ARCHITECTS OF NATURE:
ENVIRONMENTAL INFRASTRUCTUR AND THE NATURE-CULTURE DICHOTOMY

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CONTENTS

LIST OF MAPS

PREFACE

This study is the fruit of a bountiful environment that has been fertilized by many. The tree that bore it has its taproot at Wageningen University. I am grateful to the Social Science Research Council, New York for allowing me to use part of my doctoral dissertation fellowship to study tropical agriculture, forestry, and environmental sciences at Wageningen. There, Professor Adriaan van Maaren seeded the idea for a forestry dissertation. Promotor Professor Marius Wessel and Co-promotor Dr. Freerk Wiersum provided intellectual guidance and challenged me to prune what initially began as a bush of information into a cultivated dissertation. The Department of Forest and Nature Conservation Policy at Wageningen University and the CERES Research School for Resource Studies for Development supplied me with a Summer Fellowship and research funding, which allowed me to work closely with advisers and colleagues at Wageningen University.

Other roots are embedded at Yale University, where Professors Robert Harms, James Scott, and the late Robin Winks triggered my interest in the dynamics of environmental change. At Ogongo Agricultural College in Namibia, Haveeshe Nekongo, Arne Larssen, Carlos Salinas and their colleagues and students contributed greatly to the project, not in the least through assisting in developing and administering the OMITI household survey. The support of the Namibian Directorate of Forestry, the Dutch Embassy in Namibia, and IBIS-Denmark made the OMITI survey financially and logistically possible.

The informal and formal discussions with inhabitants of the historical region of Ovamboland, Namibia, were also invaluable. Their generous efforts to educate me about the region's environment was greatly facilitated by Jackson Hamatwi's linguistic skills and his intimate knowledge of Ovamboland's bush trails. Many in Namibia welcomed me in their homes and shared their ideas with me in addition to the elders who I interviewed. I would especially like to thank Dr. Peter and Jane Katjavivi, Bishop and Sally Kauluma, the late Michael Hishikushitja, Father Hamutenya of Odibo, and Joseph Hailwa, the Director of the Department of Forestry.

Princeton University provided the nurturing environment where the study came to fruition. My colleagues from the department of history and the Princeton Environmental Institute provided critical feedback and support. I was also fortunate to be afforded the opportunity to present my findings to fora of colleagues through the

CERES Research School for Resource Studies for Development and the African Studies Association. Various archives, including those of the Holy Ghost Congregation in Paris, France, the United Evangelical Mission in Wuppertal-Barmen, Germany and especially the National Archives of Namibia provided rich soil. The late Brigitte Lau and Werner Hillebrecht, respectively the former and the current director of the National Archives of Namibia, were immensely helpful.

Light is critical to creating and sustaining physical and intellectual life. I am grateful to my parents, my teachers, and my fellow students for instilling me with a love for study and to my grandparents Paulus and Adriana Tak for instilling in me a love for the land. My father, Hermanus Kreike passed away before I could complete and defend the dissertation but I know he is with me in spirit. My children Hermanus Clay and Eleanora Grace, and, above all, my spouse Dr. Carol Lynn Martin are my sun and moon. It is to Carol that I dedicate this study.

CHAPTER 1
PARADIGMS OF ENVIRONMENTAL CHANGE

Concern for environmental degradation has rapidly increased since the late 1960s. Tropical deforestation has been especially highlighted. Various recent studies, however, including those of Fairhead and Leach for West Africa, have questioned the unequivocal emphasis on deforestation.[1] Moreover, other studies have argued that the focus on deforestation obscures the issue of the type of forest replacement systems that are developed, and the extent to which these systems display the environmental characteristics of the vegetation that they have replaced.[2]

This study argues that while each of the dominant paradigms that currently are employed to analyze environmental change, that is, the modernization, the declinist, and the inclinist paradigms, offer critical insights into the dynamics of environmental change, they do not fully capture the intricacies of Human-Nature interactions. Rather, the paradigms tend to portray environmental change as a linear event, with environmental change as a singular process with a singular outcome. The study argues that because the paradigms tend to be treated as competing and mutually exclusive models, they create paradoxes about the process of environmental change. They do not explain, for example, the presence of urban ruins in pristine forests in Palenque, Mexico, or the occurrence of simultaneous processes of deforestation and reforestation in, for example, Ovamboland, Namibia, giving rise to respectively, the Palenque Paradox and the Ovambo Paradox.

In addition, many studies of environmental change focus exclusively on a specific type of natural resource, e.g. vegetation, fauna, soil, or water. Tropical deforestation, for example, is often attributed to population growth that results in either a higher demand for forest products and subsequent overexploitation, or to an increased conversion of forests into agricultural lands. Moreover, the interactions between changes in vegetation, fauna and hydrological conditions and how these

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[1] J. Fairhead and M. Leach, Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic (Cambridge: Cambridge University Press, 1996).

[2] A.B. Henkemans, G.A. Persoon, and K.F. Wiersum, "Landscape Transformations of Pioneer Shifting Cultivators at the Forest Fringe," K.F. Wiersum, ed., Tropical Forest Resource Dynamics and Conservation: From Local to Global Issues (Wageningen: Wageningen Agricultural University, 2000), pp. 53-69; K.F. Wiersum, "Use and Conservation of Biodiversity in East African Forested Landscapes," P.A. Zuidema, Tropical Forests in Multi-Functional Landscapes: Proceedings of Two Seminars Organised by the Prince Bernard Centre for International Nature Conservation, Utrecht University, in Collaboration with the Dutch Association for Tropical Foresters, held in Utrecht, 2 December 2002 and 11 April 2003 (Utrecht: Utrecht University, 2003), pp. 33-39.

changes are related to the quality rather than the sheer quantity of human actions has been relatively understudied.

This study aims to assess the current paradigms of environmental change, using the history of environmental change in Ovamboland, Namibia, from the late 1800s to the late 1900s as a case study. The study emphasizes the process(es) of environmental changes in Ovamboland: how, when, why, by whom or what and for whom or what did what changes take place, and how did these changes affect society, environment, and the interface between the two, and with what feedback?

Paradigms of Environmental Change

Three contemporary paradigms that are key to the analysis of environmental change in Ovamboland include the modernization paradigm, the declinist paradigm, and the inclinist paradigm.[3] The declinist paradigm is pessimistic concerning the future of the environment. In contrast, the modernization paradigm and the inclinist paradigm are marked by optimism that economic and/or population growth can be combined with environmental improvement (or stabilization). All three paradigms, however, are analytical categories; they are neither static nor discrete. They are not static because they are continuously being reproduced.[4] They are not discrete because the borders between the paradigms are not alwaysdistinct; these contesting worldviews nevertheless shape and influence one another.

The Modernization Paradigm

The Modernization paradigm posits environmental change as a progression from a primitive state of Nature to an advanced state of Culture, resulting in an environment that is controlled through the state and exploited in a rational scientific manner.[5] The tools and objectives of modernization are seen to be western science,

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[3] Paradigm is used here in the meaning of worldview. For definitions, see K.F. Wiersum, Social Forestry: Changing Perspectives in Forest Science or Practice? (Wageningen: Wageningen Agricultural University, 1999), pp. 8-15.

[4] Sivaramakrishna argues that scientific and technical discourses are shaped by their historical contexts and that environmental discourses as a result are continuously in production. The implications are that if the paradigms are continuously being produced, then it is also difficult to pinpoint a clear paradigm shift. See K. Sivaramakrishna, "State Sciences and Development Histories: Encoding Local Forestry Knowledge in Bengal, M. Doornbos, A. South, and B. White, eds., Forests: Nature, People, Power (Oxford, UK: Blackwell, 2000), pp. 61-88.

[5] P. Richards, Indigenous Agricultural Revolution: Ecology and Food Production in West Africa (London: Hutchinson: Boulder, Co.: Westview Press, 1985), pp. 31-40; P. Blaikie and H. Brookfield, Land Degradation and Society (London: Methuen, 1987), pp. xviii-xix. See also C. Merchant,

modern "westerners," and the species they had domesticated or adopted. A measure of accompanying environmental degradation was thought to be an acceptable price for progress.[6]

The main objective of conservation was to prevent the irrational and wasteful use of natural resources and to protect wildlife and forest resources from "primitive" western and non-western farmers and pastoralists.[7] In 1930s British colonial East Africa, the administration became increasingly convinced of the necessity of direct intervention in African land use.[8] Colonial officials and experts viewed "the natives" as potential sources of pollution and disease, who also abused or underutilized the land. Consequently, the local indigenous population should not have any rights whatsoever to lands that they did not inhabit or cultivate. This characterization legitimized alienating as state land of vast expanses of fallow, pasture lands, and

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Reinventing Eden: The Fate of Nature in Western Culture (New York: Routledge, 2003), pp. 20-186; C. Merchant, Ecological Revolutions: Nature, Gender, and Science in New England (Chapel Hill and London: The University of North Carolina Press, 1989; K. Thomas, Man and the Natural World: Changing Attitudes in England, 1500-1800 (New York and Oxford: Oxford University Press, 1996 [first published 1983]), especially pp. 17-50; R.H.Grove, Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism 1600-1860 (Cambridge: Cambridge University Press, 1997 [first published 1995]); T.J. Bassett and D. Crummey, eds., African Savannas: Global Narratives and Local Knowledge of Environmental Change (Oxford: James Currey: Heinemann, 2003), pp. 13-15 and the chapter by M. Saul, J.-M. Ouadba and Q. Bognounou, "The Wild Vegetation Cover of Western Burkina Faso: Colonial Policy and Post-Colonial Development," p. 126; D. Worster, Dust Bowl: The Southern Plains in the 1930s (Oxford: Oxford University Press, 1982 [first published 1979]), pp. 182-229; and R. White, The Organic Machine: The Remaking of the Columbia River (New York: Hill and Wang, 2000 [1995]), 59-88.

[6] Game was exterminated in colonial Zimbabwe to protect livestock ranching, see R. Mutwira, "A Question of Condoning Game Slaughter: Southern Rhodesian Wildlife Policy, 1890-1953," Journal of Southern African Studies, vol. 15, no. 2 (1989), pp. 250-262.

[7] See D. Anderson, and R. Grove, eds., Conservation in Africa: People, Policies and Practice (Cambridge: Cambridge University Press, 1987), especially pp. 1-12; J.M. MacKenzie, ed., Imperialism and the Natural World (Manchester: Manchester University Press, 1990); J.M. MacKenzie, The Empire of Nature: Hunting, Conservation and British Imperialism (Manchester: Manchester University Press, 1988); Grove, Green Imperialism; J. Carruthers, The Kruger National park: A Social and Political History (Pietermaritzburg: University of Natal press, 1995). On soil conservation, see, for example, P.A. Maack, "'We Don't want Terraces!' Protest and Identity under the Uluguru Land Usage Scheme," and J. Monson, "Canoe Building under Colonialism: Forestry and Food Policies in the Inmen Kilombero Region, 1920-1940," G. Maddox, J. Giblin, and I.N. Kimambo, eds., Custodians of the Land: Ecology & Culture in the History of Tanzania (London: James Currey, 1996), pp. 152-170 and 200-212 respectively and K.B. Showers, "Soil Erosion in the Kingdom of Lesotho: Origins and Colonial Response, 1830s-1950s" Journal of Southern African Studies, vol. 15, no. 2 (1989), pp. 263-286. On colonial discourses, see A.F.D. Mackenzie, "Contested Ground, Colonial Narratives and the Kenyan Environment, 1920-1945," Journal of Southern African Studies, vol. 26, no. 4 (2000), pp. 697-718.

[8] D. Anderson, "Depression, Dust Bowl, Demography, and Drought: The Colonial State and Soil Conservation in East Africa during the 1930s," G. Maddox, ed., Colonialism and Nationalism in Africa, vol. 2: The Colonial Epoch in Africa (New York: Garland, 1993), pp. 209-231; S. Berry, No Condition is Permanent: The Social Dynamics of Agrarian Change in Sub-Saharan Africa (Madison: University of Wisconsin Press, 1993), pp. 46-54.

forests, as well as hunting and gathering grounds.[9] Some indigenous peoples were seen as part and parcel of Nature ("Stone Age" hunters and gatherers) and as such were conserved with Nature in the reserves and parks that were established during the colonial era. By the 1950s, however, even they were removed from the conservation areas.[10]

To the modern colonial and postcolonial state, forests and trees especially were highly valuable economic resources to be managed and exploited by professional foresters under the aegis of scientific forestry.[11] Tropical rain forests were valuable because they were a source of timber hardwoods.[12] In contrast, other woodlands typically were viewed as wastelands that could and should be transformed into agricultural lands, for example, for the scientific production of sugar cane, cotton, cocoa, tea, coffee or other market crops.[13] Moreover, wilderness expanses offered refuge for outlaws.[14] In practice, however, colonial and postcolonial states frequently

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[9] W. Cronon, Changes in the Land: Indians, Colonists, and the Ecology of New England (New York: Hill and Wang, 1988 [first print 1983]), p. 53. On land alienation, see M. Colchester, "Forest Peoples and Sustainability," M. Colchester and L. Lohmann, eds., The Struggle for Land and the Fate of the Forests (Penang, Malaysia: the World Rainforest Movement, 1995 [first impression, 1993]), pp. 61-95. On the view of Africans as sources of disease, see J. Farley, Bilharzia: A History of Imperial Tropical Medicine (Cambridge: Cambridge University, 1991), pp. 13-20, 130, 137-139.

[10] H.W. Konrad, "Tropical Forest Policy and Practice during the Mexican Porfirato, 1876-1910," H.K. Steen and R.P. Tucker (eds.) Changing Tropical Forest: Historical Perspectives on Today's Challenges in Central and South America (n.p.: Forest History Society, 1992), pp. 123-143. On removals of indigenous people from parks, see M. Colchester, "Forest Peoples and Sustainability," Colchester and Lohmann, The Struggle for Land, pp. 61-95; T. Ranger, "Whose Heritage? The Case of the Matobo National Park," Journal of Southern African Studies, vol. 15, no. 2 (1989), pp. 217-249; E. Kreike, Re-creating Eden: Land Use, Environment, and Society in Southern Angola and Northern Namibia (Westport, CT.: Heinemann, 2004), ch. 7; Merchant, Reinventing Eden, pp. 152-154.

[11] For "conventional forestry" see Wiersum, Social Forestry, pp. 27-36, 54-60; M. Williams, Deforesting the Earth: From Prehistory to Global Crisis (Chicago: University of Chicago Press, 2003), pp. 145-168, 242-275, 383-419; R. Guha, The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya (Berkeley: University of California Press, 1989), pp. 35-61; N.L. Peluso, Rich Forests, Poor People: Resource Control and Resistance in Java (Berkeley: University of California Press, 1994 [first published 1992]), pp. 44-160.

[12] P.B. Tomlinson and M.H. Zimmermann, eds., Tropical Trees as Living Systems (Cambridge: Cambridge University Press, 1978) focus on the tropical rain forest.

[13] Budowski identifies a major shift in how forests were perceived in the 1970s-1980s: previously, conquering the forest was seen as a sign of progress. I would argue that the discourse related to conquering the forests pertains to non-timber forests. See G. Budowski, "Perceptions of Deforestation in Tropical America: The Last 50 Years," Steen and Tucker, Changing Tropical Forest, p. 1 and R.P. Tucker, "The Depletion of India's Forests under British Imperialism: Planters, Foresters and Peasants in Assamand Kerala," D. Worster, ed., The Ends of the Earth: Perspectives on Modern Environmentalism (Cambridge: Cambridge University Press, 1999 [first published 1988]), pp. 118-140. In the 1960s-1970s the Tanzanian authorities encouraged people to convert forest to cropland, G.C. Kajembe, Indigenous Management Systems as a Basis for Community Forestry in Tanzania: A Case Study of the Dodoma Urban and Lushoto Districts (Wageningen: Wageningen Agricultural University Tropical Resource Management Papers, 1994), p. 10.

[14] D. Anderson, "Managing the Forest: The Conservation History of Lembus, Kenya, 1904-63," Anderson and Grove, Conservation in Africa, pp. 249-268, especially pp. 260-261; Williams, Deforesting the Earth, pp. 145-168.

lacked the capacity, the coherence, or the will to enforce their own conservation regulations or to rationally exploit the forest and other natural resources, especially when they were met by fierce resistance from populations that relied heavily on forest access.[15]

The Declinist Paradigm

The Declinist paradigm construes human interference in "pristine" Nature as a disturbance that typically leads to a downward spiraling process of environmental degradation that ultimately may cause the destruction of ecosystem Earth.[16] Some

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[15] D. Anderson, "Managing the Forest: The Conservation History of Lembus, Kenya, 1904-63," Anderson and Grove, Conservation in Africa, pp. 249-268, especially pp. 261-265. See also Guha, The Unquiet Woods and Peluso, Rich Forests. On the limits of colonial enforcement, see J.M. MacKenzie,"Experts and Amateurs: Tsetse, Nagana and Sleeping Sickness in East and Central Africa," MacKenzie, Imperialism and the Natural World, pp. 187-213 and J. Monson, "Canoe Building under Colonialism: Forestry and Food Policies in the Inmen Kilombero Region, 1920-1940," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 200-212, especially 210. On dissenting scientists, see Grove, Green Imperialism, pp. 381-384 and A.F.D. Mackenzie," Contested Ground, Colonial Narratives and the Kenyan Environment, 1920-1945," Journal of Southern African Studies, vol. 26, no. 4 (2000), pp. 697-718. Mandala emphasizes peasant agency, E.C. Mandala, Work and Control in a Peasant Economy: A History of the Lower Tchiri Valley in Malawi, 1859-1960 (Madison: University of Wisconsin Press, 1990), pp. 1-11, 118-131, 127, 133-150. Steinhart argues that game hunting was a hidden subsidy for colonialism and that game preservation was a low priority until the 1950s, E.I. Steinhart, "Hunters, Poachers and Gamekeepers: Towards a Social History of Hunting in Colonial Kenya," Journal of African History, no. 30 (1989), 247-264. Grove points out that western environmental ideas borrowed heavily from non-western concepts, Grove, Green Imperialism, pp. 3, 6-7, 60-61, 3-94, and Berry suggests that Africans ensured that they remained participants in the debate about customary law by offering conflicting interpretations, Berry, No Condition is Permanent, pp. 16, 26-27. Khan shows how Africans contributed to the discussion about conservation in South Africa, see F. Kahn, "Rewriting South Africa's Conservation History: The Role of the Native Farmers Association," Journal of Southern African Studies, vol. 20, no. 4 (1994), pp. 449-516.

[16] See S.C. Chew, World Ecological Degradation: Accumulation, Urbanization, and Deforestation, 3,000 BC-AD 2000 (Walnut Creek: Alatamira Press, 2001) pp. 1, 172, and chapters 2-8; C.B. Cox and P.D. Moore, Biogeography: An Ecological and Evolutionary Approach (Oxford: Blackwell, 2000 [6th ed.; first published, 1973]), pp. 1, 8; G.A. Bradshaw and P.A. Marquet, "Synthesis and Final Reflections," G.A. Bradshaw and P.A. Marquet (eds.), How Landscapes Change: Human Disturbance and Ecosystem Fragmentation in the Americas (Berlin etc.: Springer Verlag, 2003), p. 350; Williams, Deforesting the Earth; D.A. Burey, "Paleoecology of Humans and their Ancestors," T.R. McClanahan and T.P. Young, eds., East African Ecosystems and their Conservation (New York and Oxford: Oxford University Press, 1996), pp. 19-36; S. Misana, C. Mung'ong'o and B. Mukamuri, "Miombo Woodlands in the Wider Context: Macro-Economic and Inter-Sectoral Influences," B. Campbell, ed., The Miombo in Transition: Woodlands and Welfare in Africa (Bogor, Indonesia: CIFOR, 1996), p. 84-96; N. Myers, Deforestation Rates in Tropical Forests and their Climatic Implications (London: Friends of the Earth Trust, 1991 [reprint of 1989 original]); C.J. Jepma, Tropical Deforestation: A Socio-Economic Approach (London: Earthscan, 1995). Woodwell acknowledges that Myers' deforestation rates are too high but stresses that deforestation is severe, see G.M. Woodwell with contributions from O. Ullstein, R.A. Houghton, S. Nilsson, P. Kanowski, E. D. Larson and T.B. Johansson, B. Kerr, Forests in a Full World (New Haven: Yale University Press, 2001), pp. 18-23. For a history of the declinist paradigm, see Merchant, Reinventing Eden, especially pp. 187-203. Chew stresses that environmental concerns are neither a recent invention, nor a Western monopoly, see Chew, World Ecological Degradation, chapter 9. Pimentel sees modern industrial society as unsustainable, D. L. Pimentel, Westra, R.F. Noss (eds.), Ecological Integrity: Integrating Environment, Conservation, and Health (Washington, D.C. & Covelo, Calif.: Island Press, 2000), pp. 3-7. On soil erosion, see A. Young, Agroforestry for Soil

authors have emphasized the continuity between the modernist and declinist paradigms: both highlight the threat of environmental decline.[17] The declinist paradigm, however, differs fundamentally from the modernization paradigm in that it identifies modernity itself as the major cause of environmental decline. Even the neo-Malthusian "population bomb" argument ultimately can be understood as having been caused by modern science: western medicine brought mortality rates down so radically that population growth soon outpaced food production.[18] This idea is pronounced not only in studies that focus on modern western industrial society, but also in historical studies of environmental change in Africa, Asia, and (Native) America.[19] Many historians who focus on environmental and/or agricultural change in the non-western world have written from a declinist perspective.[20] They argue that the modern western economy (including capitalism, market forces, commodification of natural resources and labor) caused overexploitation (for example, overhunting elephant, bison, beaver, and tiger) or the diversion of precious land and labor away from food production and local resource management, resulting in malnutrition and famines.[21] The introduction of commercial crops or livestock, at times forced, as in

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Management (Wallingford, UK: CAB International, 1997 [first edition 1989]), pp. 23-24. Woodwell emphasizes that deforestation is not only about fewer trees but also about biotic impoverishment and greenhouse emissions because forests are major carbon sequesters and deforestation releases CO2 and carbon in the atmosphere, G.M. Woodwell with contributions from O. Ullstein, R.A. Houghton, S. Nilsson, P. Kanowski, E. D. Larson and T.B. Johansson, B. Kerr, Forests in a Full World (New Haven: Yale University Press, 2001), pp. 2-3, 9-23.

