. With New Species Still to Discover," the *New York Times* March 6, 2007; N.D. Burgess et al, "The Biological Importance of the Eastern Arc Mountains of Tanzania and Kenya," *Biological Conservation* v. 134 (2007), pp. 209-231 [this is a special issue on "Conservation in Areas of High Population Density in Sub-Saharan Africa"]; Celia Nyamweru, "The African Rift System," in W.M. Adams, A.S. Goudie, and A.R. Orme, eds., *The Physical Geography of Africa* (Oxford: Oxford University Press, 1996), pp. 18-33, on p. 24.

[67] Michael Summerfield, "Tectonics, Geology, and Long-Term Landscape Development," in Adams et al, *The Physical Geography of Africa*, pp. 1-17, on p. 1.

. . . to an extent that the challenge of African data has revolutionized methodology in demography."[68] (The same challenges, especially in terms of oral history, have arguably also revolutionized historical methods.) Issues of scale and control as well as interdisciplinary and transnational methods clearly remained salient for scientists throughout the colonial period, and even after, as they turned different facets of the continent into scientific objects of analysis.

If scientists were unable to go to Africa, however, Africa could be brought to them. Organisms unique to the continent, such as tsetse flies and certain species of trypanosome, found their way into laboratories around the world. This was not simply a matter of African objects *on display* – as was predominantly the case in museums and zoos – but of the circulation of material expressly and often solely for scientific research.[69] Africanizing science, in this case, was a subtle and gradual process that began because people were concerned with sleeping sickness epidemics and ended with the organisms themselves becoming a "model" for the study of protozoa.[70] In a striking example of the continued tradition of auto-critique, David Molyneux, of the Liverpool School of Tropical Medicine, recently lamented the "failure of science" in the control of African trypanosomiasis:

> There is probably more information about the biochemisty and molecular biology of [African] trypanosomes than any other non-mammalian cell type and a great deal is known about the differences between trypanosomes and mammalian cells, but there is no new therapeutic product . . . Why will scientists not admit that they are

[68] J.C. Caldwell, "The Social Repercussions of Colonial Rule: Demographic Aspects," in Adu Boahen, ed., *Africa Under Colonial Domination 1880-1935* (Berkeley: University of California Press, 1985), pp. 458-486, on p. 462; for a bibliography of examples and a discussion of the methodological challenges see, for instance, Frank Lorimer, William Brass, and Etienne van de Walle, "Demography," in Robert Lystad, ed., *The African World: a Survey of Social Research* (New York: Praeger, 1965), pp. 271-303.

[69] Both museums and zoos encouraged research as well, but their display function was paramount to their existence. See, for instance, Annie Coombes, *Reinventing Africa: Museums, Material Culture, and Popular Imagination in Late Victorian and Edwardian England* (New Haven: Yale University Press, 1995).

[70] Research into the history of model organisms in the biosciences is relatively recent; see Angela Creager, *The Life of a Virus: the Tobacco Mosaic Virus as an Experimental Model, 1930-1965* (Chicago: University of Chicago Press, 2002); and Robert Kohler, *The Lords of the Fly: Drosophila Genetics and the Experimental Life* (Chicago: University of Chicago Press, 1994).

> simply fascinated by the organism and admit that the studies they propose won't have any public health impact?[71]

Similar structures were in place to allow for the circulation from Africa to elsewhere of botanical and zoological specimens, blood samples, soil profiles, mineral deposits, and more recently genetic data.[72] These material flows, while initially facilitated by colonial states and imperial apparatus, were often quickly divorced from such structures once the "scientific objects" were in another site. African-based specialists and institutions, especially in South Africa, tried, during the colonial period, to maintain mastery over this material, often initiating or taking part in some of the earliest studies, but they could never achieve a monopoly. It thus gradually became possible to make one's career out of African materials and to never once step foot on the African continent.[73] This was something that would have been almost unimaginable in 1890, but which was eminently possible by 1950. The actual magnitude of this phenomenon, however, remains an open question. It would probably be misleading to suggest that a large number of scientists built their careers in this way. I suspect that the actual figures were relatively low since there were not many "model" organisms or objects of analysis in circulation that were unique to tropical Africa. (Individuals who undertook pharmaceutical testing, of the sort done at the University of Edinburgh and the Imperial Institute, or parasite analysis at the Schools of Tropical Medicine, probably provide the majority of the British examples.) Yet there were numerous scientists within European and North

[71] D.H. Molyneux, "African Trypanosomiasis: Failure of Science and Public Health," in Samuel Black and J. Richard Seed, eds., *The African Trypanosomes* (Boston: Kluwer Academic Publishers, 2001), pp. 1-10, on pp. 3-4; also see D.H. Molyneux, ed., *Control of Human Parasitic Diseases* (Amsterdam: Elsevier, 2006).

[72] Earlier chapters have offered examples of the circulation of botanical and mineral samples; for blood group research see, for instance, CO 847/8/2 "African Research: Survey of the Blood Groups of African Natives by Dr. Ronald Elsdon-Dew, 1937," [Elsdon-Dew was an assistant pathologist at the South African Institute for Medical Research], BNA; also the panel on "blood groups and race" at the 1934 Anthropological Congress; Edwin Smith's 1935 RAI speech; and the special committee established by the Royal Anthropological Institute in 1951, File 91/1/1 "Blood Groups and Anthropology, 1951" RAI Archives. The latter committee made very clear, however, that samples and data from Europe and North America *far out-weighed* material from anywhere else.

[73] With the ascendancy of interest in genetic mapping and genome studies it seems likely that more people today than in the colonial era actually use samples from African sites without ever going there.

American laboratories whose quotidian research included African materials, but who never did any work on site.

With the introduction of computer modeling, global information systems, and even more thorough aerial surveys, in the last several decades, distinctions between field and laboratory sciences are being broken down and reconfigured. This actually makes it easier, not harder, to study African objects theoretically and from a distance. The years and even decades of "foot safari" that technical officers during the colonial period pursued probably have few parallels in the present day even if one is a scientist based permanently in tropical Africa. One could argue, in fact, that colonial field officers' proximity to the land and constant contact with peoples in their environs enabled a kind of *vernacular science* that is actually increasingly difficult to produce in the present-day.

I revisit these questions briefly in the epilogue, "Laboratory Redux," but for now we need to go back in time and ask just how these different dynamics played out within colonial states and across British Africa more generally. This will require close attention not only to the politics of knowledge, including disciplinary, institutional, and personal relations, but also to the fault lines of science and empire, which such interactions made visible. In the following chapters, it will be important to determine just how officials and scientists selected their sites for research and defined their objects of study. Why, in other words, were some kinds of research undertaken in Northern Rhodesia, but not in Kenya and vice versa; and why were some objects of study pursued in Tanzania and Nigeria, but not in the Sudan? How did pan-African scientific conferences in South Africa and inter-imperial coordinating conferences in East and West Africa, as well as in Paris and London, influence developments throughout Africa as a whole? And what was the relationship between settler and non-settler states and also between state-sponsored and semi-autonomous research institutions? These are far-reaching questions, so I would not

want to suggest that I am able to offer all-encompassing answers. I do wish to highlight, though, that the cases I have selected were central to inter-imperial and scientific debates in the colonial period (circa 1900-1960). Many of these examples, not coincidentally, also tie back to questions considered by the African Research Survey and later by the Scientific Council for Africa South of the Sahara.