[17] J. Fairhead and M. Leach, Reframing Deforestation: Global Analysis and Local Realities: Studies in West Africa (London and New York: Routledge, 1998), pp. 172-173; Bassett and Crummey, African Savannas, pp. 1-31 and W.A. Munro, "Ecological 'Crisis' & Resource Management Policy in Zimbabwe's Communal Lands," pp. 178-204, especially 192-196. See also D.E. Rocheleau, P.E. Steinberg, and P.A. Benjamin, "A Hundred Years of Crisis? Environment and Development Narratives in Ukwambani, Kenya" (Boston: Boston University African Studies Center Working Papers, 1994) and Peluso, Rich Forests, pp. 44-160.

[18] T.R. Malthus, An Essay on the Principle of Population. D. Winch, ed. (Cambridge: Cambridge University Press, 1992); P. Ehrlich, The Population Bomb (New York: Ballantine, 1968); P. Ehrlich and A.H. Ehrlich, The Population Explosion (New York: Simon and Schuster, 1990). For a critique, see L. Lohman, "Against the Myths," M. Colchester and L. Lohmann, eds., The Struggle for Land and the Fate of the Forests (Penang, Malaysia: the World Rainforest Movement, 1995 [second impression; first impression, 1993]), pp. 16-34.

[19] A seminal book was R. Carson, Silent Spring (New York: Houghton Mifflin, 1994 [first published 1962]). See also White, The Organic Machine, p. 91. For a global perspective, see J. Westoby, Introduction to World Forestry (Oxford and New York: Basil Blackwell, 1989). Rackham emphasizes that deforestation in England was a post-WWII phenomenon, O. Rackham, Trees and Woodland in the British Landscape (London: J.M. Dent 1993 [first revised paperback edition; first published 1976]), pp. 91-106.

[20] Grove, Green Imperialism, pp. 365-375. See also S. Schama, Landscape and Memory (New York: Alfred Knopf, 1995), pp.12-14.

[21] R. Palmer and N. Parsons, eds., The Roots of Rural Poverty in Central and Southern Africa (Berkeley and Los Angeles: University of California Press, 1977), see especially the "Introduction," pp. 1-32; L. van Horn, "The Agricultural History of Barotseland, 1840-1964," pp. 144-169; C. Bundy,

the case of cotton, or as a result of local initiative, as in the case of maize and cocoa, also led to forest and bush land being cleared. Some of the crops, for example maize and cotton, caused soil erosion.[22] Modern agriculture was also introduced through large scale commercial plantations for crops and trees, and, where lands were suitable for European settlement, through imported white farmers. Prime agricultural lands typically were allocated to white settlers and the local populations were either transformed into squatters or they were removed from their former lands and crowded into small reserves on often marginal lands.[23] A related argument stresses structural imbalances in access to land and other resources as the underlying cause for deforestation: poor, landless farmers are pushed into forest wildernesses because arable land is concentrated in the hands of a small elite. While such conditions may be

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"The Transkei Peasantry, c. 1890-1914: 'Passing through a Period of Stress,'" pp. 201-220. See also L. Vail, "Ecology and History: The Example of Eastern Zambia," Journal of Southern African Studies, vol. 3 (1977), pp. 129-155; B. Rau, From Feast to Famine: Official Cures and Grassroots Remedies to Africa's Food Crisis (London: Zed, 1993 (reprint; first published 1991); Chew, World Ecological Degradation; C.D. Becker and R. Léon, "Indigenous Forest Management in the Bolivian Amazon: Lessons from the Yuracaré People," Colchester and Lohmann, The Struggle for Land, pp. 163-191. Berry has a less mechanical approach to the impact of "capitalism" see Berry, No Condition is Permanent, especially pp. 1-16. But compare Marks, who posits that the commercialization process that transformed the Chinese environment was indigenous, see R.B. Marks, "Commercialization without Capitalism: Processes of Environmental Change in South China, 1550-1850," Environmental History, 1 (Jan. 1996), pp. 56-82. On the commodification of labor, see C. Murray, Families Divided: The Impact of Migrant Labour in Lesotho (Johannesburg: Ravan Press, 1981); R. First, Black Gold: The Mozambican Miner, Proletarian and Peasant (New York: St. Martin's Press, 1983); P. Harries, Work, Culture, and Identity: Migrant Laborers in Mozambique and South Africa, c. 1860-1910 (Portsmouth, N.H.: Heinemann, 1994); G. Maddox, "Environment and Population Growth in Ugogo, Central Tanzania," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 43-65, especially pp. 56-59.

[22] The introduction of plantation agriculture caused severe environmental degradation on the Canary Islands and Cape Verde, see G.E. Brooks, Landlords and Strangers: Ecology, Society, and Trade in West Africa, 1000-1630 (Boulder, Col.: Westview Press, 1993), pp. 121-126, 143-148. On the impact of cotton: A. Isaacman and R. Roberts, eds., Cotton, Colonialism, and Social History in Sub-Saharan Africa (Portsmouth, N.H.: Heinemann, 1995); A. Isaacman, Cotton is the Mother of Poverty: Peasants, Work, and Rural Struggle in Colonial Mozambique, 1938-1961 (Portsmouth, N.H.: Heinemann, 1996); E.C. Mandala, Work and Control in a Peasant Economy: A History of the Lower Tchiri Valley in Malawi, 1859-1960 (Madison: University of Wisconsin Press, 1990). Toure points out that the "modernization" of Peul pastoralism in Senegal has had disastrous environmental effects, O. Toure, "The Pastoral Environment of Northern Senegal," Review of African Political Economy, no. 42 (1988), pp. 32-39. See also Williams, Deforesting the Earth, pp. 383-410 and 145-379.

[23] See W. Beinart, P. Delius, and S. Trapido, eds., Putting a Plough to the Ground: Accumulation and Dispossession in Rural South Africa, 1850-1930 (Johannesburg: Ravan Press, 1986); C. Bundy, Rise and Fall of the South African Peasantry (London: Heinemann, 1979); M. Legassick, "Gold, Agriculture, and Secondary Industry in South Africa, 1885-1970," and R. Palmer, "The Agricultural History of Rhodesia," R. Palmer and N. Parsons, eds., The Roots of Rural Poverty in Central and Southern Africa (Berkeley and Los Angeles: University of California Press, 1977), pp. 174-200 and 221-254 respectively. On the environmental impact of dam building, see A. Isaacman and C. Sneddon, "Toward a Social and Environmental History of Cahora Bassa Dam," Journal of Southern African History, vol. 26, no. 4 (2000), pp. 597-632.

aggravated by capitalism and commercialism, they are not tied uniquely to modernity; rather, they can occur throughout history.[24]

Another focus of the writing on environmental change within the declinist perspective emphasizes how the modern colonial and postcolonial states sought to control not only nature but also the management and use of nature by the local indigenous population, especially through conservation. Forests were declared reserves to facilitate their scientific exploitation; game reserves and national parks were gazetted to protect wildlife; and even some upper water catchments received protected status.[25] Although these measures proved difficult to enforce, in combination with the destruction or modification of indigenous administrative institutions and environmental management practices, they nevertheless restricted local populations' access by to important natural resources (e.g. game meat, forest products, forages and grazing) and led to the erosion of indigenous natural resource management, including practices that previously had contained the spread and impact of the trypanosomiases-carrying tsetse fly in Africa.[26] For example, during the 1930s, fearing the collapse of African food production systems under the strain of environmental change and population pressure that coincidentally was largely caused

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[24] See Colchester and Lohmann, The Struggle for Land, especially the contributions by M. Colchester (pp. 1-15), L. Lohman (pp. 16-34), R. Plant (pp. 35-60), M. Colchester (pp. 99-138), and G. Monbiot (pp. 139-163).

[25] A classical study on the impact of European ideas and practices of conservation in Africa is Anderson, and Grove, Conservation in Africa, see especially the "Introduction" and the chapters by W. Beinart (pp. 15-19) and R. Grove (pp. 21-39). On the tropical origins of environmentalism and conservation, see Grove, Green Imperialism. On conservation in Africa see also the Journal of Southern African Studies special issue "The Politics of Conservation in Southern Africa, vol. 5, no. 2 (1989), the special issue on "The African Environment" of the Review of African Political Economy, vol. 42 (1988), and J. Monson, Canoe Building under Colonialism: Forestry and Food Policies in the Inmen Kilombero Region, 1920-1940," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 200-212.
See also W. Beinart, "Soil Erosion, Conservationism, and Ideas about Development: A Southern African Exploration, 1900-1960," Journal of Southern African Studies, vol. 11, no. 1 (1984), pp. 52-83 and I. Phimister, "Discourse and the Discipline of Historical Context: Conservationism and Ideas about Development in Southern Rhodesia," Journal of Southern African Studies, vol. 12, no. 2 (1986), pp. 263-275.

[26] H. Kjekhus, Ecology Control and Economic Development in East African History: The Case of Tanganyika, 1850-1950 (London: Heinemann, 1977); J.L. Giblin, "The Precolonial Politics of Disease Control in the Lowlands of Northeastern Tanzania," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 127-151. McCracken warns against idealizing pre-colonial indigenous management institutions, J. McCracken, "Introduction," Anderson and Grove, Conservation in Africa, pp. 189-190. See also P.D. Little and D.W. Brokensha, "Local Institutions, Tenure, and Resource Management in East Africa," and M. Gamaledinn, "State Policy and Famine in the Awash Valley of Ethiopia: The Lessons for Conservation," Anderson and Grove, Conservation in Africa, pp. 193-209 and 327-344 respectively. On the limits of colonial policies, see also R. Grove, "Colonial Conservation, Ecological Hegemony and Popular Resistance: Towards a Global Synthesis" and J.M. MacKenzie,"Experts and Amateurs: Tsetse, Nagana and Sleeping Sickness in East and Central Africa," MacKenzie, Imperialism and the Natural World, pp. 15-50 and 187-213 respectively.

by economic, political and conservation colonial policies, the colonial state introduced soil conservation projects in the African reserves. These projects, however, often exacerbated matters given the required extra labor investment, although the full weight of such policies was only felt after WWII.[27]

A third prism of declinist environmental change can be termed "biological imperialism." The introduction of new animals, plants, and microbes or the selective favoring of indigenous species unleashed such pests and plagues as, for example, smallpox, yellow fever, malaria, and sheep in the Americas, Rinderpest and lungsickness in Africa, and rabbits in Australia. Some authors have emphasized that the impact of such "invaders" and/or pre-existing microbes was multiplied because colonialism or more recently globalization weakened or destroyed pre-existing environmental management arrangements.[28] Often, the scenario is portrayed in terms of a pre-existing ecological or human-nature "balance."[29]

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[27] W. Beinart and C. Bundy, Hidden Struggles in Rural South Africa: Politics and Popular Movements in the Transkei and the Eastern Cape, 1890-1930 (London: James Currey, 1987). Showers emphasized that soil erosion in Lesotho was grossly exaggerated and that colonial anti-erosion projects were counterproductive, K.B. Showers, "Soil Erosion in the Kingdom of Lesotho: Origins and Colonial Response, 1830s-1950s," Journal of Southern African Studies, vol. 15, no. 2 (1989), pp. 263-286. See also P.A. Maack, "'We Don't want Terraces!' Protest and Identity under the Uluguru Land Usage Scheme," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 152-170; J. Drummond and A. Manson, "The Rise and Demise of Agricultural Production in Dinokana Village, Bophuthatswana," Canadian Journal of African Studies, vol. 27, no. 3 (1993), pp. 462-479. See also Journal of Southern African Studies, vol. 15, no. 2 (1989) Special Issue on Conservation in southern Africa, contributions by W. Beinart, "Introduction: The Politics of Colonial Conservation," pp 143-162; M. Drinkwater, "Technical Development and Peasant Impoverishment: Land Use Policy in Zimbabwe's Midlands Province,", pp. 287-305; F.T. Hendricks, "Loose Planning and Rapid Resettlement: The Politics of Conservation and Control in Transkei, 1950-1970," pp. 306-325; C. de Wet, "Betterment Planning in a Rural Village in Keiskommahoek, Ciskei," pp. 326-345; P.A. McAllister, "Resistance to 'Betterment' in the Transkei: A Case Study from Willowvale District," pp. 346-368.

[28] See Kjekhus, Ecology Control; J. Giblin, "Trypanosomiasis Control in African History: An Evaded Issue?" Journal of African History, no. 31 (1990), pp. 59-80; M. Lyons, The Colonial Disease: A Social History of Sleeping Sickness in Northern Zaire, 1900-1940 (Cambridge: Cambridge University Press, 1992) and J. Farley, Bilharzia: A History of Imperial Tropical Medicine (Cambridge: Cambridge University Press, 1991), pp. 298-299. For a dissenting view see R. Waller, "Tsetse Fly in Western Narok, Kenya" Journal of African History, no. 31 (1990), pp. 81-101. Van Sittert argues that invasive weeds in the Cape became a burden to colonialism, L. Van Sittert, "'The Seed blows about in Every Breeze': Noxious Weed Eradication in the Cape Colony, 1860-1909," Journal of Southern African Studies, vol. 26, no. 4 (2000), pp. 655-674.

[29] R. Headrick, Colonialism, Health and Illness in French Equatorial Africa, 1885-1932, edited by D.R. Headrick (Atlanta, Georgia: ASA Press, 1994). Kjekhus attributes epidemic sleeping sickness to "ecological imbalances" associated with colonialism, Kjekhus, Ecology Control, p. 166. Brook, Webb, Johnson and Anderson, and Mandala show that desiccation, drought, and famine were factors in pre-colonial Africa, implying that a general ecological balance did not exist, see D.H. Johnson and D.M. Anderson, eds., The Ecology of Survival: Case Studies from Northeast African History (London: Lester Crook Academic Publishing, 1988), for example, the chapters by R. Pankhurst and D.H. Johnson, "The Great Drought and Famine of 1888-92 in Northeast Africa," pp. 47-70; Brooks, Landlords and Strangers; J.L.A. Webb, Desert Frontier: Ecological and Economic Change along the Western Sahel, 1600-1850 (Madison, Wisc.: University of Wisconsin Press, 1995); and Mandala, Work and Control in a Peasant Economy, pp. 15-97.

Although declinist analysis identified modernity as the main culprit of environmental destruction, the practice of conservationist intervention often required that non-western local communities be requested or even forced to modify their environmental management and use strategies. Indigenous knowledge, although sometimes admired, was seen as "traditional" and static, and thus unable to cope with the new challenges brought by the modern economy and population growth.[30] The need for radical intervention was felt to be even more urgent because of a series of devastating droughts in Africa in the 1970s and 1980s. A contributing factor was the notion that the tropical rain forests of Africa, Latin America, and Southeast Asia constituted the most prized remnants of pristine Nature.[31]

To counter deforestation, western experts introduced agroforestry and social forestry projects in Africa, Asia and Latin America, with the goal of afforestation of lands outside of the protected forests. Attention to people and their social networks and to forests and trees outside of the formal forests, however, was instrumental: because the practice of protecting existing forests against human intrusion was considered to be a failure, foresters sought to boost forest production outside of the

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[30] Richards noted that colonial officials discovered indigenous knowledge before WWII; during WWII, however, the paradigm shifted to state-led scientific technical approaches, Richards, Indigenous Agricultural Revolution, pp. 31-40. Colchester claims that the myth of the tragedy of the commons prevented a real assessment of indigenous natural resource management systems, M. Colchester, "Forest Peoples and Sustainability," Colchester and Lohmann, The Struggle for Land, pp. 61-95. On the view of indigenous knowledge as outdated, see H.N. Le Houérou, The Grazing Land Ecosystems of the African Sahel (Berlin and New York: Springer-Verlag, 1989), p. 63; H.N. Le Houérou, ed., Browse in Africa: The Current State of Knowledge (Addis Ababa: ICLA, 1980), "Conclusions and Recommendations," pp. 485-486; L. Núnez and M. Grosjean "Biodiversity and Human Impact During the Last 11,000 Years in North-Central Chile" G.A. Bradshaw and P.A. Marquet, eds., How Landscapes Change: Human Disturbance and Ecosystem Fragmentation in the Americas (Berlin etc.: Springer Verlag, 2003), pp. 7-17; P. Frost, "The Ecology of Miombo Woodlands," and J. Clarke, W. Cavendish, and C. Coote, "Rural Households and Miombo Woodlands: Use, Value, and Management," Campbell, The Miombo in Transition, pp. 44-45 and p. 120 respectively; V. Balasubramanian and A. Egli, "The Role of Agroforestry in the Farming Systems in Rwanda with special Reference to Migongo (BGM) Region," and S. Miehr, "Acacia albida and other Multipurpose Trees on the Fur Farmlands in the Jebel Marra Highlands, Western Darfur, Sudan," P.K.R. Nair, ed., Agroforestry Systems in the Tropics (Dordrecht: Kluwer, 1989), pp. 333-352 and 353-384 respectively. See also Richards, Indigenous Agricultural Revolution, pp. 71-72, 84, 138-139; Peluso, Rich Forests, p. 125; Peluso notes that foresters also disdained indigenous knowledge because doing so gave them the monopoly over "real" knowledge; and K.S. Amanor, The New Frontier: Farmer Responses to Land Degradation: A West African Study (Geneva: UNRISD, 1994), pp. 160-162.

[31] Bassett and Crummey argue that the Sahel drought reinvigorated environmental interventionism and brought about a merger of the old desiccation paradigm with the new environmentalism, Bassett and Crummey, African Savannas, pp. 15-17. Swift notes that the desertification narrative, which dated from the 1920s and 1930s French West Africa was revived in the 1970s, J. Swift, "Desertification: Narratives, Winners & Losers," M. Leach and R. Mearns, eds., The Lie of the Land: Challenging Received Wisdom on the African Environment (Oxford: IAI & James Currey, 1996), pp. 73-90. On shifting cultivators as deforesters, see Myers, Deforestation Rates, pp. 4-5, 30, 45-48 and Jepma,

forests to provide an alternative source for the fuel wood and other products that local populations previously had gathered from the forests.[32]

In Africa, the communal woodlot approach met with little success, an outcome that in the late 1970s and early 1980s contributed to increased attention to the role of on-farm trees and farmers in agroforestry and social forestry research and projects. Yet, this micro focus was short-lived. After farm level projects appeared to favor men over women and the wealthy over the poor, the pendulum swung back again to a more macro level of analysis in the 1980s and early 1990s. Moreover, fuel wood proved not to be a key issue for farmers.[33] Instead, multipurpose trees took center stage in agroforestry and social forestry, with an emphasis on the ability of trees, especially such "miracle trees" as Leucanea leucocephala, to enhance and maintain soil fertility and agricultural production.[34] The interest of the state, particularly forestry

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Tropical Deforestation, pp. 17-21, 104-109. Guha emphasizes that the notion of pristine Nature served to legitimize colonial intervention, Guha, The Unquiet Woods, pp. 138-151.

[32] See Wiersum, Social Forestry, pp. 54-74, 79, 81, 166-170. On the coercive role of foresters and social forestry, see respectively K.F. Wiersum with B.E.J.C. Lekanne dit Deprez, "The Forestry Agent at the Interface between Local Level Environmental Management and External Policies: Reflections on Forestry Intervention in the Sahel," Wiersum, Social Forestry, pp. 112-126 and M. Hobley, Participatory Forestry: The Process of Change in India and Nepal (London: ODI, 1996), pp. 56, 66-81. On agroforestry, see K.F.S. King, "The History of Agroforestry," and P.K.R Nair, "Agroforestry Defined," P.K.R. Nair, ed., Agroforestry Systems in the Tropics (Dordrecht, etc.: Kluwer, 1989), pp. 3-11 and 14-18 respectively. The published papers of a 1992 symposium on southern Africa focused on forests and forestry institutions, see G.D. Piearce and D.J. Gumbo, eds., P. Shaw, compiler, The Ecology and Management of Indigenous Forests in Southern Africa. Proceedings of an International Symposium, Victoria Falls, Zimbabwe, 27-29 July 1992 (Harare: The Forestry Commission in collaboration with SAREC, 1993).

[33] On the shifts in the level of analysis/intervention, see Wiersum, Social Forestry, pp. 1,3, 62-67; K.F. Wiersum and G.A. Persoon, "Research on Conservation and Management of Tropical Forests: Contributions from Social Sciences in the Netherlands," K.F. Wiersum, ed., Tropical Forest Resource Dynamics and Conservation: From Local to Global Issues (Wageningen: Wageningen Agricultural University, 2000), pp. 3-4; Leach and Mearns, Beyond the Fuelwood Crisis, pp. 23-40. On the undesired side effects of farm forestry, see R.A. Schroeder, "Shady Practice: Gender and the Political Ecology of Resource Stabilization in the Gambian Garden/Orchards." Economic Geography, vol. 69, no. 4 (1993), pp. 349-365 and Wiersum, Social Forestry, pp. 66-67. On the failure of communal woodlots, see Leach and Mearns, Beyond the Fuelwood Crisis, pp. 66-67 and P. Kerkhof, Agroforestry in Africa: A Survey of Project Experience (London: The Panos Institute, 1990), pp. 87-111. Young attributes the mixed success of agroforestry interventions to the uncritically application from techniques developed in the humid tropics to the dry tropics, Young, Agroforestry for Soil Management, pp. 266-267. See also Kerkhof, Agroforestry in Africa, pp. 79-83.

[34] On the exaggerated wood fuel crisis see Leach and Mearns, Beyond the Fuelwood Crisis, pp. 23-40. On the increased association of forestry with agriculture, see Leach and Mearns, Beyond the Fuelwood Crisis, pp. 23-40 and Fairhead and Leach, Reframing Deforestation, pp. 179-180. On trees and soil fertility, Young, Agroforestry for Soil Management. Recent studies are more cautious, pointing out, for example, that nutrient pumping by trees is a theory that as a process is not very well documented; see G. Schroth, B. Vanlauwe and J. Lehmann, "Soil Organic Matter," J. Lehmann and G. Schroth, "Nutrient Leaching," and G. Schroth and J. Lehmann, Nutrient Capture," G. Schroth and F.L. Sinclair, eds., Trees, Crops and Soil Fertility: Concepts and Research Methods (Wallingford, UK.: Cabi Publishing, 2003), pp. 77-91, 151-166, and 167-179, respectively. See also P. Huxley, Tropical Agroforestry (Oxford: Blackwell Science, 1999), pp. 280.

departments' interventions in extra-forest agroforestry, social forestry, and community forestry, may in part have been driven by "forestry imperialism" legitimated in the name of conservation and rural development.[35]

The Inclinist Paradigm

Similar to the modernization paradigm, the inclinist paradigm is optimistic about humans' ability to mitigate the environmental cost of environmental change.[36] Fairhead and Leach turned the declinist paradigm thesis about the direction of environmental change on its head and identified "forest islands" not as relics of natural or climax forest vegetation (as in a declinist reading), but as a human creation.[37] In sharp contrast to the modernization paradigm, however, the optimism is not derived from a belief in western science, but from confidence in the potential of indigenous knowledge, which is seen to be highly dynamic.[38] An important second root of inclinist revisionism stems from the rejection of the declinists' alarmist claims based on the use of prejudicial colonial information and contemporary data that were

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[35] See, for example, J. van den Bergh, "Diverging Perceptions on the Forest: Bulu Forest Tenure and the 1994 Cameroon Forest Law," Wiersum, Tropical Forest Resource Dynamics, pp. 25-36; Fairhead and Leach, Reframing Deforestation, p. 170. See also Guha, The Unquiet Woods, pp. 44-45. The forest services of Indonesia and Thailand control 74% and 40% respectively of the national territories, M. Colchester, "Forest Peoples and Sustainability," Colchester and Lohmann, The Struggle for Land, pp. 61-95, especially p. 75.

[36] Bassett and Crummey, African Savannas, pp. 1-4. Henkemann, Persoon, and Wiersum speak of an emerging paradigm that stresses peoples' capacity for innovation, A.B. Henkemann, G.A. Persoon, and F.K. Wiersum, "Landscape Transformations of Pioneer Shifting Cultivators at the Forest Fringe," Wiersum, Tropical Forest Resource Dynamics, p. 55. Fairhead and Leach state that what they offer is not a new "unequivocal, alternative story;" the aim is to demonstrate that alternative "and strongly contrasting, interpretations…of the same 'facts'" are possible, Fairhead and Leach, Reframing Deforestation, p. 191.

[37] This argument was first made in Fairhead and Leach, Misreading the African Landscape, pp. 55-85. Fairhead and Leach extended the argument to other West African countries in Reframing Deforestation.

[38] Richards stresses the dynamic and inventive nature of African agriculture and speaks of an incipient African "agricultural revolution," Richards, Indigenous Agricultural Revolution, pp. 12, 70-72, 84-85, 128-139, 151-152, 155; Leach and Mearns, Beyond the Fuelwood Crisis, pp. 26-40; Leach and Fairhead discuss indigenous knowledge more from a "production of knowledge" perspective, Fairhead and Leach, Misreading the African Landscape, see, for example, pp. 165-174. Rau sees "people's knowledge" as key to ending Africa's food and environmental crisis, Rau, From Feast to Famine, pp. 145-166. On the dynamism of African farmers/peasants, see also Berry, No Condition is Permanent, pp. 49-52; Mandala, Work and Control in a Peasant Economy, for example, p. 176; M. Tiffen, M. Mortimore and F. Gichuki, More People, Less Erosion: Environmental Recovery in Kenya (Chichester: John Wiley and Sons: 1994), pp. 226-245; Bassett and Crummey, African Savannas, pp. 18-19; Amanor, The New Frontier, pp. 166-216; V. Mazzucato and D. Niemeijer, Rethinking Soil and Water Conservation in a Changing Society: A Case Study in Eastern Burkina Faso (Wageningen: Wageningen University Tropical Resource Management Papers, 2000).

estimates at best.[39] Boserup's Conditions of Agricultural Growth, which argues that population pressure gives rise to technical innovation and the intensification of land use, further strengthens the inclinist world view.[40]

In the inclinist paradigm, indigenous knowledge about and indigenous management and use of forest resources take center stage as a point of departure for research and intervention.[41] Reflecting the shift from forest first and people second,

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[39] See Leach and Mearns, Beyond the Fuelwood Crisis, pp. 1-9; Fairhead and Leach, Misreading the African Landscape, especially 1-85, 121-136, 182-197, 237-278; J.C. McCann, Green Land, Brown Land, Black Land: An Environmental History of Africa, 1800-1990 (Portsmouth: Heinemann, 1999), pp. 79-107; Bassett and Crummey, African Savannas, pp. 4-15, 24; M.P. Lehman, "Deforestation and Changing Land Use Patterns in Costa Rica," Steen and Tucker, Changing Tropical Forest, p. 67. Although all the contributors in Steen and Tucker acknowledge deforestation as an important issue, a number of them reject declinism as a straightjacket; see, for example, the chapters by S.M. Pierce (40-57), M.P. Lehman (pp. 58-76), E. Graham & M. Prendergast (pp. 102-109), and W. Balée (pp. 185-197). Myers predicted in 1989 that little forest would be left by the end of the century. His prediction is still far from a reality although deforestation continues to be a major concern. See Myers, Deforestation Rates, p. 4. Williams notes that the statistics for deforestation between 1976 and 1998 were based on only two sets of primary sources that were themselves estimates: an FAO/UNDP analysis that relied partly on satellite data and Myers' study, Deforestation Rates, which was based on Myers' and others' experience, Williams, Deforesting the Earth, p. 457. Williams points out that in measuring deforestation, previously deforested land that had become afforested ("fallow forest"), frequently was counted twice! (pp. 453-454) and that if the early 1980s deforestation rates employed for the Amazon had been correct, the Amazon rainforest should have entirely disappeared (pp. 477-479). Westoby and Jepma acknowledge that the deforestation figures are unreliable but both accept a trend of deforestation. See Westoby, Introduction to World Forestry, pp. 90-97 and Jepma, Tropical Deforestation, pp. 12-13. Young asserts that soil fertility has been in rapid decline during the last 50 years but acknowledges that the quantitative assessment of soil degradation is deficient, Young, Agroforestry for Soil Management, pp. 24-25. In his case study in central Tanzania, Kajembe found that estimates of wood fuel consumption may have been exaggerated by a factor of two or more, Kajembe, Indigenous Management Systems, pp. 10-11.

[40] E. Boserup, Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure (New York: Aldine Pub. Co., 1965). See P. Pingali, Y. Bigot, and H.P. Binswanger, Agricultural Mechanization and the Evolution of Farming Systems in Sub-Saharan Africa (Washington, D.C.: The Johns Hopkins University Press, 1987); Leach and Mearns noted that in certain densely populated regions, the wood volume seemed to increase with population density, Leach and Mearns, Beyond the Fuelwood Crisis, pp. 1 and 53. See also S. Miehr, "Acacia albida and other Multipurpose Trees in the Fur Farmlands in the Jebel Marra Highlands, Western Darfur, Sudan" (the decline of an intensive agroforestry system as the result of population decrease), P. Poscher, "An Evaluation of Acacia albida-based Practices in the Hararghe Highlands of Eastern Ethiopia" (more people, more trees), and J.C. Okafor and E.C.M. Fernandes, "The Compound Farms of Southeastern Nigeria: A Predominant Agroforestry Homegarden System with Crops and Small Livestock" (population increase driven intensification), Nair, Agroforestry Systems in the Tropics, pp. 353-384, 385-400, and 411-426 respectively; M. Tiffen, M. Mortimore and F. Gichuki, More People, Less Erosion: Environmental Recovery in Kenya (Chichester: John Wiley and Sons, 1994); S.F. Siebert, "Beyond Malthus and Perverse Incentives: Economic Globalization, Forest Conversion and Habitat Fragmentation," G.A. Bradshaw and P.A. Marquet (eds.), How Landscapes Change: Human Disturbance and Ecosystem Fragmentation in the Americas (Berlin: Springer Verlag, 2003), p. 29; and Bassett and Crummey, African Savannas, pp. 20-21.

[41] Leach and Mearns, Beyond the Fuelwood Crisis, pp. 23-40. Leach and Fairhead acknowledge that they may have overstated the juxtaposition of the deforestation discourse and a coherent body of "citizen science," M. Leach and J. Fairhead, "Fashioned Forest Pasts, Occluded Histories? International Environmental Analysis in West African Locales," M. Doornbos, A. South, and B. White, eds., Forests: Nature, People, Power (Oxford, UK,: Blackwell, 2000), pp. 35-59, especially 54-55. Franzel et al. emphasize the importance of building on Indigenous Technical Knowledge (ITK), S. Franzel, P.

with people playing an instrumental role, to people and forest, the definition of what constituted "forest" was further expanded to include the dry forests (including the miombo expanses of Africa) and the woodlands that support much larger populations than the rainforests.[42] Indigenous populations were no longer identified as a major, if not the major, threat to environmental conservation and to tropical forests, but as a critical part of the solution.[43] Social forestry included transferring "forest" management from the state to local communities, although in practice, officials and scientists overwhelmingly have been unable to relinquish real control over conservation areas and experiments.[44] N. Sundan, for example, is critical of joint state-local community forest management projects in India, asserting that the state still sets the agenda and that the practice is not really new but rather similar to colonial indirect rule, that is, forest management on the cheap.[45]

Cooper, G.L. Denning, and D. Eade, eds., Development and Agroforestry: Scaling up the Impacts of Research (Oxford: Oxfam, 2002), see especially the contributions by G.L. Denning (pp. 1-14), J. Haggar et al. (pp. 15-23), J.C. Weber et al. (pp. 24-34), and C. Wambugu et al. (pp. 107-166). See also Balée, who argues Indians altered their environments but did not cause widespread degradation, W. Balée, "Indigenous History and Amazonian Biodiversity," Steen and Tucker , Changing Tropical Forest, pp. 185-197. On tropical farmers rationalism, see A-M.N. Izac, "Economic Aspects of Soil Fertility: Management and Agroforestry Practices," G. Schroth and F.L. Sinclair, eds., Trees, Crops and Soil Fertility: Concepts and Research Methods (Wallingford, UK.: Cabi Publishing, 2003), pp. 13-37.

[42] Westoby emphasizes that the dry forests, woodlands, and shrub lands are even more threatened by environmental degradation than the rainforests, and that they support far greater populations, Westoby, Introduction to World Forestry, pp. 147, 169-170. On the miombo woodlands see Campbell, The Miombo in Transition. For miombo ecology, see P. Frost, "The Ecology of Miombo Woodlands," Campbell, The Miombo in Transition, pp. 11-57. On non-rain forest forests, see also, for example, B.R.T. Seward, "Threatened Dry Forest Ecosystems," Piearce and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 273-278.

[43] Wiersum acknowledges that social forestry brought about a normative change in forestry because forest professionals' control over forestry and forest management no longer went unchallenged, but he does not see this as a major paradigmatic shift in forest science, see Wiersum, Social Forestry, pp. 175, 183-191. Several chapters in Franzel and Scjerr underline the importance of on-farm participatory research with farmers yet express strong concerns about the implication for the quality of the trials if the scientists are not fully in control, see S. Franzel et al., "Methods of Assessing Agroforestry Adoption Potential," and S.J. Scherr and S. Franzel, "Promoting Agroforestry Technologies: Policy Lessons from On-Farm Research," S. Franzel and J. Scherr, eds., Trees on the Farm: Assessing the Adoption Potential of Agroforestry Practices in Africa (Wallingford, UK: CABI, 2002), pp. 11-36 and 145-164 respectively. For social forestry and indigenous forest management as environmentally sound, see Wiersum, Social Forestry, pp. 75-88, 126-182.

[44] On the transfer of control over forests, see Leach and Mearns, Beyond the Fuelwood Crisis, pp. 230-231. Franzel at al. discuss experiments with farmer participation, see G.L. Denning, "Realising the Potential of Agroforestry: Integrating Research and Development to Achieve Greater Impact," J. Haggar et al., "Participatory Design of Agroforestry Systems: Developing Farmer Participatory Research Methods in Mexico," J.C. Weber et al., "Participatory Domestication of Agroforestry Trees: An Example form the Peruvian Amazon," and C. Wambugu et al., "Scaling Up the Use of Fodder Shrubs in Central Kenya," S. Franzel, P. Cooper, G.L. Denning, and D. Eade, eds., Development and Agroforestry: Scaling up the Impacts of Research (Oxford: Oxfam, 2002), pp. 1-14, 15-23, 24-34, and 107-116 respectively.

[45] N. Sundan, "Unpacking the 'Joint' in Joint Forest Management," Doornbos, South, and White, Forests: Nature, People, Power, pp. 249-273, especially pp. 252, 258-259, 269. See also Peluso, Rich

Pathways of Environmental Change

All three of the paradigms outlined above portray environmental change as (1) unilinear, (2) due to human agency, (3) organic, and (4) homogenous. The paradigms are unilinear because they describe change in linear fashion and occurring along a Nature-Culture (or "wilderness"- humanized landscape) gradient. Depending on the paradigm, change is progressive, for the better or for the worse, as well as cumulative, and irreversible.[46] All three paradigms have the tendency to attribute environmental change to human agency alone. As a result, Humans appear all-powerful, environmental agency is downplayed, and Nature is depicted as a victim or simply a backdrop.[47]

The paradigms are organic in the sense that to a greater or lesser extent they privilege collectivities as the subjects and objects of environmental change, imbuing the collectivities with organism-like properties. In the modernization and declinist paradigms, "populations" and "forests" are respectively the subject and the object of environmental change. Nygren notes that deforestation studies with a macro-structural focus depict the peasantry as a monolith instead of taking into account class and gender.[48] The inclinist paradigm emphasizes the practices and knowledge of indigenous communities, for example "tribes" or ethnic groups, rather than

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Forests, pp. 124-165; M. Hobley, Participatory Forestry: The Process of Change in India and Nepal (London: ODI, 1996), pp. 59-60, 80, 130, 139-157, 191-193, 244, 251, 259-260; Fairhead and Leach, Reframing Deforestation, pp. 192-193. On hesitations about full on-farm participatory research with farmers, see S. Franzel et al., "Methods of Assessing Agroforestry Adoption Potential," and S.J. Scherr and S. Franzel, "Promoting Agroforestry Technologies: Policy Lessons from On-Farm Research," S. Franzel and J. Scherr, eds., Trees on the Farm: Assessing the Adoption Potential of Agroforestry Practices in Africa (Wallingford, UK: CABI, 2002), pp. 11-36 and 145-164 respectively.

[46] Merchant criticizes both the progressive (here: Modernization) and declinist paradigms as linear unidirectional, Merchant, Reinventing Eden, pp. 4, 6, 215. See also G.A. Bradshaw and P.A. Marquet, "Synthesis and Final Reflections," Bradshaw and Marquet, How Landscapes Change, pp. 345-346; D. L. Pimentel, L. Westra, R.F. Noss, eds., Ecological Integrity: Integrating Environment, Conservation, and Health (Washington, D.C.: Island Press, 2000), pp. 7-8; P. Huxley, Tropical Agroforestry, p. 301; and V. Mazzucato and D. Niemeijer, Rethinking Soil and Water Conservation in a Changing Society: A Case Study in Eastern Burkina Faso (Wageningen: Wageningen University Tropical Resource Management Papers, 2000), pp. 309, 316.

[47] G.A. Bradshaw and P.A. Marquet, "Introduction," Bradshaw and Marquet, How Landscapes Change, p. 1. Bassett and Crummey stress that even though they believe that all landscapes are anthropogenic, humans are not the single cause of change within them, Bassett and Crummey, African Savannas, p. 5. See also Fairhead and Leach, Reframing Deforestation, p. 192. Williams points out that a number of environmental changes attributed to human actions, including changes in the flow of such major rivers as the Nile, Senegal and Niger, can be attributed to natural phenomena, M. Williams, "Changing Land Use & Environmental Fluctuations in the African Savanna," Bassett and Crummey, African Savannas, p. 51. In a declinist worldview, human environmental agency may give rise to a degree of misanthropy, E. Hargrove, "Foreword," L. Westra and P.S. Wenz, eds., Faces of Environmental Racism: Confronting Issues of Global Justice (Lanham, Md.: Rowman & Littlefield Publishers, 1995), pp. x-xi.

[48] A. Nygren, "Development Discourses and Peasant-Forest Relations: Natural Resource Utilization as Social Process," Doornbos, South, and White, Forests: Nature, People, Power, p. 25.

individuals, because indigenous knowledge is seen as a "collective" body of knowledge.[49] Moreover, even when "forests" are not singled out as the object of research and intervention, analysis centers on species, families, or "tribes" of woody plants, rather than on individual trees. Indigenous peoples are equally analytically viewed as being organized into "tribes," ethnic groups, and/or clans.[50] Similarly, the fields of ecology, environmental studies, agriculture, and forestry analytically highlight ecosystems, plant communities and taxonomic collectives, with the lowest significant level being comprised of the species and the subspecies, rather than the individual.[51] Moreover, traditional western science tends to atomize the collectivity but analyze the resulting unit as being representative; a single buffalo is thus analyzed as being representative of a herd, a species, a genus, or an order, as opposed to being an individual animal. An individual person similarly is seen to be representative of a

[49] On the focus on collectives and collective bodies of knowledge, see, for example Wiersum, Social Forestry, pp. 67, 81, 84, 96, 134-135; J.F. Kessy, Conservation and Utilization of Natural Resources in the East Usambara Forest Reserve: Conventional Views and Local Perspectives (Wageningen: Wageningen Agricultural University, 1998), p. 21; A.A. De Wit & D.M.E. van Est, "Storytelling for People and Nature: Reflections on a Potential Toll for Dialogue about Local and Supra-Local Environmental Views," Wiersum, Tropical Forest Resource Dynamics, p. 38; Mazzucato and Niemeijer, Rethinking Soil and Water Conservation, p. 172. The idea of indigenous knowledge as a collective body, however, is highly problematic because certain types of knowledge were kept by specific sub-groups, see, for example, Mandala, Work and Control in a Peasant Economy, p. xx and M. Wagner, "Environment, Community and History: 'Nature in the Mind' in Nineteenth Century and Early Twentieth Century Buha, Tanzania," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 175-199, especially 176. Feierman highlights the key role of "peasant intellectuals" in the production and reproduction of "indigenous" knowledge, see S. Feierman, Peasant Intellectuals: Anthropology and History in Tanzania (Madison: University of Wisconsin Press, 1990), pp. 34-39. In some cases, farmers resisted the imposition of communal approaches, see, for example, Kajembe, Indigenous Management Systems, p. 11-12 and P.A. Maack, '"We don't want Terraces!' Protest and Identity under the Uluguru Land Usage Scheme," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 152-170, especially pp. 162-164.

[50] "Tribe" and its politically correct version, "ethnic group," are highly problematic because they suggest primordiality and homogeneity. On tribes as historical creations, L. Vail, ed., The Creation of Tribalism in Southern Africa (London: Currey, 1989). Berry stresses that membership of such social units as "tribe" were essential to individuals to gain access to, for example, land, since colonialism had a collective approach and vested land ownership in tribal collectives, managed through the tribal chiefs and headmen, S. Berry, "Social Institutions and Access to Resources," Africa, 59, no. 1 (1989), pp. 41-55 and Berry, No Condition is Permanent, pp. 106-132. White rejects "tribe" as a useful unit of analysis for American Indian societies and instead proposes village as an alternative, see R. White, The Middle Ground: Indians, Empires, and Republics in the Great Lakes Region, 1650-1815 (Cambridge: Cambridge University Press, 1991), p. xiv. Cronon notes the difficulty in drawing the boundaries of the environmental unit to be analyzed: he proposes ethno-ecological boundaries, that is, the point of departure should be what a society see as its "territory," Cronon, Changes in the Land, pp. 14-15.

[51] The exception is pets, which are considered individuals, K. Thomas, Man and the Natural World: Changing Attitudes in England, 1500-1800 (New York: Oxford University Press, 1996 [first published 1983]), pp. 100-142. Grove stresses the non-Western origins of the environmental and bio-sciences and highlights small tropical islands – i.e. discrete closed ecosystems – as critical sites where "Western" ecological science developed. Furthermore Western ecological science developed in the colonial context, where the concept of tribe was central (and anthropology/ethno science co-evolved with eco-science). This may be one reason why ecology has a much more holistic focus than other sciences. On the non-western roots of environmentalism, see Grove, Green Imperialism.

population, a tribe/ethnic group, or a "race."[52] In short, individuals in human and animal or plant "tribes" alike are not appreciated for their unique qualities; rather, they are treated as though they constitute a core sample. Such thinking facilitates extrapolating of the results of, for example, small trial plots to measure soil erosion, to larger areas, regions, or continents, a problematic methodology.[53]

Finally, the paradigms are homogenous because they analyze environmental change as singular and undifferentiated, in terms of the process and the outcome. Blaikie and Brookfield stress, however, that degradation is very much in the eye of the beholder. In other words, degradation is socially defined. An increase in the woody vegetation component in pastures, for example, may constitute degradation to pastoralists, but reforestation to ecologists and foresters.[54]

Objective of the Study

The objective of the study is to analyze environmental change in the forested landscapes in the colonial and post-colonial period as multi-faceted and multi-trajectory processes and to assess how these changes are perceived and valued when considered from the perspective of traditional western science or indigenous knowledge and practices. The study focuses on the history of environmental change in Ovamboland from the late 1800s to the late 1900s.

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[52] Grove notes that the holistic outlook of modern environmentalism so strongly stresses the importance of the (eco)system over the individual that it may devalue the importance of a plant, animal or human as an individual, Grove, Green Imperialism, pp. xii-xiii.

[53] M. Stocking, "Measuring Land Degradation," P. Blaikie and H. Brookfield, Land Degradation and Society (London: Methuen, 1987), pp. 49-63, especially pp. 50-54. For example Stocking points out that sediment loads of rivers are extremely variable and thus taking one sample and using that as a base to calculate annual average sediment transport is very problematic. See also T.T. Kozlowski, P.J. Kramer, S.G. Pallardy, The Physiological Ecology of Woody Plants (San Diego: Academic Press, 1991), pp. 222 and 236 and K.A. Longman and J. Jeník, Tropical Forest and its Environment (Burnt Mill, England: Longman 1987 [second edition; first published 1974]), p. 116.

[54] See Blaikie and Brookfield, Land Degradation and Society, pp. 4-7, 14-16. See also C.C. Gibson, M.A. McKean, and E. Ostrom, "Explaining Deforestation: The Role of Local Institutions," C.C. Gibson, M.A. McKean, and E. Ostrom, eds., People and Forests: Communities, Institutions, and Governance (Cambridge, Mass.: MIT Press, 2000), p. 2. The concept of ecological integrity is an attempt to move beyond a static Nature-Culture dichotomy by setting as a benchmark to assess environmental change a (near) natural state that is not necessarily "virgin" but that nevertheless has the capacity to regenerate over time to a state that is "natural." Ecological "integrity" is difficult to measure and the level of integrity that is desirable depends on one's point of view and needs, A. Holland, "Ecological Integrity and the Darwinian Paradigm," Pimentel, Westra, Noss, Ecological Integrity, p. 55. J. Haggar et al. stress that "rather than trying to homogenize management" the "plasticity" of Agroforestry should be exploited to develop custom-made solutions, J. Haggar et al., "Participatory Design of Agroforestry Systems: Developing Farmer Participatory Research Methods in Mexico," S. Franzel, P. Cooper, G.L. Denning, and D. Eade, eds., Development and Agroforestry: Scaling up the Impacts of Research (Oxford: Oxfam, 2002), p. 15.

In conceptualizing, analyzing, and narrating environmental change each of the three paradigms remain embedded in a one-dimensional Nature-Culture dichotomy that depicts environmental change in abstract, static, monolithic, linear, and unidirectional terms and that privileges the outcome of change over the process of change, obscuring agency, motivation, and the day-to-day mechanics involved as well as homogenizing the subjects and the objects of environmental change.

The Palenque Paradox problematizes the conceptualization of environmental change as a linear progression from a state of Nature to a cultural landscape dominated by humans. The Ovambo Paradox suggests that because deforestation and reforestation may occur simultaneously not only across different units of space (interspatially) but also within a single continuous space (intraspatially), environmental change cannot be construed in terms of a singular process with a singular outcome.

The Nature-Culture dichotomy defines human and non-human entities and their products as either part of Nature or of Culture. For example, plants and animals are wild (and part of Nature) or domesticated (and part of Culture). But many plants and animals do not fit neatly into this binary framework, including feral animals and the so-called "semi-domesticated" plants. The idea that westerners armed with science and technology and motivated by a modern market-oriented outlook seek and manage to overcome and destroy Nature, replacing it by a wholly human-construct (Culture) and in the process freeing themselves entirely from Nature's bounds places the west and science unambiguously in Culture. The complimentary idea that non-westerners have not liberated themselves from the yoke of Nature, and live by Nature and in Nature assigns the non-West and its indigenous knowledge systems to the realm of Nature.

The concept of "environmental infrastructure" facilitates a focus on the twilight zone between Nature and Culture. The term "infrastructure" not only stresses the utilitarian value that humans ascribe to it (by humans), but also allows room for environmental agents to shape or re-shape it mentally as well as physically. The use of the adjective "environmental" highlights that human control, use, and agency are neither absolute nor exclusive. Thus, unlike conventional infrastructure (i.e. bridges, roads, schools), which is controlled, designed and created by humans to support human activity, environmental infrastructure is not confined to the realm of Culture. Rather, it operates at a level below and distinct from conventional infrastructure.

Environmental infrastructure may include, for example, "cultivated landscapes," landscapes created by fire regimes and/or shifting cultivation, abandoned urban and rural landscapes as well as anthropogenic soils, fruit trees and orchards, coppice woodland, localized or decentralized water-management systems (including, for example, simple water holes or wells), farms and fields, and seed stores.

Humans are "architects of Nature" because they are environmental actors. Humans, however, work with nature (which is at once an actor and a medium), rather than dominating nature or being dominated by nature. The "architects of nature" create, configure, maintain and remake "environmental infrastructure" in interaction with other local, regional, and global actors, factors, and processes (for example, climate change). Any change in how the architects maintain their environment has implications for the environmental infrastructure.

Structure of the Study

This chapter discusses the dominant paradigms that are used to analyze and describe environmental change. Chapter 2 explores how the three dominant paradigms give rise to analytical blind spots, illustrated by the Palenque and Ovambo Paradoxes, questioning respectively the views that environmental change is a unilinear Nature-to-Culture progression or a singular homogenous process.

Chapter 3 introduces the Ovamboland case, outlines the sources used for the study, and describes the research methodology. The study approaches the issue of environmental change from three vantage points within a historical framework that focuses on the processes involved rather than emphasizing the outcome of change by, for example, measuring change between a single present state of the environment and a presumed past benchmark. First, a variety of sources are employed to analyze the processes of change. Second, environmental change is assessed at multiple levels of analysis, including macro- (Ovamboland), meso- (subdistricts and villages) and micro-levels (households and individuals). Third, environmental change as evidenced by changes in vegetation cover is construed not merely as the result of changes in the realm of forest (or tree) use and management as such; it is also seen to emanate from a multitude of nature-nature, society-nature, and society-society interactions.

An analysis of historical data about population, migration, land and wood use, and environmental conditions provides the study's overall framework. A dynamic time series of macro-level "states" of the environment was constructed based on historical literature, archival documents, including reports about agriculture and forestry, and testimonies by Namibian men and women. These sources reflected on the use and management of natural resources and environmental change that were contained in colonial reports. The historical analysis serves to highlight correlations between various factors impacting on environmental change, when and how change occurred, and how policy makers and land-use experts perceived the changes. The historical analysis is augmented by qualitative life history interviews to obtain information about local agency and about the “day-to-day” details of environmental change and a sample household survey that provided detailed quantitative information on past and present tree use and management. The combined information from the archives, the interviews, and the surveys provided insight into environmental use and management practices amongst households, groups of households, villages, and groups of villages.

Chapter 4 argues that the search for “absolute” benchmarks to measure environmental change by (i.e. “pristine” Nature or the state of Nature) is futile; rather, relative benchmarks should be identified and used. Chapters 5 and 6 analyze environmental change at the macro level, focusing on arguably the most critical human-related catalysts for environmental change: population growth and human environmental management practices. The chapters stress that the relationships between the factors of “population” and “management” and environmental change are marked more by correlations than by evidence of causality. Chapter 5 demonstrates that the impact of population density on the forest environment is ambiguous and that population should not be regarded merely as a quantitative and biological factor, but rather as a qualitative factor that impacts on forest resources through social processes. <u>Where</u> and <u>how</u> people impacted on local natural resources was as important as <u>how many</u> people affected the environment of Ovamboland.

Chapter 6 focuses explicitly on the effects of human agency on the environment that are caused by the management and use of livestock. It is often argued that population growth in semi-arid regions is accompanied by increases in livestock herd sizes, resulting in overgrazing. These arguments are largely based on the idea that human agency in livestock management is circumscribed by culture or tradition. For example, in the “cattle complex” model, cattle population numbers increase beyond environmental bounds because cattle is a symbol of status and wealth as opposed to a commodity. Yet, hard evidence for the existence of a livestock population bomb or serious overgrazing is lacking. Moreover, Ovamboland's cattle owners readily exported cattle before the imposition of colonial rule, a practice that contradicts the "pre-colonial" or "traditional" origins of the presumed cattle complex.

Chapters 7 and 8 highlight the contradictory nature of environmental change exemplified in the Ovambo Paradox: in Ovamboland dramatic deforestation and reforestation both occurred within a few generations. The chapters operate at the meso- and micro-levels of analysis, differentiating the process of environmental change to be able to identify the details of the process and the agents of deforestation and reforestation. The chapters raise the question of whether contradictory outcomes (i.e., deforestation and reforestation in Ovamboland) are merely a product of the use of different valuations of the same process and/or the same outcome, or if these are the result of the co-occurrence of multiple (sub)processes of environmental change. Chapter 8 differentiates environmental change at the meso- (village) and micro levels (household, individuals), showing the how, when, where and by whom day-to-day environmental change is accomplished by the human architects of Nature. The chapter also underscores that specific environmental considerations regarding the role of trees or forests did not necessarily provide the motivation to cut down and to propagate trees. In 20th century Ovamboland, for example, women were responsible for much of the on-farm reforestation because tree fruit was a source of food and the raw material to produce alcoholic beverages that could be consumed, traded, or sold.

Chapter 9 problematizes Culture as the outcome of environmental change in particular and as an analytical and descriptive category in general. Even as it caused dramatic environmental change, colonial science failed to domesticate wild Ovamboland. For example, intervention in the region's hydraulics resulted in the creation of an "organic machine," a Nature-Culture hybrid and not Nature or Culture. Moreover, the hydraulic society that emerged at the end of colonial rule was the product not only of western science and technology but equally so of indigenous knowledge and technology.

Chapter 10 introduces the concept of environmental infrastructure to analyze and describe (sub)processes of environmental change and (dynamic) "outcomes" that are located in the twilight zone between Nature and Culture or that fall beyond the purview of the Nature-Culture dichotomous model. Colonial and post-colonial officials and experts regarded "indigenous" fruit trees, sources of water (water holes), wood (mopane bush), and field crop (land, soils), and, indeed, Ovamboland as a whole, as wild (undomesticated) and part of (often degraded) Nature. In sum, they were natural resources. Yet, they are not natural as in naturally occurring. As chapter 9 demonstrates, women and men actively or passively propagated fruit trees and Ovamboland’s dry-season sources of water, i.e., the water holes, are as much the product of human labor and capital investment as are the fruit trees, the mopane coppice woodland, and the soils in the crop fields.

Chapter 11 concludes with a brief discussion of the implications of reconceptualizating how environmental change is analyzed and narrated.

CHAPTER 2
PARADOXES OF ENVIRONMENTAL CHANGE

The three dominant paradigms depict environmental change as a linear progression from a state of Nature to a state of Culture, which gives rise to at least two paradoxes that are defined in this study as the Palenque Paradox and the Ovambo Paradox. The presence of the ruins of Palenque and other cities in what are assumed to be the earth's last remaining wilderness environments constitutes a puzzle: how can the forests of Central America, the jungles of Southeast Asia and the wilderness expanses of Africa be pristine and natural if they are littered by urban ruins?

Moreover, the paradigms frame change in terms of a singular process with a singular outcome: either environmental degradation or improvement. The Ovamboland case study presented in this book, however, demonstrates that environmental change can be characterized by simultaneous environmental degradation in the form of deforestation and environmental recovery in the form of reforestation. None of the paradigms alone can satisfactorily explain the Ovambo paradox.

The Palenque Paradox

The modernization, declinist, and inclinist paradigms of environmental change each offer important insights into the dynamics of environmental change. Because they are cast as being competing and mutually exclusive, however, the paradigms create paradoxes about the process of environmental change. The first paradox is the presence of such remnants of urban settlements as, for example those of Palenque, in pristine forest. The urban environment is a powerful symbol of the dominance of Culture over Nature, representing the apex of civilization to modernizers, and Nature's nadir to declinists. The urban environment is also seen to be the antithesis of wilderness in the Nature-Culture dichotomous framework that the three paradigms share.[1] The benchmark environment against which environmental change is assessed

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[1] The classic study on the concept of wilderness is R. Nash, Wilderness in the American Mind (New Haven: Yale University Press, 1982 [first published 1967]). Cronon and White reject the Nature-Culture dichotomy and instead stress a Nature-Culture (urban-rural and wild-domesticated) continuum, see W. Cronon, Nature's Metropolis: Chicago and the Great West (New York: W. W. Norton & Company, 1991), pp. 17-19 and White, The Organic Machine, pp. 105-109. See also S. Schama, Landscape and Memory (New York: Alfred Knopf, 1995), pp.12-13. Schama emphasizes the links between nature and culture, pp. 13-15. Following Cronon's lead, Crabbé emphasizes that cities should be as integrated in nature as any other entity that exchanges energy, P. Crabbé, "A Complex Systems

and measured is variously referred to as wilderness, Nature, pristine Nature, state of Nature/Natural state, pre-contact environment (indigenous Edens or people-Nature balances), or vegetation climax.[2] The defining characteristic is essentially the same: the absence of human action in shaping the environment. As humans impact on the environment, the environment transforms increasingly and irreversibly away from its pre-human contact state. The closer the human communities are perceived to be to the "Natural State," the less they are thought to change their environment (either for the worse or the better, depending on the paradigm). For example, until recently, conventional wisdom maintained that such "indigenous" people who live by Nature as hunter-gatherers did not shape their environment. The impact of "indigenous" peoples on the environment is now hotly debated.[3]

Approach to Urban Ecosystem Integrity: The Benefit Side," Pimentel, Westra, Noss, Ecological Integrity, pp. 317-333. See also T. Trefon, "Libreville's Evolving Forest Dependencies," M.C. Reed and J.F. Barnes, eds., Culture, Ecology, and Politics in Gabon's Rainforest (Lewiston, USA: Edwin Mellen Press, 2003), pp. 37-62, especially 57-58. In his revised edition of the classic study on agroforestry and soils, Young uses the concept of a "natural equilibrium" but he also emphasizes that soil organic matter is the key to soil quality and that it can be restored (albeit at a price), Young, Agroforestry for Soil Management, pp. 23 and 59, 98-99 respectively. For examples of studies that use the concept of stable climax vegetation as a point of departure, see, for example, A. Erkkilä and H. Siiskonen, Forestry in Namibia, 1850-1990 (Joensuu: University of Joensuu, 1992), p. 167 and G.M. Woodwell with contributions from O. Ullstein, R.A. Houghton, S. Nilsson, P. Kanowski, E. D. Larson and T.B. Johansson, B. Kerr, Forests in a Full World (New Haven: Yale University Press, 2001), pp. 1, 7.

[2] P. Blaikie and H. Brookfield, for example, posit an Edenic point of departure; see Land Degradation and Society (London: Methuen, 1987), p. xx who. Longman and Jeník view climatic climax as vegetation potential under regional rainfall conditions. They emphasize that the FAO/UNESCO vegetation maps based on soil types "indicate potential vegetation in the absence of human interference," and they are uneasy about the idea of climax stage/balance, see K.A. Longman and J. Jeník, Tropical Forest and its Environment (Burnt Mill, England: Longman 1987 [second edition: first published 1974]), pp. 13-14, 20-21, 25. Kozlowski et al. acknowledge that climax is "rarely achieved because of the frequency of disturbances" and emphasize that even mature forest ecosystems attain at best an "oscillating steady state." See T.T. Kozlowski, P.J. Kramer, S.G. Pallardy, The Physiological Ecology of Woody Plants (San Diego: Academic Press, 1991), p. 100. Pimentel et al. acknowledge that the "linear-mechanical" paradigm is problematic but nevertheless adhere to a wild nature/natural state as a baseline/benchmark, defining the natural state as relatively free from human impacts, although they concede that this methodology may not work everywhere, Pimentel, Westra, Noss, Ecological Integrity, pp. 12-13 and L. Westra et al., "Ecological Integrity and the Aims of the Global Integrity Project," Pimentel, Westra, Noss, Ecological Integrity, pp. 19-41. For a critical overview, see Fairhead and Leach, who argue that climax vegetation is merely a new name for natural state, in Reframing Deforestation, pp. 10-11, 20, 24, 164-166.

[3] For studies that are based on the premise that, for example, hunting and gathering societies live by Nature, see M. Sahlins, Stone Age Economics (Chicago: Aldine-Atherton, 1972), p. 27 and R. Lee, "What Hunters do for a Living; or how to make out on Scarce Resources," R. Lee and I. DeVore, eds., Man the Hunter (Chicago: Aldine Pub. Co., 1968), pp. 30-43. For a critique of the concept of a pre-modern human-nature balance in North America, see A.C. Isenberg, The Destruction of the Bison (Cambridge, Cambridge University Press, 2000) especially pp. 2-10. For a similar critique regarding Central America, see for example, J.D. Wingerd, "Interactions between Demographic Processes and Soil Resources, S.L. Fedick, ed., The Managed Mosaic: Ancient Maya Agriculture and Resource Use (Salt Lake City: University of Utah Press, 1996), pp. 207-235 and M.J. MacLeod, "Exploitation of Natural Resources in Colonial Central America: Indian and Spanish Approaches," Steen and Tucker,

Indeed the very idea of assessing and measuring environmental change along a Nature-Culture gradient with Nature as the point of departure creates a paradox: the principal remaining vestiges of unspoiled Nature, that is, the forest regions of Central and South America and Southeast Asia as well as the proverbial last Wilderness Continent, Africa, contain such "lost cities" as, for example, Palenque in Mexico's rainforest and Thulamela in South Africa's Kruger National Park.[4] Moreover, wilderness' more scientific incarnation, the concept of vegetation climax, has been criticized as being a-historical, because it is based on the highly problematic premise of ecological stability. The concept is also challenged by alternative theories about environmental dynamics and by an outright rejection of the existence of any underlying patterns of Nature, except for chaos.[5] The concept of biodiversity is also

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Changing Tropical Forests, pp. 31-39. Meggers argues that the Indian population numbers and their environmental impact on the pre-Columbian environment have been exaggerated, B.J. Meggers, "Natural Versus Anthropogenic Sources of Amazonian Biodiversity: The Continuing Quest for El Dorado," Bradshaw and Marquet, How Landscapes Change, pp. 89-107. See also Sponsel who contends that if a "traditional" society becomes accultured, it passes through an "ecological transition," moving from an "dynamic equilibrium" to an environmental "disequilibrium." He argues that indigenous models of environmental use can serve as examples for rethinking western environmental use. See L.E. Sponsel, "The Environmental History of Amazonia: Natural and Human Disturbances and the Ecological Transition," Steen and Tucker, Changing Tropical Forest, pp. 233-251. In the same volume, Balée (pp. 185-197) argues that Indian management enhanced or maintained biodiversity. The relationship of indigenous peoples with their environment typically is seen to be static and structural, i.e. they are either considered to be natural conservators, or not. But M. Colchester points out that the Ho groups of Bihar have taken to clearing the forests they "traditionally" had been protecting in order to assert their property rights in the face of expanding commercial plantations, M. Colchester, "Forest Peoples and Sustainability," Colchester and Lohmann, The Struggle for Land, pp. 61-95, especially p. 84.

[4] On Palenque, see G.S. Stuart and G.E. Stuart, Lost Kingdoms of the Maya (Washington D.C.: The Society, 1993), pp. 19, 31 and V. Perera and R.D. Bruce, The Last Lords of Palenque: The Lacandon Indians of the Mexican Rainforest (Berkeley: University of California Press, 1985 [first published 1982], pp. 10-26. On Thulamela, see P. Davidson, "Museums and the Reshaping of Memory," S. Nuttall and C. Coetzee, eds., Negotiating the Past: The Making of Memory in South Africa (Oxford: Oxford University Press, 1999 (First impression 1998), pp. 143-160, especially pp. 150-151. http://www.geocities.com/Athens/6398/ingwe2.htm. On Africa as the last wilderness, see, for example, J.S. Adams and T.O. McShane, The Myth of Wild Africa: Conservation without Illusion (Berkeley: University of California Press, 1996 [1992]), chapter 1 and J.A. Murray, Wild Africa: Three Centuries of Nature Writing from Africa (New York and Oxford: Oxford University Press, 1993), p. 4. That Africa has so long maintained the image as the last wild continent is especially intriguing because no other continent has been exposed to human occupation as long as Africa, see T.R. McClanahan and T.P. Young, eds., East African Ecosystems and their Conservation (New York and Oxford: Oxford University Press, 1996), pp. v-vi. Compare Rackham who points out that many large wooded areas of post-Roman England contain traces of Roman and pre-Roman settlements, Rackham, Trees and Woodland in the British Landscape, p. 41.

[5] Hallé et al. reject the stasis/stability concept and assert that even under natural conditions, forest is marked more by change than by stability, F. Hallé, R.A.A. Oldeman, P.B. Tomlinson, Tropical Trees and Forests: An Architectural Analysis (Berlin: Springer Verlag, 1978), pp. 333-379. Le Houérou rejects the usefulness of the concept of climax vegetation in the Sahel zone because of climatic changes and the presence of human-and-livestock for over 7,500 years. But he still uses a similar concept, "primeval vegetation" which he sees as little affected by humans and livestock, H.N. Le Houérou, The Grazing Land Ecosystems of the African Sahel (Berlin: Springer-Verlag, 1989), pp. 86-87. Leakey

frequently – sometimes explicitly, sometimes implicitly – used as a benchmark. The premise is that biological diversity was greater in an ill defined and vague, "past," and that human influence is causing biodiversity to rapidly decline. Yet, hard quantitative data about historical biodiversity are lacking and assessments about biodiversity are made on the basis of anecdotal evidence. Moreover, some authors argue that people in fact increase biodiversity and/or they question the implication that the evolutionary process has ended (and that no new species are created).[6]

Neither Palenque nor Thulamela are exceptional: Mexico alone boasts 10,000 known pre-Columbian urban sites and Thulamela and 50 other similar locations are associated with the ruins of the medieval city of Great Zimbabwe, in modern Zimbabwe.[7] In addition, Palenque, Thulamela, Great Zimbabwe and the other lost cities were not isolated anomalies in an otherwise pristine wilderness: the impact on

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rejects the balance of nature idea, emphasizing that ecosystems are dynamic and that change is their main characteristic, R. Leakey and R. Lewin, The Sixth Extinction: Biodiversity and its Survival (London: Weidenfeld and Nicolson, 1996), p. 211. Cooper notes that the debate between equilibrium and disequilibrium has not been resolved and proposes a middle ground between the equilibrium position that ecology is subject not to history but to laws, and the disequilibrium/New Ecology position that everything is historically contingent, G.J. Cooper, The Science of the Struggle for Existence (Cambridge, UK: Cambridge University Press, 2003), pp. 18-20, 75-95, 96, 124, 131-135, 155-195. See also Sagroff who regrets that "Ecology in large part has become the science of Eden – of Nature 'out there'" and who claims that Darwin did not think that there was any design to ecosystems and that Darwin was mainly concerned with historical explanation, M. Sagroff, "Ecosystem Design in Historical and Philosophical Perspective," Pimentel, Westra, Noss, Ecological Integrity, pp. 61-78, especially 64-65 and 74. Pimentel, Westra, and Noss criticize the chaos concept because it still imposes a natural law since chaos is seen paradigmatically as "deterministic chaos," pp. 7-8. In the same volume Partridge asserts that ecologists and biologists have always known that balance/equilibrium conceptualizations are not perfect. He accepts the idea of a "natural state" that is determined by the climatic and other conditions prevailing in a given era and claims that undisturbed nature in a climax stage remains more or less in stasis. See E. Partridge, "Reconstructing Ecology," pp. 79-97. See also Holland in the same volume: A. Holland, "Ecological Integrity and the Darwinian Paradigm," p. 55. Fairhead and Leach claim that the so-called New Ecology disequilibrium ideas have not made significant inroads on the balance/climax idea, Fairhead and Leach, Reframing Deforestation pp. 176-178. Williams, in a more recent study, claims that few ecologists still use the concept of balance that lies at the roots of the idea of climax, although he accedes that it is still omni-present in textbooks and rhetoric, Williams, Deforesting the Earth, p. 433.

[6] Woodwell uses biodiversity in this way; see G.M. Woodwell with contributions from O. Ullstein, R.A. Houghton, S. Nilsson, P. Kanowski, E. D. Larson and T.B. Johansson, B. Kerr, Forests in a Full World (New Haven: Yale University Press, 2001), pp. 51-64. On people enhancing biodiversity, see J.F. Kessy, Conservation and Utilization of Natural Resources in the East Usambara Forest Reserve: Conventional Views and Local Perspectives (Wageningen: Wageningen Agricultural University, 1998), pp. 36-38, 125-126. Kessy also emphasizes that there are many unknowns in biodiversity including a lack of data (pp. 36-38). See also C.D. Becker and R. Léon, "Indigenous Forest Management in the Bolivian Amazon: Lessons from the Yuracaré People," C.C. Gibson, M.A. McKean, and E. Ostrom, eds., People and Forests: Communities, Institutions, and Governance (Cambridge, Mass.: MIT Press, 2000), pp. 163-191, especially p. 176.

[7] On the Meso-American ruins, see L.V. Foster, A Brief History of Central America (New York: Facts on File, 2000), pp. 20-21. On Great Zimbabwe, see M. Hall, The Changing Past: Farmers, Kings, and Traders in Southern Africa, 200-1860 (Cape Town: D. Philip, 1987), pp. 91-116 and D.N. Beach, The Shona and Zimbabwe, 900-1850 (Gweru: Mambo Press, 1990 [1980]), pp. 1-52.

their surroundings must have been considerable. Great Zimbabwe had a population of 30,000 and stood at the center of a trade network that linked it to an enormous hinterland encompassing much of southern Africa, as well as to the Middle East, India, Southeast Asia, and China.[8] In North America, modern Vancouver's hinterland, for example, is 318 times the actual size of the city, with the city and its population using the biophysical output of 3.6 million hectare scattered across the entire globe, and Chicago's urban growth similarly consumed the resources of an enormous hinterland, dramatically transforming the city's environment in the process.[9] That archeological research long has been biased towards excavating temples and palaces has resulted in a dearth of data on the daily activities of urban inhabitants, including environmental resource use and the size of the populations of the urban centers and their hinterlands.[10] The lost cities in the African, the Central and Latin American, and the Southeast Asian wilderness must have left extensive environmental footprints. The Inca cities of Latin America drew firewood from the mountain forest of the Andes and the Mayan urban centers relied on the upland forests for a variety of products. The Maya city-state Copán had a hinterland that comprised up to 13,500 hectare. Historical Angkor Wat in Cambodia relied on stone quarries 20 miles away and the upkeep of just one of its many temples was the responsibility of 3,140 villages that had a combined population of 80,000 inhabitants.[11]

The primordial forest and woodland of much of America, Southeast Asia, and Africa are prhaps just one to five centuries old. The forests that hide the Maya ruins

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[8] Hall, The Changing Past, pp. 91-116 and Beach, The Shona and Zimbabwe, pp. 1-52.
[9] B.J. Meggers, "Natural Versus Anthropogenic Sources of Amazonian Biodiversity: The Continuing Quest for El Dorado," Bradshaw and Marquet, How Landscapes Change, pp. 89-107 and Cronon, Nature's Metropolis, especially pp. 17-19.
[10] E. Graham and D.M. Prendergast, "Maya Urbanism and Ecological Change," Steen and Tucker, eds., Changing Tropical Forests, pp. 102-109 and Stuart and Stuart, eds., Lost Kingdoms of the Maya, p. 32. See also W.A. Hartland, "Maya Settlement Patterns: A Critical Review," E. Wyllys Andrews IV et.al., eds., Archaeological Studies in Middle America (New Orleans: Middle American Research Institute, Tulane University, 1970), p. 37. See also N.P. Dunning, "A Reexamination of Regional Variability in the Pre-Hispanic Agricultural Landscape," Fedick, ed., The Managed Mosaic, pp. 53-91.
[11] On the Mayan urban centers, see E. Graham and D.M. Prendergast, "Maya Urbanism and Ecological Change," Steen and Tucker, Changing Tropical Forests, pp. 102-109 and P.S. Dunham, Resource Exploitation and Exchange among the Classic Maya," Fedick, The Managed Mosaic, pp. 320-325. On Copán, see E.M. Abrams et.al., "The Role of Deforestation in the Collapse of the Late Classic Copán Maya State," L.E. Sponsel, T.N. Headland, and R. Baily, eds., Tropical Deforestation: The Human Dimension (New York: Columbia University Press, 1996), pp. 55-75, especially p. 61. On Angkor Wat, see C. Higham, The Archaeology of Mainland Southeast Asia from 10,000 B.C. to the Fall of Angkor Wat (Cambridge: Cambridge University Press, 1989), pp. 333 and 339-340. On the Andean forests, see D.W. Gade, Nature and Culture in the Andes (Madison: University of Wisconsin Press, 1999), p. 52. In general, see also P. Crabbé, "A Complex Systems Approach to Urban Ecosystem Integrity: The Benefit Side," Pimentel, Westra, Noss, Ecological Integrity, pp. 317-333.

may be no more than 400 years old and they differ in composition from the pre-Mayan era woody vegetation. The pristine rainforest of Suriname in the 17th and 18th centuries was the locus of a thriving plantation system that collapsed with the abolition of slavery. Today's forests in the northeastern United States grew on abandoned agricultural lands. The jungles of Kalimantan cover the ruins of mighty Srwijaya, which thrived from the 6th to the 14th century AD. The forest "wilderness" of southeastern Borneo in the 17th and 18th century was not only extensively used for shifting cultivation and permanent agriculture, but also for commercial agriculture. Africa's "wild" landscapes similarly are arguably human creations: for example, the West African forest islands that Fairhead and Leach study are human-made and the extensive miombo woodlands of eastern and southern Africa have been modified by human use.[12] Slave and cattle raids and warfare in 19th and early 20th century Africa led to the depopulation of vast regions; farms, fields, and entire villages were rapidly overgrown by bush vegetation, inviting wildlife (and often tsetse fly) to (re)colonize large stretches of Africa.[13] These processes resulted in the African wilderness that

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[12] On the Maya, see B.W. Leyden, M. Brenner, T. Whitmore, J.H. Curtis, D.R. Piperno, and B.H. Dahlin, "A Record of Long – and Short – Term Variation from Northwest Yucatán: Cenote San José Culchacá," Fedick, The Managed Mosaic, pp. 30-49. Fedick stresses that ancient Maya agriculture supported millions of people over centuries in a marginal environment, S.L. Fedick, "Introduction: New Perspectives on Ancient Maya Agriculture and Resource Use," Fedick, The Managed Mosaic, p. 10. See also J.D. Wingard, "Interactions between Demographic Processes and Soil Resources in the Copàn Valley, Honduras, Fedick, The Managed Mosaic, pp. 207-235. For a similar argument regarding Northern Mexico, see J.B. Alcorn, "Huastec Noncrop Resource Management: Implications for Prehistoric Rain Forest Management," Human Ecology, 9, no. 4 (1981), pp. 395-417. Becker and Léon argue that fruit tree planting by humans contributed to the shaping of the Amazonian forests, C.D. Becker and R. Léon, "Indigenous Forest Management in the Bolivian Amazon: Lessons from the Yuracaré People," C.C. Gibson, M.A. McKean, and E. Ostrom, eds., People and Forests: Communities, Institutions, and Governance (Cambridge, Mass.: MIT Press, 2000), pp. 163-191, especially p. 176. On Suriname, see P. Boomgaard, "Exploitation and Management of the Surinam Forests, 1600-1975," Steen and Tucker, Changing Tropical Forest, pp. 252-264. On the US, see W.J. McShea and W.M. Healy, eds., Oak Forest Ecosystems: Ecology and Management for Wildlife (Baltimore: The Johns Hopkins University Press, 2002), especially pp. 4-5, 13-33, 34-45, 46-59, and 60-79. On Srwijaya, see J.A. McNeely, "Foreword," Sponsel, Headland, and Baily, Tropical Deforestation, pp. xv-xvii. On Borneo, H. Knapen, Forests of Fortune? The Environmental History of Southeast Borneo, 1600-1880 (Leiden: KITLV Press, 2001), pp. 189-281. See also S. Rietbergen, ed., The Reader on Tropical Forestry (London: Earthscan, 1993), pp. 1-2; S.G. Boyce, Landscape Forestry (New York: J. Wiley, 1995), p. vii; L.E. Sponsel, T.N. Headland, and R. Baily, "Anthropological Perspectives on the Causes, Consequences, and Solutions of Deforestation," Sponsel, Headland, and Baily, Tropical Deforestation, pp. 3-52, especially 7-8; Longman and Jeník, Tropical Forest and its Environment, pp. 13-14, 24, and 27.

[13] On Africa, see Adams and McShane, The Myth of Wild Africa, pp. 1-13; McCann, Green Land, Brown Land, p. 2; G. Sheperd, E. Shanks, and M. Hobley, "Management of Tropical and Subtropical Dry Forests," S. Rietbergen, ed., The Earthscan Reader on Tropical Forestry (London: Earthscan, 1993), pp. 107-136, especially 107 and 112. Fairhead and Leach, Reframing Deforestation; S. Berry, Cocoa, Custom, and Socio-Economic Change in Rural Western Nigeria (Oxford: Clarendon Press, 1975), p. 66; Webb, Desert Frontier, p. 3; Campbell, The Miombo in Transition, pp. 1-3; S. Misana, C. Mung'ong'o and B. Mukamuri, "Miombo Woodlands in the Wider Context: Macro-Economic and

colonial officials and scientists described in their late 19th and early 20th centuries accounts and which subsequently served as the benchmark to assess environmental change during the colonial and post-colonial eras. The 1900-1920s baseline in Africa, however, was an entirely unrepresentative high water mark for woody vegetation cover.[14]

National parks and reserves are often portrayed as sanctuaries of pristine wilderness, for example the Kruger Park was long advertised as an African Eden, but they seldom are. Many if not all of Africa's national parks and reserves were converted into "wilderness" by forcibly removing the local populations and prohibiting them from accessing the area's resources. Enforcement, however, was often ineffective.[15] This phenomenon was not confined to Africa; clearing out populations and denying them access to forest reserves and other conservation areas in Asia especially has been marked by fierce resistance, frequently making conservation at best precarious.[16]

Ecological (and agricultural) research stations similarly are not the primordial wilderness sites that previously had been presumed. Notable examples include the heavily studied Kibale National Park at the foot of Mount Ruwenzori in Uganda, Pobé in Benin in West Africa, and La Selva in Costa Rica in Central America.[17] The realization that these areas do not constitute undisturbed sites that approach the state of nature or a natural climax is critical because much of the longer term and in depth

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Inter-Sectoral Influences," Campbell, The Miombo in Transition, pp. 73-99, especially 73; Kreike, Re-creating Eden, especially chapters 1-4; J. Ford, The Role of Trypanosomiases in African Ecology (Oxford: Clarendon Press, 1971); Kjekhus, Ecology Control.

[14] Fairhead and Leach make this argument for West Africa in Reframing Deforestation, p. 184.

[15] On the Kruger National Park, see Carruthers, The Kruger Park; J. Stevinson-Hamilton, introduction by J. Carruthers, South African Eden: The Kruger National Park, 1902-1946 (Cape Town: Struik, 1993 [first edition 1937]); B. de Villiers, Land Claims and National Parks: The Makuleke Experience (Pretoria: Human Sciences Research Council, 1999). For East Africa in particular, see R.P. Neumann, Imposing Wilderness: Struggles over Livelihood and Nature Preservation in Africa (Berkeley: University of California Press, 2000 [first published 1998]).

[16] Guha, The Unquiet Woods and Peluso, Rich Forests.

[17] On Kibale, see C.A. Chapman and L.J. Chapman, "Mid-Elevation Forests: A History of Disturbance," T.R. McClanahan, and T.P. Young, eds., East African Ecosystems and their Conservation (New York: Oxford University Press, 1996), pp. 385-400. On Pobé, see Fairhead and Leach, Reframing Deforestation, pp. 103-106. On La Selva, see S.M. Pierce, "Environmental History of La Selva Biological Station: How Colonization and Deforestation of Sarapiquí Canton, Costa Rica, have altered the Ecological Context of the Station," Steen and Tucker, Changing Tropical Forests, pp. 40-57, especially 47-48. Some scientists who worked at La Selva chose to ignore evidence that the forest where the station was based was far from pristine, see Mingguang Li et al., "Seedling Demography in Undisturbed Tropical Wet Forest in Costa Rica," M.D. Swaine, ed., The Ecology of Tropical Forest Tree Seedlings (Paris: UNESCO, 1996), pp. 285-314, especially 285-286 and G.S. Hartshorn, "Tree Falls and Tropical Forest Dynamics," P.B. Tomlinson and M.H. Zimmermann, eds., Tropical Trees as Living Systems (Cambridge, Cambridge University Press, 1978), pp. 620, 638.

research on tropical vegetation and soils has been conducted in a fairly limited number of such stations and the results of this research have been used as baseline data sets that have been used to extrapolate about tropical ecology in general.[18]

Examples of non-unilinear environmental change, with eras of deforestation followed by reforestation, and sometimes back again, abound. The waxing and waning of forests marked, for example, Ghana (forest clearing between 1000-1600 and again in the 1900s), the Ethiopian Highlands, the miombo of eastern and southern Africa (expansion and contraction over at least the last 22,000 years), and the forests of the Midwestern and Eastern United States (where oak forests have repeatedly expanded and contracted during the last 10,000 years).[19] But it is not cyclical change, as in a return to a climax. In the United States, for example, Native American use of fire fostered a forest dominated by such fire-resistant species as oak, hickory and chestnut. Fire-suppression in the 20th century, however, led to forest regrowth becoming increasingly dominated by such fire sensitive species as red maple and sugar maple. Moreover, forest is encroaching on what used to be savanna and even barrens. The composition of the Central American forests of today is also dissimilar to the forests that marked the pre-Mayan environment. And, Japan saw massive reforestation in the wake of WWII, but two thirds of its mountain forests are industrial monoculture forests.[20] Processes of afforestation that do not directly result from human agency (as occurs in forest plantations, for example), but rather from "natural" re-growth, as in the case of the re-establishment of forests and woodlands on

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[18] Longman and Jeník, for example, make reference to La Selva data, see Longman and Jeník. Tropical Forest and its Environment, p. 230.

[19] On Ghana, Fairhead and Leach, Reframing Deforestation, pp. 76-77 and cf. 89-90. On Ethiopia, J.C. McCann, Green Land, Brown Land, Black Land: An Environmental History of Africa, 1800-1990 (Portsmouth: Heinemann, 1999), pp. 79-107. On the miombo, see Campbell, The Miombo in Transition, pp. 5-6 and S. Misana, C. Mung'ong'o and B. Mukamuri, "Miombo Woodlands in the Wider Context: Macro-Economic and Inter-Sectoral Influences," Campbell, The Miombo in Transition, pp. 79-83. On the US, see W.J. McShea and W.M. Healy, "Oaks and Acorns as a Foundation for Ecosystem Management," p. 4-5 and M.D. Abrams, "The Postglacial History of Oak Forests in Eastern North America," W.J. McShea and W.M. Healy, eds., Oak Forest Ecosystems: Ecology and Management for Wildlife (Baltimore: The Johns Hopkins University Press, 2002), pp. 4-5 and 34-45 respectively. See also Williams, Deforesting the Earth, pp. 3-4, 12.

[20] On the US, see M.D. Abrams, "The Postglacial History of Oak Forests in Eastern North America," and D. Dey, "Fire History and Postsettlement Disturbance," and "The Ecological Basis for Oak Silviculture in Eastern North America," McShea and Healy, Oak Forest Ecosystems, pp. 34-45, 46-59 and 60-79 respectively. See also J.H. Brown, C.G. Curtin, R.W. Brathwaite, "Management of the Semi-Natural Matrix," Bradshaw and Marquet, How Landscapes Change, pp. 327-343, especially 331-336. On central America, see B.W. Leyden, M. Brenner, T. Whitmore, J.H. Curtis, D.R. Piperno, and B.H. Dahlin," A Record of Long – and Short – Term Variation from Northwest Yucatán: Cenote San José Culchacá," Fedick, The Managed Mosaic, pp. 30-49. On Japan, see J. Knight, "From Timber to Tourism: Recommoditizing the Japanese Forest," Doornbos, South, and White, Forests: Nature,

abandoned lands, also draw attention to Nature's role as an actor rather than a victim of or a backdrop to human initiative.[21]

The Ovambo Paradox

Whereas the Palenque Paradox problematizes unilinearity and a predominant focus on human agency because it highlights that deforestation and reforestation as a result of natural or human agency may occur sequentially and repeatedly, the Ovambo Paradox suggests that deforestation and reforestation may occur simultaneously not only across different units of space (interspatial) but also within a single continuous space (intraspatial). As inhabitants of the Ovambo floodplain settled wilderness (ofuka) areas in the floodplain and east of the floodplain between the 1910s and 1960s, they deforested land in order to construct farms, fields, and villages. As they managed their new environments, however, they propagated pre-existing and new woody vegetation, resulting in reforestation.[22] Descriptions of the late 1800s environment of the region are strikingly similar to those of the late 1900s: both depict settlements characterized by neighboring farms, with towering fruit trees and dense woody vegetation on the edges of the farms and between the villages. Yet, dramatic environmental changes occurred between the late 1800s and 1900s: many areas were heavily deforested and reforested, revealing multi-trajectory and contradictory environmental changes. Ambiguity in the record of environmental change is not rare. To the contrary, ambiguity may be attributed to different valuations of what constitutes degradation, and what may be considered to be improvement. Moreover,

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People, Power, pp. 335-336.

[21] Studies that focus on "natural" environmental change and human's reactions to it have not been in fashion in the last two decades or so and have been easy targets for criticisms of "environmental determinism." For examples of environmental histories with a focus on the environment as the primary actor, see Brooks, Landlords and Strangers; Webb, Desert Frontier; and J. Guy, Ecological Factors in the Rise of Shaka and the Zulu Kingdom," S. Marks and A. Atmore, eds., Economy and Society in Pre-Industrial South Africa (London: Longman, 1980), pp. 102-119. The latter was very influential in the historiography of southern Africa. Other studies that highlight environmental and human agency in a more interactive way are, for example, Johnson and Anderson, The Ecology of Survival and J. Giblin, The Politics of Environmental Control in Northeastern Tanzania, 1840-1940 (Philadelphia: University of Pennsylvania Press, 1992). J.C. McCann points out that the role of climate is relatively understudied in the recent environmental historiography of Africa, see "Climate and Causation in African History," International Journal of African Historical Studies, vol. 32, nos. 2-3 (1999), pp. 261-280.

[22] E. Kreike, "Hidden Fruits: A Social Ecology of Fruit Trees in Namibia and Angola, 1880s-1990s," W. Beinart and J. McGregor, eds., Social History and African Environments (Oxford: James Currey, 2003), pp. 27-42.

interpretations of the significance of the process of environmental change and its outcome may differ.[23]

Crummey and Winter-Nelson note that both afforestation and environmental decline can be observed in Wällo in Ethiopia.[24] Bassett, Kolo Bi, and Okatarra identified a decline in wildlife (unambiguous degradation) and a simultaneous increase of cropland and woodland (or afforestation) at the expense of open bush land in the Northern Ivory Coast between the 1950s through the 1980s and concluded that environmental change can occur in different directions at the same time.[25] Van der Haar's case study of a former ranch in southern Chiapas in Mexico from the 1960s through the 1990s noted a "simultaneous recovery of degraded forest lands and intensification of maize cultivation."[26]

Van der Haar concludes, however, that her paradoxical findings of intensification of agriculture and afforestation may be partly an artifact of the relatively abstract scale of her analysis, explaining that although she could demonstrate who was in control of resources and their use, she did not have the data

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[23] H.L. Moore and M. Vaughan, Cutting down Trees: Gender, Nutrition, and Agricultural Change in the Northern Province of Zambia, 1890-1990 (Portsmouth, N.H.: Heinemann, 1994) and Fairhead and Leach, Misreading the African Landscape. Blaikie and Brookfield stress that a multidisciplinary approach and a sensitivity to multi-causality are required to environmental study but regard environmental change as mono-processual, see, P. Blaikie and H. Brookfield, Land Degradation and Society (London: Methuen, 1987), pp. 14-16. Meggers attributes the conflicting interpretations about environmental change in the Amazon to a lack of communication between scholars from different disciplinary backgrounds, B.J. Meggers, "Natural Versus Anthropogenic Sources of Amazonian Biodiversity: The Continuing Quest for El Dorado," Bradshaw and Marquet, How Landscapes Change, pp. 89. See also Mazzucato and Niemeijer, Rethinking Soil and Water Conservation, pp. 114-116 and C.C. Gibson, M.A. McKean, and E. Ostrom, "Explaining Deforestation: The Role of Local Institutions," C.C. Gibson, M.A. McKean, and E. Ostrom, eds., People and Forests: Communities, Institutions, and Governance (Cambridge, Mass.: MIT Press, 2000), p. 2. Schama notes that the impact of humans on Nature is not an unmixed blessing but he stresses that the ways humans affect Nature does not constitute "unrelieved and predetermined calamity" either. See Schama, Landscape and Memory, pp. 9-10.

[24] D. Crummey and A. Winter-Nelson, "Farmer Tree Planting in Wällo, Ethiopia," Bassett and Crummey, African Savannas, pp. 91-120, especially 119. See J. McCann, People of the Plow: An Agricultural History of Ethiopia, 1800-1990 (Madison: University of Wisconsin Press, 1995).

[25] T.J. Bassett, Z. Koli Bi, T. Okattara, "Fire in the Savanna: Environmental Change & Land Reform in Northern Co^te d'Ivoire," Bassett and Crummey, African Savannas, pp. 53-71, especially 64. A baseline survey of 1800 households in a Zimbabwean afforestation project revealed that deforestation was strongly correlated with clearing land for crop cultivation but that the non-arable was not deforested and might have gained woody biomass, see Kerkhof, Agroforestry in Africa, pp. 69-73. A. Erkkilä notes both deforestation and regrowth in woody vegetation cover in some areas, A. Erkkilä, "Living on the Land: Change in Forest Cover in North-Central Namibia, 1943-1996" (Ph.D. Dissertation, University of Joensuu, 2001), pp. 73-75, 99-101. Gibson et al. suggest that multiple processes may be at work and/or that knowledge is still too limited, C.C. Gibson, M.A. McKean, and E. Ostrom, "Explaining Deforestation: The Role of Local Institutions," Gibson, McKean, and Ostrom, People and Forests, p. 2.

[26] G. van der Haar, "Peasant Control and the Greening of the Tojolabal Highlands, Mexico," Wiersum, Tropical Forest Resource Dynamics, pp. 99-114, especially 110-112.

to illuminate the step by step processes of environmental change.[27] Van der Haar used the area of the former ranch as her spatial unit of analysis, construing it as a land use system. The scale of analysis is a critical variable for analyzing the process of environmental change and for evaluating its outcome. Larger scale outcomes average out outcomes at smaller scales. For example, on a global scale, the second half of the twentieth century witnessed severe deforestation, but the United States and Western Europe actually experienced reforestation.[28] Twentieth century Bangladeshi farmers planted trees on homestead mounds but simultaneously cleared trees in the surrounding floodplain to make fields.[29] If the homestead mound gardens were the unit of analysis, the outcome of the process of environmental change would have been afforestation; if, on the other hand, the actual floodplain were the focus, the diagnosis would have been one of deforestation. If the Bangladeshi floodplain land use system as a whole were to be evaluated, the outcome would have depended on the amounts of afforestation on the mounds and the extent of deforestation in the plain. Thus, the scale of analysis may significantly influence the outcome of the analysis. Multi-scale analysis may partially counter this problem; as Huxley notes, however, "research activities are nearly always confined to a single scale level."[30]

It is not only scale that is an issue, however, but also the focus on outcome. Huxley noted that "Ecologists often study the <u>outcome</u> of plant-plant interactions in terms of changes in species number. Unfortunately, because the <u>processes</u> involved are extremely complex, less is known about these in most cases."[31] Huxley's observation is equally relevant to the way environmental change as a whole is studied under the aegis of the modernization, declinist, and inclinist paradigms: the research emphasizes the outcome of Human-Nature interactions (degradation, stabilization, or improvement) more than the processes themselves.[32] For example, a comparison of

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[27] G. van der Haar, "Peasant Control," Wiersum, <u>Tropical Forest Resource Dynamics</u>, pp. 110-112.
[28] Williams, <u>Deforesting the Earth</u>, pp. 412-431.
[29] W.A. Leuschner and K. Khaleque, "Homestead Agroforestry in Bangladesh," Nair, <u>Agroforestry Systems in the Tropics</u>, pp. 197-209.
[30] Huxley, <u>Tropical Agroforestry</u>, p. 302. On multi-scale analysis, see C.C. Gibson, M.A. McKean, and E. Ostrom, "Explaining Deforestation: The Role of Local Institutions," Gibson, McKean, and Ostrom, <u>People and Forests</u>. The contributions in the volume note contradictions in environmental trends and the need to differentiate environmental change. See. for example the chapters by G. Varughese, "Population and Forest Dynamics in the Hills of Nepal: Institutional Remedies by Rural Communities," pp. 193-226, especially p. 204, table 8.2 and C.C. Gibson and C.D. Becker, "A Lack of Institutional Demand: Why a Strong Local Community in West Equador Fails to Protect Its Forest," pp. 135-161, especially pp. 135-136, 156.
[31] Huxley, <u>Tropical Agroforestry</u>, p. 135.
[32] Williams emphasizes the high degree of uncertainty, Williams, <u>Deforesting the Earth</u>, p. 237.

two photographs or two sets of aerial photography/satellite images from different times can show differences in vegetation cover and facilitate an assessment about, for example, deforestation or reforestation, but the comparison provides no information about the process of change itself. And, even if no substantial change in vegetation cover can be detected between the two measuring points, it is possible that the actual composition of the vegetation itself has changed.[33]

Such issues may be more acute in Africa than elsewhere, not only because deforestation data (and other statistics) for the continent are especially questionable, but also because more of the environmental change is caused by individuals and households for their own benefit than in Latin America, for example, or in Southeast Asia.[34] In Latin America, especially in the Amazon, and in Southeast Asia, especially in Indonesia, the state and commercial interests play a much more direct role in encouraging deforestation through colonization schemes, timber exploitation, plantation agriculture, or ranching. State and commercial clearings are larger and more concentrated and therefore leave a much more distinct environmental footprint that can be detected in aerial photography and satellite imagery. In addition, state and commercial enterprises produce more information about their activities because they are often controversial. In Africa, forest settlement is more spontaneous, and small-scale individual clearings, even if they are numerous, are virtually impossible to detect on Landsat and SPOT satellite images and on regular scale aerial photography, especially since selected trees and bush are often spared when farms are cleared. Such images therefore, cannot identify pristine nature or climax vegetation even if they existed. In short, the images cannot unambiguously distinguish rural cultural from natural landscapes.[35]

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[33] Mazzucato and Niemeijer, Rethinking Soil and Water Conservation, pp. 125-127.

[34] Williams notes that regional level data, especially on Africa, are lacking. Although Africa between 1920 and 1950 lost millions of ha of forest, little is known about the process, Williams, Deforesting the Earth, pp. 401-406. Gibson et al. stress that the underlying causes of the process of deforestation are disputed, C.C. Gibson, M.A. McKean, and E. Ostrom, "Explaining Deforestation: The Role of Local Institutions," Gibson, McKean, and Ostrom, People and Forests, pp. 1-26, especially pp. 1-2.

[35] Farmland with trees and fallow is mostly indistinguishable from forest or woodland. See Fairhead and Leach, Reframing Deforestation, pp. 8-9; W. Balée, "Indigenous History and Amazonian Biodiversity," Steen and Tucker, Changing Tropical Forest, p. 187-188; J. Vandermeer, "The Human Niche and Rain Forest Preservation in Southern Central America," Sponsel, Headland, and Baily, Tropical Deforestation, pp. 216-229, especially p. 224; Williams, Deforesting the Earth, p. 477. On state-led forest colonization in Southeast Asia and Latin America versus spontaneous settlement in Africa, see M. Colchester, "Colonizing the Rainforests: The Agents and Causes of Deforestation," Colchester and Lohmann, The Struggle for Land, pp. 1-15, especially pp. 5-9.

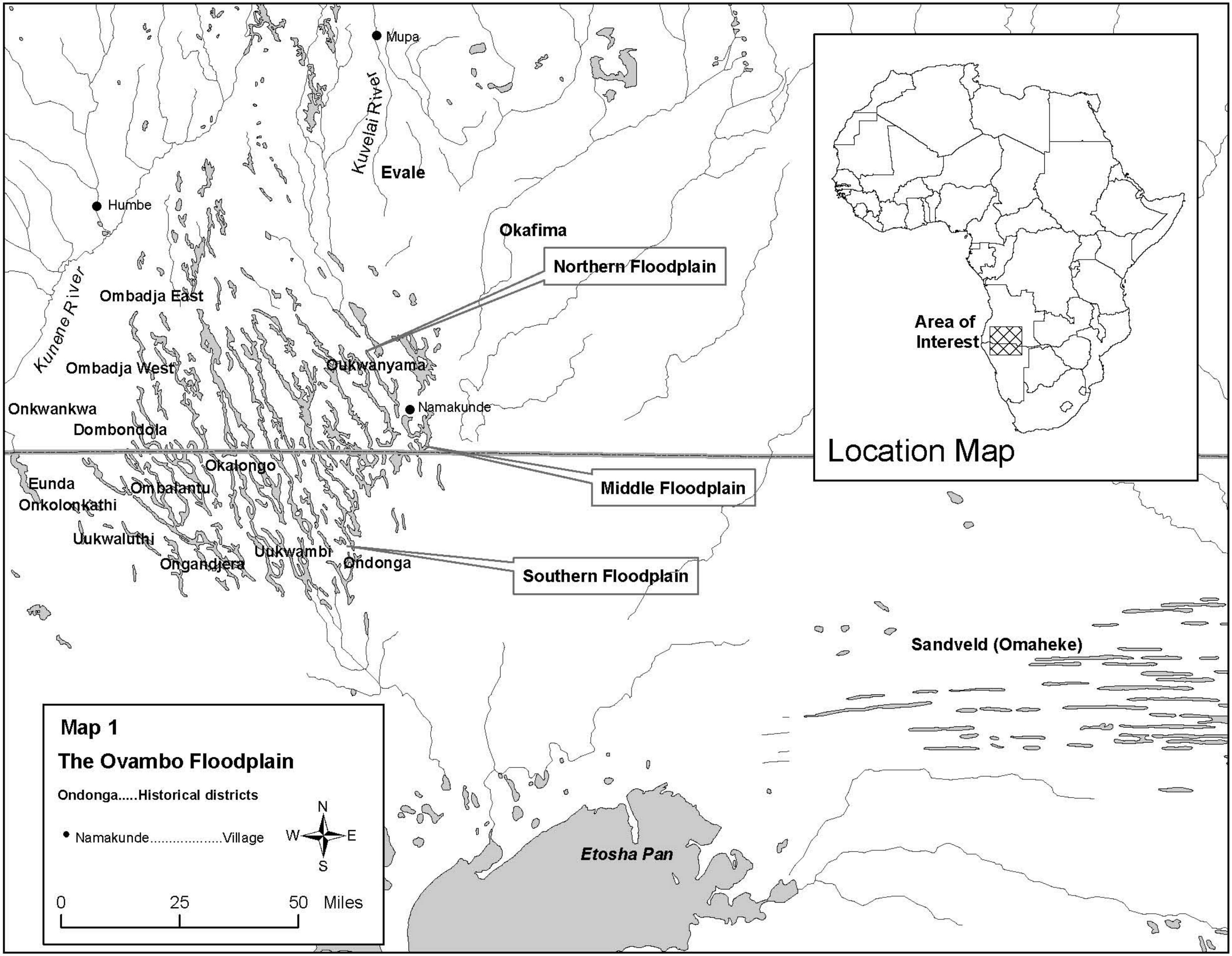
CHAPTER 3
UNRAVELING THE PARADOXES:
CASE STUDY, METHODOLOGY, AND SOURCES

The study employs a case study approach to facilitate an in depth analysis of the process(es) of environmental change at multiple levels. A micro-level analysis of multiple discrete (but interacting) sub-processes facilitates understanding non-linear, multi-trajectory, and even contradictory environmental changes. Moreover, it highlights the day-to-day dynamics of environmental changes and reveals agency and motivations. Ovamboland, Namibia offers a good case study because the modernization, the declinist, and the inclinist paradigms have strongly influenced the ways in which its environmental history has been understood. Moreover, environmental change in late-1800s to late-1900s Ovamboland shows contradictory trends that give rise to the Ovambo Paradox. Finally, environmental change in Ovamboland cannot be understood as a linear process within a Nature-to-Culture model, as problematized by the concept of the Palenque Paradox. The case study focus requires a discussion of how to translate the conceptual challenges identified in chapters one and two into an explicit methodology with appropriate tools of analysis, including identifying relevant sources.

The Environment and History of Ovamboland

The historical region of Ovamboland is demarcated by the border with Angola to the north, and flanked by the Kunene River to the west, the Kavango (Cubango) River to the east, and the Etosha Pan to the south. The region consists of the modern Ohangwena, Omusati and Oshana regions and of most of Oshikoto region. The region experiences sparse rainfall and dramatic seasonal contrasts. During the dry season, the area appears desert-like; during the rainy season it is a large swamp. Ovamboland's recent history is marked by warfare, disease, and population displacement, factors that contributed to environmental dynamics in the region. Land use takes the form of small-scale household farming and can be characterized in terms of an agro-silvipastoral system based on a millet staple and livestock raising. Woody vegetation is the principal source of firewood and construction materials, and it provides food and forage.

Most of Ovamboland's inhabitants are concentrated in the Ovambo floodplain, which occupies the western half of the region (see map 1).



Mupa
Kuvelai River
Evale
Humbe
Okafima
Northern Floodplain
Kunene River
Ombadja East
Ombadja West
Oukwanyama
Namakunde
Onkwankwa
Dombondola
Okalongo
Middle Floodplain
Eunda
Ombalantu
Onkolonkathi
Uukwaluthi
Uukwambi
Ondonga
Ongandjera
Southern Floodplain
Sandveld (Omaheke)
Etosha Pan
Area of Interest
Location Map
Map 1
The Ovambo Floodplain
Ondonga.....Historical districts
Namakunde..................Village
N
W
E
S
0
25
50
Miles

The floodplain itself lacks any permanent rivers or other natural sources of surface water. Although the rainfall in Ovamboland on average is higher than in most of Namibia, the average rainfall of 400-500 mm is thought to be barely adequate for agriculture. Average rainfall, which is heavily concentrated in a November to April rainy season, increases from the southwest to the northeast. Average rainfall in the far southwestern parts of Ovamboland, located in the western Etosha National Park south of the floodplain, is only 250 to 300 mm. In the central parts of the floodplain and east of the floodplain, rainfall averages 450 to 500 mm.[1] In January/February, the semi-annual flood or efundja brings water from Angola further north in the catchment area through a series of seasonal rivers (sing. omulonga) and a network of flood channels (sing. oshana, pl. eeshana). The flood is critical to augment household water supplies, sustain the inhabitants' livestock herds, and support the natural and cultivated vegetation of the floodplain. It also brings a sharp increase in malaria, but the region is free of sleeping sickness carried by the dreaded tsetse fly (causing nagana in cattle), which makes north central Namibia and the adjacent Lower Kunene Province of Angola prime cattle raising regions. Although warfare in Angola decimated cattle herds and the occurrence of foot and mouth currently prevents the export of cattle from the area, Ovamboland boasts large cattle populations and historically it was one of the leading cattle exporting regions of southern Africa.

Pearl millet is Ovamboland's staple. Other crops include sorghum, groundnuts, pumpkins, and beans. In the lower lying parts of the floodplain that have soils with a higher clay content, the danger of flooding and salinity prohibit crop cultivation. Outside of the floodplain, especially east of the floodplain in eastern Ovamboland, by contrast, crop cultivation is concentrated in the lower-lying areas along the edges of seasonal ponds or lakes (called "pans" in southern Africa) or seasonal rivers. Millet and other products were widely traded in Ovamboland. Moreover, many households relied on income from wage labor. Especially since the 1940s, many men and boys from Ovamboland sought contract labor in the mines and on the commercial farms of colonial Namibia and South Africa. They often engaged in multiple, successive contracts, each of one to two years' duration. The returns from migrant labor were spent not only on consumer products but were also invested in agriculture through the purchase of cattle, donkeys, land, and plows. As a result of the

[1] J. Mendelsohn, S. el Obeid, and C. Roberts, A Profile of North-Central Namibia (Windhoek, Namibia: Gamsberg Macmillan Publishers, n.d.), pp. 9-11.

day-to-day absence of men, however, crop cultivation in particular and natural resource management in general became predominantly an affair of women, children, and the elderly.[2]

The political history of Ovamboland had a profound impact on the patterns of environmental change in Ovamboland. By the late 19th century, the largest polities were located in the northern floodplain and in the southern floodplain, separated by a sparsely populated middle floodplain. The northern floodplain kingdoms – their territories now located in modern Angola – included the most populous polity, Oukwanyama, as well as Ombadja-West, Ombadja-East, Evale, Okafima and a few smaller polities including Onkwankwa. Ondonga, Uukwambi, Ombalantu, Ongandjera, Uukwaluthi, Onkolonkathi, and Eunda were located in the southern floodplain, with the latter smaller polities stretching into parts of the middle floodplain; these polities were located in present-day Namibia. By the late 19th century, an additional kingdom, ruled by King Haudanu, had occupied part of the middle floodplain around modern Okalongo, but it was destroyed by warfare and abandoned. The various polities were separated from one another by bands of uninhabited wilderness or ofuka. Ofuka separated not only the individual polities, but also divided the northern floodplain from the southern floodplain, and separated the floodplain from the surrounding regions. To the northeast and east, the prevalence of tsetse fly hindered travel with horses and oxen, and to the south, travelers were faced with very limited water supplies in addition to malaria and horsesickness. Yet these conditions did not isolate the region: by the late 1800s, the area had become a major exporter of cattle and ivory, and it was subjected to Nama raids from central Namibia.[3]

The Portuguese occupied the northern floodplain in 1915, after a violent conquest that stretched over more than a decade,. At the same time, the South Africans took control of the southern floodplain and the middle floodplain, defeating the German forces, which, however, had not effectively colonized the area. The violence that accompanied Portuguese conquest and that continued to mark Portuguese rule until at least the 1940s triggered a population exodus from the northern floodplain into the South African territories. In general, security had improved in the South African parts of the floodplain – which became known as

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[2] Kreike, Re-creating Eden, chs. 5-6.
[3] Kreike, Re-creating Eden, chs. 2-3.

Ovamboland – from the late 1920s onward, a factor that encouraged the population to leave the densely settled safe zones around the forts of their kings and headmen and to fan out into the ofuka wilderness areas that had separated the pre-colonial polities. By the early 1960s, very little of the late 1800s ofuka was left; even eastern Ovamboland, which lay beyond the floodplain environment, was dotted by villages, whereas previously it had only contained a small number of widely dispersed San/Bushmen villages and Ovambo cattle posts. [4]

The concentration of residents in Ovamboland made it a key labor reserve for South Africa. After taking over South West Africa/Namibia from Germany during the First World War, South Africa ruled the country as a mandate from the League of Nations. After the Second World War, South Africa administered the territory as a mandate from the successor organization, the United Nations. From the 1960s onward, however, South Africa disregarded the legal status of South West Africa/Namibia and treated the area as though it were a province of South Africa. During the 1960s-1990s regional Apartheid Wars Namibia became one of the major fronts for defending the Apartheid regime. Following the escalation of the war in the 1980s, which severely affected Ovamboland and the adjacent Lower Kunene Province of Angola, Namibia gained independence in 1990.[5]

Environmental change in Ovamboland between the late 1800s and the late 1900s is generally framed in terms of a declinist narrative of deforestation and desertification caused by overpopulation and overgrazing.[6] A few studies counter that deforestation in Ovamboland may be much less severe, and that it is accompanied by reforestation, suggesting that Fairhead and Leach's inclinist thesis that human settlement is associated with afforestation may also be a highly relevant model for studying vegetation dynamics in southern Africa. Erkkilä, for example, concludes that between the early 1980s and 1996, initial deforestation and the subsequent woody

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[4] Kreike, Re-creating Eden, chs. 6-7.

[5] On the impact of the Apartheid wars, see E. Kreike, "War and the Environmental Effects of Displacement in Southern Africa (1970s-1990s)," in W.G. Moseley and B. Ikubolajeh Logan, eds., African Environment and Development: Rhetoric, Programs, Realities (Ashgate, 2004).

[6] [K. Morrow], "A Framework for the Long Term Development of Agriculture within Owambo" (August, 1989); M. Seely and A. Marsh, eds., Oshanas: Sustaining People, Environment, and Development in Central Ovambo ([Windhoek], 1992); Erkkilä and Siiskonen, Forestry in Namibia; Mendelsohn, el Obeid, and Roberts, A Profile of North-Central Namibia.

vegetation regrowth in his study area cancelled one another out, and that woody vegetation use in Ovamboland is sustainable.[7]

According to the interpretation of some inhabitants of the Ovambo floodplain, when people settle "wilderness" areas, they convert the landscape into human space (oshilongo). When people abandon settled areas, the areas transform into wilderness (ofuka).[8] Humans thus play a central role in making and unmaking human space and wilderness, as is the case in the modernist, declinist, and inclinist paradigms. In contrast to these paradigms, however, environmental change is neiter unilinear or irreversible; through human intervention, an abandoned oshilongo may revert to ofuka, and land that was once ofuka can be converted to oshilongo.[9]

If environmental change(s) is (are) conceptualized as being caused by multiple sub-processes and resulting in multiple outcomes (i.e., deforestation and reforestation) environmental agency should similarly be differentiated because different environmental agents (and sometimes even the same agents) may contribute in different ways to different sub-processes, and in different "phases" of a particular sub-process. These processes are embedded not only in changes in the realm of forest (or tree) use and management as such, but also emanate from a multitude of nature-nature, society-nature, and society-society interactions. Moreover, although the various sub-processes may interact, they need not be synchronous: sub-processes of environmental change may have their own chronologies. In order to be able to distinguish these sub-processes and their multiple and even contradictory trajectories, the process itself needs to be differentiated, as well as the subject and object of environmental change, i.e. the agents and what they change. Finally, the time frame of analysis needs to be differentiated: comparing the state of the environment at two discrete moments in time does not allow for a detailed analysis of the processes of environmental change; moreover, the selected moments in time may not be representative.

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[7] E. Kreike, "The Ovambo Agro-Silvipastoral System: Traditional Land Use and Indigenous Natural Resource Management in Northcentral Namibia" (Windhoek: Ministry of Environment and Tourism, Forestry Publication No. 4, 1995); Erkkilä, "Living on the Land, " pp. 73-75, 99-101; Kreike, "Hidden Fruits," Beinart and McGregor, Social History and African Environments, pp. 27-42.
[8] Kreike, Re-creating Eden, ch. 1.
[9] Feierman outlines an equally dynamic conceptualization of change, Feierman, Peasant Intellectuals, especially pp. 6-7 and chapter 3.

Unraveling the Paradoxes: Research Design and Methodology

Problematizing environmental change as multiple processes with internally differentiated trajectories presents significant methodological challenges. For one, it is difficult to discern when and where a process begins and ends, when and where a process is still in motion, and when and where a more or less finished product or outcome is emerging, especially if multiple (sub)processes are involved. Building on Fairhead and Leach's approach to assessing environmental dynamics, the present study methodologically relies heavily on historical approaches and a variety of historical and modern data sources to differentiate processes of change at multiple levels of analysis, including macro- and micro-levels.[10] The emphasis is on understanding the process(es) of environmental change, rather than on measuring change between a single original state of (pristine) Nature and a current vantage point or on describing the outcome of the process(es).

Conceiving environmental change as being multi-linear and consisting of multiple sub-processes complicates identifying a reliable benchmark. If, as the Palenque Paradox suggests, there is no remaining nature that is untouched, the scientific benchmark of climax vegetation/ecological equilibrium is not only a-historical but is also in fact entirely fictive: no modern scientist ever can have observed climax vegetation or an ecosystem in equilibrium.[11] Moreover, even if one accepts that pre-contact non-Western peoples lived in Edenic harmony with Nature, there are no existing detailed descriptions of any pre-(European) contact climax vegetation or equilibrium ecosystem.

A common alternative to using such conventional benchmarks as pristine nature or climax vegetation is to infer the past from the present. For example, in his influential Guns, Germs, and Steel, Diamond identifies domestication as an important process in explaining the dominant position of "The West" in the 20th century. He traces the origins and history of domesticates that are currently central and makes a powerful case for why it was the West (i.e. Europe) that colonized Africa and Asia,

[10] Fairhead and Leach, Misreading the African Landscape, pp. 16-20.
[11] Holland points out that a historical definition of ecological integrity "must speak, hypothetically of 'what this patch would be like without human influence'" ….but because there were humans "one has to construct a hypothetical history beginning with some false or invented incident, and it is hard to see how this could count as the onset of a natural [emphasis original] sequence." A. Holland, "Ecological Integrity and the Darwinian Paradigm," Pimentel, Westra, Noss, Ecological Integrity, pp. 52-53.

and not Africa that colonized Europe.[12] His method, however, is based on two tenuous premises: first, it presumes that the present is the outcome of a process that has been completed, or that has at least reached a certain stage or plateau. Second, the analysis presumes that the most important domesticates of today were also critical in the past, and that they in and of themselves contributed very significantly to the outcome of the process of environmental change.[13] In short, the complexity of environmental change cannot be fully captured and understood through conventional models and methods.

Rather than an outcome, the present state of the environment is more likely to be a fleeting moment that, moreover, may not be representative of the process as a whole.[14] For example, mixing the colors red and blue yields green, but the benchmark and thus the research question differs depending upon whether the red was poured first, or the blue. This not merely a philosophical issue. For example, the oak may be the single most important tree species in the Western imagination. Because it is and was an important timber tree, and because it was and in some places still is a critical forage source for wild and domestic animals alike, the “king of trees” looms large in western culture as a symbol of Nature.[15] It is also a dominant and much celebrated component of the eastern United States woodlands; oak forests have been present in the Midwest and eastern United States for the last 10,000 years and are thus considered to be native and natural. Yet, the oak’s dominance is not permanent because it is more characteristic of the savanna than the forest. In the past, the human use of fire, chestnut blight, and the eradication of the passenger pigeon (a major seed predator) favored the fire tolerant oak over chestnut, which was previously a dominant species. Fire suppression from the 1930s onward led to tree and forest

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[12] J. Diamond, Guns, Germs, and Steel: The Fates of Human Societies (New York: W.W. Norton & Company, 1999 [1997]. Fairhead and Leach question the methodology of interpreting the process of environmental change by using current vegetation as the point of departure. See Fairhead and Leach, Reframing Deforestation, pp. xxii-xxiii, 187-188. In discussing the problems with “ calibrating change,” Williams points out that disagreement about the extent of today’s forest is rife, Williams, Deforesting the Earth, pp. 446-450.

[13] Leakey and Lewin point out that the order of Proboscidea once dominated the age of mammals and boasted almost 200 species but today only two species of elephants remain: “The fact that only two species remain today is yet another remainder that dominance it not forever.” See Leakey and Lewin, The Sixth Extinction, p. 198.

[14] Holland also emphasizes that environmental change is a continuing although singular process, see A. Holland, “Ecological Integrity and the Darwinian Paradigm,” Pimentel, Westra, Noss, Ecological Integrity, p. 52. Amanor emphasizes the fleeting nature of the environment, Amanor, The New Frontier, p. 218.

encroachment on more open landscapes, including savannas, prairies, barrens, and abandoned fields. As forests grew denser, maple and other shade tolerant tree species began to out-compete oaks at the same time that oaks pioneered the open landscapes.[16] Thus, the present-day dominance of oak in the eastern United States forests is not merely an outcome; it is as much a reflection of ongoing processes of environmental change in which oak dominance is temporary, and old growth oak stands are rare.

Differentiating the process of environmental change also further complicates the practice of what White has called "upstreaming," or projecting data and descriptions back in time. White's reference is to projecting 19th and 20th century ethnographic data back in time, but the concept is equally applicable to scientific data and models, including rainfall patterns, soil composition, and plant and animal associations. [17] For example, the present-day behavior and habitats of plant and animal species are readily used to interpret past environments where evidence of the presence of such indicator species is encountered. Marks, for example, used reports of tiger attacks in 17th and 18th century south China as indirect evidence for the prevalence of a forested environment because the tiger is known as the king of the forest. But animals can change their behavior and adapt to new habitats and may do so rapidly, and in terms of historical time rather than evolutionary time. The Javanese tiger in 18th and 19th century Indonesia did not adhere to the behavior or customary habitat customs of the "guardian of the jungle" fame: it hunted by day instead of by night, and it preferred the more open environment along the human settlement frontier, including plantations, rather than the depths of the jungle.[18]

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[15] On the oak in the US, see W.H. McWilliams et al., "Distribution and Abundance of Oaks in North America," McShea and Healy, Oak Forest Ecosystems, pp. 13-33. C. Watkins, ed., European Woods and Forests: Studies in Cultural History (Wallingford, UK: CAB International, 1998).

[16] See W.H. McWilliams et al., "Distribution and Abundance of Oaks in North America," M.D. Abrams, "The Postglacial History of Oak Forests in Eastern North America," D. Dey, "Fire History and Postsettlement Disturbance," and "The Ecological Basis for Oak Silviculture in Eastern North America," and L.E. Frelich and P.B. Reich, "Dynamics of Old-Growth Oak Forests in the Eastern United States," McShea and Healy, Oak Forest Ecosystems, pp. 13-33, 34-45, 46-59, 60-79, and 113-126 respectively. See also J.H. Brown, C.G. Curtin, R.W. Brathwaite," Management of the Semi-Natural Matrix," Bradshaw and Marquet, How Landscapes Change, pp. 327-343, especially 331-336. On the symbolic significance of the oak, see Thomas, Man and the Natural World, pp. 220-221. Other plant and animal species also have strong symbolism in western culture. On the salmon, see White, The Organic Machine, pp. 89-104 and on the bison, see Isenberg, The Destruction of the Bison, pp. 4-6.

[17] White, The Middle Ground, p. xiv.

[18] For a critique of the use of biological indicators, see J.G. Evans, Environmental Archaeology: Principles and Methods (Phoenix Mill: Sutton Publishing, 1999), pp. 132-134, 177-179. On China, see R.B. Marks, "Commercialization without Capitalism: Processes of Environmental Change in South China, 1550-1850," Environmental History, vol. 1 (Jan. 1996), pp. 56-82. On the Javanese tiger, see P.

Upstreaming is further complicated because the often implicit notion that change occurs gradually and evenly, and therefore at a more or less constant rate, may not always be accurate.[19] If change takes place at a constant rate, present-day data or patterns can be somewhat calibrated before they are projected back in time. If change is irregular and occurs in leaps and bounds, however, the calibration process becomes much more intricate.[20]

A research approach that is not based on such a priori environmental trends as, for example, deforestation or reforestation may yield a deeper understanding of environmental change. Emphasizing relative benchmarks based on empirical historical research, rather than such "absolute" and a-historical benchmarks as, for example, vegetation climax, may help to facilitate a focus on the process(es) of change. In addition, distinguishing sub-processes of environmental change that may even be contradictory also contributes to a more nuanced analysis.

Unraveling the Paradoxes: Sources

Fairhead and Leach propose the use of a wide variety of - especially historical - sources in order to understand environmental change, including oral history, archival documents, aerial photography and satellite images, household surveys, and participatory observation. They claim that "[s]uch an assortment is rarely treated together in the same field of inquiry."[21] Too exclusive a reliance on a single data source has shortcomings because specific data sets and sources have their own weaknesses. For example, deforestation statistics are guesstimates, the standard scale of aerial photos and satellite images is too small to evaluate the environmental change that is caused by individual people or households, and individual interviews are too particular to be able to infer impact at a meso- (village and sub-district) or macro-

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Boomgaard, Frontiers of Fear: Tigers and People in the Malay World, 1600-1950 (New Haven: Yale University Press, 2001), pp. 8, 228-236. Grant's gazelle is considered to be a typical grazer that prefers open grassland habitats but in northern Kenya it is a mixed feeder that heavily relies on browse, D.M. Swift, M.B. Conghenour, and M. Atsedu, "Arid and Semi-Arid Ecosystems," T.R. McClanahan and T.P. Young, eds., East African Ecosystems and their Conservation (New York and Oxford: Oxford University Press, 1996), pp. 243-272, especially p. 250. Open savanna has conventionally been considered the natural habitat of the cheetah but in southern Africa they occur in a variety of habitats, including dense bush land on commercial farms. See http://www.cheetah.org/?html=aboutcheetah-05.

[19] C.B. Cox and P.D. Moore, Biogeography: An Ecological and Evolutionary Approach (Oxford: Blackwell, 2000 [6th ed.; first published, 1973]), p. 172. Rackham attributes the bulk of deforestation in the UK to the three decades since 1950, Rackham, Trees and Woodland in the British Landscape, pp. 77-83, 104-105.

[20] Amanor, The New Frontier, p. 218.

[21] Fairhead and Leach, Misreading the African Landscape, pp. 16-20.

level of analysis. Moreover, sources each have their own biases: archival documents, for example, reflect colonial and often racist prejudices and officials and missionaries frequently had little interest in or understanding of tropical environments. Interviewees may tell interviewers what they think the latter want to hear, perhaps in the hope of attracting development projects to their area. Moreover, descriptions of a past environment as wilderness or forest that was cleared by an interviewee's ancestors may serve to establish some villagers as the founders of an area and thus as the legitimate "owners."[22]

The use of multiple sources, however, is by no means a foolproof recipe for careful analysis and in fact many excellent studies of environmental change have been written on the basis of one or two types of sources. Still, the use of a variety of sources not only facilitates a critical assessment of the biases that underlie data, but also contributes to understanding and demonstrating how knowledge is produced, and how to approach environmental change at multiple scales of analysis simultaneously.[23]An analysis of historical data about population, development and migration, land and wood use and environmental conditions provides the overall framework for the study. A dynamic time series of macro-level "states" of the environment was constructed based on historical literature and such archival documents as, for example, reports on agriculture and forestry, as well as testimonies by Namibian men and women in colonial reports (often from court cases) that reflected upon the use and management of natural resources and environmental change. The analysis of the historical data also provided insights into correlations between various factors impacting on environmental change, when and how change occurred, and how policy makers and land-use experts perceived the changes.

Portuguese and South African colonial archives proved especially helpful where they pertain to agriculture, hunting, water affairs, drought and famines, land tenure, forestry, livestock herding, diseases, and conservation, because they assisted in structuring a dynamic time series of "states" of the environment. In addition, the archives offered insights into how the environment was used. A range of highly detailed colonial reports on specific events and witness statements in disputes provided insights into what drove environmental change at the meso levels and micro

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[22] Fairhead and Leach, Misreading the African Landscape, pp. 70-73. On the biases in colonial documents, see Moore and Vaughan, Cutting down Trees.
[23] McCann, Green Land, Brown Land, pp. 2-3.

levels of analysis (i.e. the settlement of certain areas) generating answers to, for example, the questions of who cut down and propagated trees, when, and why. Finally, the documents also included assessments of environmental change at the level of Ovamboland as a whole as well as at a district level, information that can be compared with data from other sources.

Interviews are prime sources to uncover human motivations and practices and to understand the day-to-day intricacies of environmental use and therefore the details of the processes of environmental change.[24] The study relies both on individual qualitative and unstructured life history interviews and questionnaire based sample household interviews.

Sixty individuals were interviewed using the life history format. Individual interviews lasted from two to four hours and particularly knowledgeable and willing interviewees were interviewed in multiple sessions. The interviews were relatively unstructured. Interviewees were asked to describe life, livelihoods, and the environment they lived in during the time of their parents/grandparents; their own early childhood (both of these categories of response were usually based on stories parents/grandparents had narrated to them); and their childhood, adolescence, early adulthood, middle adulthood, recent past, and the present at the time of the interview. When interviewees referred to major historical events, they were requested to elaborate and to place the event in the context of the chronology of their specific life history. Because in-depth archival research had preceded the fieldwork, the relative chronologies of the interviewees' life histories could often be correlated to the more general chronology found in the colonial documents.

Using the life history method rather than limiting interviews to the details of, for example, woody vegetation or even land use, had several advantages. First, it allowed the interviewee greater initiative to structure the narrative. Affording the interviewee this latitude was key to uncovering the interviewee's motivations, interpretations, and priorities rather than those of the researcher, and assisted in revealing agency. Identifying agency is especially important because the modernization, the declinist, and the inclinist paradigms each have their own particular presumptions about the role of human intervention in shaping the environment. The open-ended interview formal enables interviewees to guide

[24] The interviewees were selected mainly from areas of Ovamboland that were settled after the colonial occupation in 1915. Most of the interviewees came from the Oukwanyama district and Okalongo.

researchers in exploring new and unforeseen avenues of understanding and in framing environmental change. Second, qualitative life history interviews not only facilitate the contextualization of data and interpretations within the interviews, but, in conjunction with archival and other data sets, they also facilitate the analysis of motivations for and interpretations of environmental change at multiple levels.

Interviews and oral sources also present pitfalls. One drawback relates to issues of memory, including the possibility that the past and the present may become indistinguishable, with present concerns sometimes clearly coloring the oral histories. In addition, the account of one interviewee is often difficult to compare to the account of another. Moreover, it is difficult to extrapolate more general patterns of environmental use and change on the basis of individual interviews alone. Two strategies facilitated incorporating insights about the subtleties of the "day-to-day" processes of environmental change beyond the micro level of the individual interviewee. The first strategy was to select two to four interviewees in each of a larger number of villages spread over various administrative and agro-ecological sub-zones, an approach that differs from classical ethnographic research in which the focus is on one village The second strategy was to draw on the results of the interviews to design a survey questionnaire to collect quantitative data about the issues that the interviewees had raised.

The resulting sample household survey was administered in almost 400 households by students from the Ogongo Agricultural Training College in north central Namibia after a three-day training workshop. The households were from 90 villages that represented all the historical districts of Ovamboland. Each district was assigned a number of villages to be surveyed based on the district's share in the total population of Ovamboland. Villages within each district were selected from a map to represent different locations vis-à-vis towns, roads, canals, pipelines, and other infrastructure and different environmental conditions. The surveyed households were randomly selected from lists of households that were provided by the village headmen. The survey sample, which was substantially larger than the number of individual interviews, facilitated identifying patterns of environmental use and management, including tree use and management, livestock ownership and management, and changes in land tenure. The senior and village headmen's councils and the local radio station announced the survey, which was known as the Ovambo Multi-purpose Investigation for Tree-use Improvement or the OMITI survey – omiti is also the plural for the local word for "tree" and for a palisaded homestead (omuti). While the questionnaire primarily focused on land use and perceptions of environmental change with an emphasis on woody vegetation, sections on livestock, crops, and land and water tenure were also included. The questionnaire encouraged the survey respondents to contextualize their answers in terms of the present and the past, which was defined as the interviewee's childhood/early adulthood. Frequently, respondents were requested to be more specific in terms of providing a time context for a practice, idea, or event, especially in terms of local chronology, i.e. before or after such well-known events as particular famines, wars, or the era of certain rulers. The additional detail facilitated historicizing the survey data in addition to identifying patterns of change in environmental use, management, and landscapes. The detail was also critical to interpreting and analyzing the data because Ovamboland's populations historically were highly mobile: war- and famine- induced population displacement, for example, was common, as was the practice of men and women moving to different villages after they married.[25]

Most of the questions invited the survey respondents to choose from a list of possible answers in a multiple-choice format. The lists, which were compiled based on the life history interviews, subsequently had been tested in a small pilot survey. The category "other" was typically included to augment the choices that were offered by the list. The questionnaire also included many open questions, a factor that often prolonged administering the questionnaire, and which, moreover made data entry, processing, and analysis more challenging. But, as in the case of the open-ended structure of the life history interviews, the open questions permitted greater respondent initiative and yielded information about new, unanticipated interpretations, correlations, causal relationships, explanations for motivations, and patterns of environmental use and management.

The data provided by the OMITI survey are critical to assess the pervasiveness of wood use and management ideas and practices. Several of the chapters, for example, detail which species of woody vegetation were used and for what purposes. In addition, the aggregate results from the OMITI data facilitate a quantitative analysis of the occurrence of various tree propagation practices and their frequency, thus contributing to meso- and micro-level analysis. While the qualitative interviews

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[25] The Namibian district of Oukwanyama (by and large the modern Ohangwena region) was chiefly a colonial era creation that was settled by refugees from Angola. See Kreike, Re-creating Eden.

served to identify, for example, woody vegetation use and management knowledge and practices (as well as motivation), quantitative data reveals the extent to which interview content is representative of larger patterns across time and space, as opposed to being confined to a single individual or household. The OMITI survey data thus provide key information for linking micro-level analysis to analysis at the meso- and macro-level.

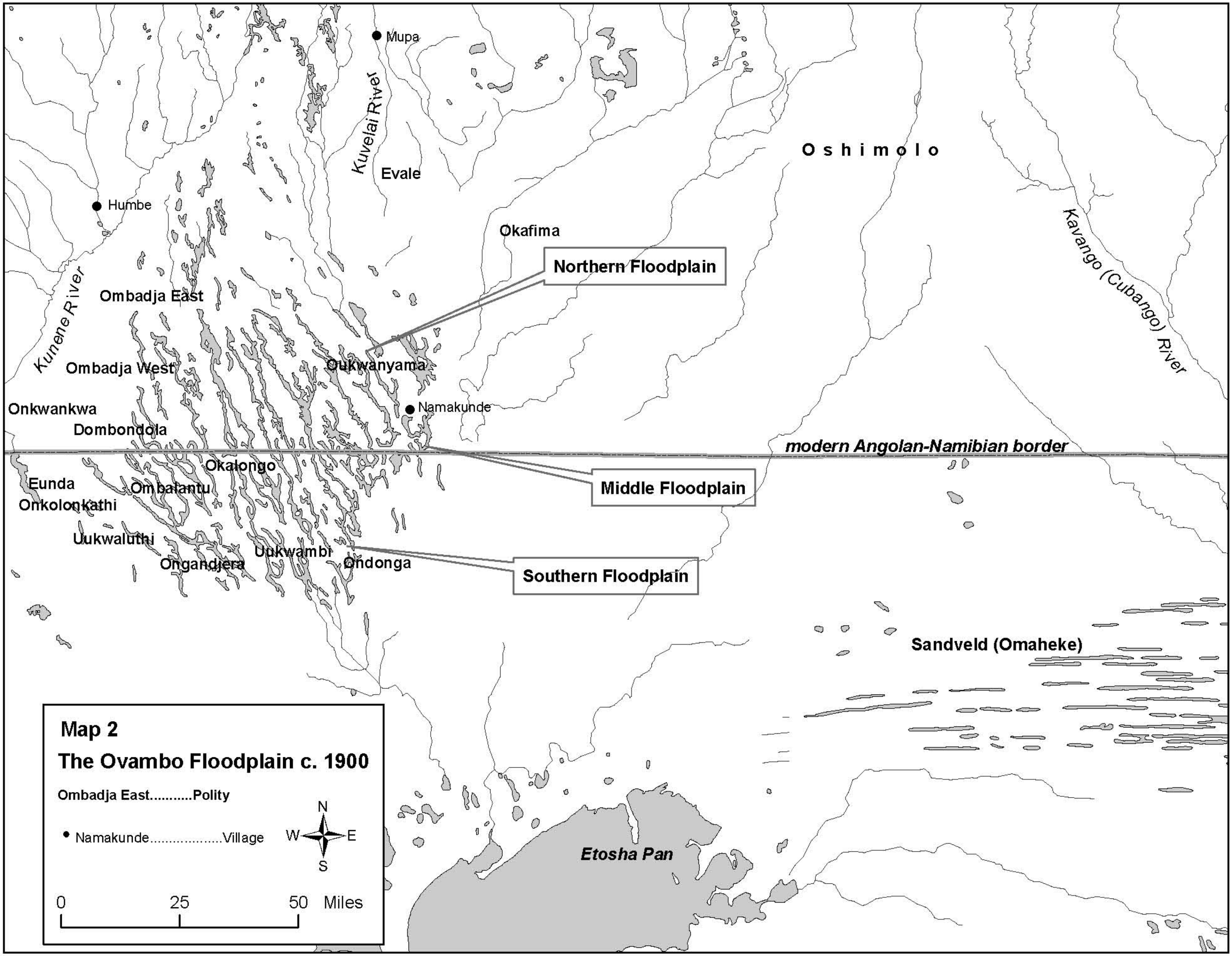
CHAPTER 4
IN THE BEGINNING:
NATURE, CULTURE, AND BENCHMARKS

Assessing environmental change requires identifying an appropriate benchmark. Conventionally, study of environmental change opens with an "in-the-beginning-there-was-Nature" and ends with a description of the outcome accompanied by a discussion of how the change(s) came about.

Late 1800s descriptions of pre-colonial Ovamboland offer the possibility of a benchmark that can be used to measure environmental change in the 1900s. The late 1800s natural environment, if not entirely pristine, seemed approximate enough: large areas, including the middle Ovambo floodplain, were uninhabited, wild animals were abundant and small bands of San/Bushmen roamed freely. Ovamboland's wilderness and "wild" animal and human populations, however, were not as natural as they appeared and the environment certainly was not pristine. The middle Ovambo floodplain wilderness contained the ruins of villages, farms, and fields, and human use and management had significantly shaped the wilderness of eastern Ovamboland. Moreover, Ovamboland's wildlife populations had been dramatically affected by human actions, not least by the San/Bushmen in the region who engaged in commercial hunting, managed local vegetation through the use of fire regimes, and settled around dug water holes. It is thus problematic to use the immediate pre-colonial era as a benchmark for Nature or a natural state. It is equally problematic to consider present stretches of wilderness in Ovamboland or the wider region as relics of Nature or climax vegetation that can be used to measure environmental change.

Nature, Culture, and Forest in the Late 1800s Floodplain Region

In a 1950 report, most of Ovamboland was defined as "True Indigenous Forest" characterized by trees of 15 feet in height and taller. The assessment, however, took place following massive population movements into Ovamboland and the accompanying large-scale clearing of "forest" areas that accommodated settlement and thus cannot be taken at face value (see map 2).


Mupa
Kuvelai River
Evale
Oshimolo
Humbe
Okafima
Northern Floodplain
Kunene River
Ombadja East
Kavango (Cubango) River
Ombadja West
Oukwanyama
Onkwankwa
Namakunde
Dombondola
modern Angolan-Namibian border
Okalongo
Eunda
Ombalantu
Middle Floodplain
Onkolonkathi
Uukwaluthi
Uukwambi
Ondonga
Ongandjera
Southern Floodplain
Sandveld (Omaheke)
Etosha Pan
Map 2
The Ovambo Floodplain c. 1900
Ombadja East..........Polity
Namakunde..................Village
N
W
E
S
0
25
50
Miles

In fact, the 1950 assessment of the forested surface of Ovamboland was based solely on rather simplistic arithmetic: "[t]ake each kraal to cultivate 1 ha. which gives you 27,606 ha. cultivated; therefore not cultivated - 4 172 394 ha. Forest - 3/4 of 4,172,394 ha. equals 3,129,295 ½ ha."[1]

Descriptions from the 1890s that pre-date the massive influx of refugees and migrants into the ofuka-wilderness areas of the floodplain and east of the floodplain reveal a highly differentiated woody vegetation cover. The more densely settled northern floodplain was richer in woody vegetation cover than the less densely populated southern floodplain. A 1895 traveler who traversed the floodplain from north to south noted that "[a]s one continues towards the south the country becomes more sandy, the bush thinner, the open spaces larger."[2] In the late 1800s northern floodplain, marula (omwoongo/omugongo or Sclerocarya birrea), birdplum (omuve/omuye or Berchemia discolor), jackalberry (omwandi or Diospyros mespiliformis), Faidherbia albida (omuyele) and acacias - including umbrella thorn (omutoka or Acacia tortilis) and camel thorn (omwoonde or Acacia erioloba) were abundant and mopane (omufyaati or Colophospermum mopane) trees and bush were common. Mountain mahogany (omutaku or Entandrophragma spicatum), transvaal teak (omuuva or Pterocarpus angolensis), Sansiveria angolensis, and the sourplum (oshipeke or Ximenia spp.) bush were common in Oukwanyama.[3]

The tops of the ridges that separated the flood channels were covered by dense, sometimes impenetrable bush, as was the case in the early 1880s in the area between Omoukekete (Omukekete) in (Small) Ombadja and Oukwanyama.[4] Omufitu-forests were located on the highest parts of the ridges both in the ofuka-wilderness and the inhabited oshilongo in the Ombadjas, and they were not well suited for farms. In the Ombadjas, farms and fields were principally concentrated on the lower slopes of the ridges. The middle slopes were unsuitable for crop cultivation because they

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[1] NAN, NAO 103 f. 62/2, NCO, Ondangwa, 21 October 1950 and Census of Agriculture, 1949-1950.

[2] Möller, Journey in Africa, pp. 116-117. See also, AGCSSp, Duparquet 1879 journal, information from Mr. Leen 29 April 1879 and information from Mr. Cloete [29 April 1879].

[3] AGCSSp, Duparquet, journals 1879 and 1880; AGCSSp 485-A-IV, Cinquentenário da Morte heróica dos primeiros missionários da Congregação do Espiríto Santo no Cuanhama, 1885-1935, p. 257; NAO 104 diary Jordan; AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892 and RMG C/h 52, Speiker, Visitationsbericht der Station Namakunde, Namakunde 13-18 July 1906; CNDIH, Avulsos, Caixa 3439, Ribeiro da Fonseca, "Relatório do reconhecimento," Cuamato, 26 September 1913 and Caixa 3703, Processo Missão de Estudos no Sul de Angola, Relatório do Mez de Outubro [1914]; "Campanha do Cuamato," Portugal em Africa, 14 (September 1907), no. 165, p. 446; interviews by author: Johannes Shipunda, Omudaunghilo, 14 July 1993 and Julius Abraham, Olupito, 16 June 1993.

tended to become waterlogged during the rainy season; although the slopes were covered by bush, they boasted few such large trees as mopane and tamboti (omuhongo or Grewia spp.).[5]

Woody vegetation was less abundant downstream in the southern floodplain. In the late 19th century the heartland of Ondonga was marked by an open landscape dominated by palm trees and small groves of fig trees. The contrast between the village landscape of Ondonga and the wilderness to its south was stark. In July 1891, a missionary described the changes in the landscape after he had crossed the line of green palm trees that marked Ondonga's border: "[b]ehind them [the palm trees] stretched the limitless grassplain lacking water and people, before them [the palm trees] appeared a fertile landscape of fields, here and there interspersed with groves of darkleaved trees or tall palms."[6] Uukwambi to the west of Ondonga was equally marked by tall palm trees, although in the Elim area, where the king of Uukwambi's heavily palisaded palace was located, other trees were sparse. The area east of Elim (toward Ondonga) was marked by open grassy sandy plains with isolated stands of mopane bush. The uninhabited wilderness between Uukwambi and Ondonga was open, sandy, and subjected to dust storms. The area around modern Oshakati was characterized by waterless mopane "veld" and it took almost three days to travel through a "dry, steppelike landscape" to reach Ondonga from Uukwambi.[7] Southwest again of Uukwambi lay Ongandjera and Uukwaluthi, known for their enormous baobabs. These landscapes reputedly resembled Oukwanyama.[8] In 1918, Uukwaluthi boasted more trees than most of the southern floodplain districts, including fig, baobab and palm trees. Watercourses, including the Etaka, had open grassy vegetation and were lined with mopane and thorn "forest."[9] Northwest of Uukwambi lay Ombalantu, beyond a series of broad seasonal watercourses that were separated by strips of mopane bush and trees.[10]

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[4] AGCSSp 466-A-vii journal no 7, Duparquet 1882, 14 July 1882 and "Campanha do Cuamato," Portugal em Africa, 14 (September 1907), no. 165, p. 446.
[5] Petrus Shanika Hipetwa, interview by author, Oshiteyatemo, 17 June 1993.
[6] Lau, Carl Hugo Hahn Tagebücher, vol iv, 22 July 1857; Wülfhorst, Aus den Anfangstagen, p. 4; Möller, Journey, p. 116-117; AGCSSp, Duparquet 1879 journal, information from Mr. Leen 29 April 1879 and Mr. Cloete [29 April 1879].
[7] Möller, Journey, pp. 116-120 and NAO 104, diary Jordan.
[8] AGCSSp, Duparquet 1879 journal, September 13, 1879.
[9] NAN, RCO 8 f. 9, RCO to Sec. SWA, Ondonga [Ondangwa], 27 October 1918.
[10] NAN, RCO 8 f. 9, Extract from RCO's Personal Diary, 10 March 1917.

A large ofuka-wilderness in the middle floodplain separated the northern floodplain polities (Oukwanyama, the Ombadjas, Evale, Okafima, Onkwankwa, and Dombondola) from those of the southern floodplain (Ondonga, Uukwambi, Ombalantu, Ongandjera, Uukwaluthi, Onkolonkathi, and Eunda). In the 1880s, large fig and jackalberry trees along the banks of the seasonal watercourses marked the middle floodplain. Dispersed baobabs could be found, in addition to lowveld clusterleaf (omuhama or Terminalia prunioides), acacia, and mopane. The open landscape of broad watercourses was interspersed by ridges with bush, toward Uukwambi, the bush was principally characterized by mopane.[11]

On the eastern side immediately south of Oukwanyama, the middle floodplain ofuka resembled "an English park landscape" dominated by enormous mopane and jackalberry trees, grass clearings and small palm (omulunga or Hyphaene ventricosa) trees. Further south, this landscape gave way to a "forest" of moderate height trees (including acacia species) intersected with clearings. Beautiful locations lush with fruit trees at pans occurred at irregular intervals between Oukwanyama to the north and Ondonga to the south; the sites appeared to be abandoned settlements.[12] Portuguese threats followed by a series of invasions into the northern floodplain during the turn of the 19th to 20th centuries caused the Oukwanyama settlement frontier to move gradually southwards. By the 1890s, the southernmost part of Oukwanyama oshilongo reached the modern Angolan-Namibian border.[13]

The eastern half of the middle floodplain ofuka was not the only area that was marked by signs of abandoned settlements not only marked In the late 1800s, the Okalongo region in the western half of the middle Ovambo floodplain was described as an uninhabited hunters' paradise. When refugees from the northern floodplain settled the area in the 1920s and 1930s, however, they encountered evidence of the presence of earlier settlement: fruit trees, water holes, water reservoirs, and pottery fragments. They attributed these relics of a past humanized landscape to the

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[11] AGCSSp, Duparquet 1879 journal, August 12-14, 1879 (Duparquet made frequent mention of Bauhinia trees but he probably mistook mopane for Bauhinia); Duparquet 1880 journal, July 5-7, 1880; Möller, Journey, pp. 107-115; NAO 104, diary Jordan; interviews by author: Julius Abraham, Olupito, 15-16 June 1993 and Mathias Walaulu, Onandjaba, 15 June 1993; CNDIH, Avulsos, Caixa 4130, Governo do Distrito 31-20.1, Relatório sobre a Occupação, Lubango 22 May 1909.
[12] AGCSSp, Duparquet 1879 journal, August 12-14, 29, 1879 and info Leen, 29 April 1879.
[13] Kreike, "Recreating Eden," chapters 2-4.

prosperous kingdom of Haudanu, which was abandoned after a destructive war in the early 1800s.[14]

Whereas war and population dislocation led to the re-colonization of the Okalongo wilderness, the same processes had an opposite effect just north of Okalongo on the Angolan side of the border with Namibia. By the 1990s, local inhabitants designated large areas directly north of the Angolan-Namibian border on the western side of the Ovambo floodplain as wilderness.[15] Yet, less than a century earlier, these same areas had been described as lush, fruit tree shaded expanses of adjoining farms and fields.[16]

Warfare, famine, and disease and the heavy taxation and forced labor that was associated with colonial conquest between 1900 and 1930 led to massive mortality and flight, decimating the northern floodplain populations, and triggering the abandonment of entire villages and districts, especially in the southern parts of the Ombadja region. By the 1930s, many of the formerly most densely populated Ombadja districts were uninhabited and entirely overgrown by bush vegetation. One Portuguese source estimated that between 1915 and 1918 alone, the population density of Angola as a whole declined from 9 persons per square kilometer to 6 persons per square km. A Portuguese official report from 1919 claimed that the pre-1915 population density in Oukwanyama was 8 persons per square kilometer and 12 persons per square kilometer in the Ombadjas. The figures may be inflated because they legitimized indemnity claims against Germany, but they nevertheless illustrate that the region was considered to be fairly densely settled. In the context of the descriptions of the kingdoms as expanses of farms, fields, and villages with an extensive water infrastructure, these reports emphasize the extent to which barely a

[14] See interviews with author: Julius Abraham, Olupito, 15 and 16 June 1993; Petrus Shanika, Oshiteyatemo, 17 June 1993; and Mathias Malaula, Onandjaba, 15 June 1993. See also Kreike, Re-Creating, chapters 2, 4, and 7.

[15] See interviews with author: Julius Abraham, Olupito, 15 and 16 June 1993; Petrus Shanika, Oshiteyatemo, 17 June 1993; and Mathias Malaula, Onandjaba, 15 June 1993. Kreike, Re-Creating Eden, chapters 2, 4, and 7.

[16] For the Ombadjas, see D.M. Lima, A Campanha dos Cuamatos: Contado por um Soldado Expedicionàrio (Lisbon, 1908); A. Wülfhorst, Von Hexen und Zaubern: Bilder aus dem Leben der heidnische Amboleute in Süd-West-Afrika (Wuppertal-Barmen, 1935), pp. 6, 13, and 17; General Archives of the Congregation of the Holy Ghost, Paris, France (henceforth AGCSSp), Duparquet 1879 journal, entries August 12-14, 19-20, and 5 September 1879; P.J. Veth, Daniel Veth's Reizen in Angola (Haarlem, 1887), pp. 340-341; P. Möller, Journey in Africa through Angola, Ovamboland and Damaraland (Cape Town, 1972), pp. 110-112.

century earlier, the 1990s wilderness had very much appeared to be a "managed mosaic" environment similar to that of rural lowland Central America.[17]

In the second half of the 19th century, directly south and southeast of the floodplain towards Etosha Pan, dense and at places impassable bush dominated deep white sands interspersed with grassy pans. Further to the south the dominant bush gave way to a grass plain with isolated trees, bushes, and patches of bush, including mopane and camelthorn.[18] The Kunene River valley that framed the Ovambo floodplain to the west consisted of a floodplain with grassy plains; the bush and forest on its banks was at times so dense that ox wagons could not pass through. During the late 1800s, the most impressive tall trees along its banks were jackalberries and baobabs. The riverine bushbelts consisted mainly of thorn species.[19] North of the floodplain, very dense "forests" separated grassy plains in wide pans and seasonal watercourses from one another. Towards Evale in the floodplain stretched a savanna like landscape dotted with baobabs and groves of fig trees. North of the floodplain, denser vegetation with tall yellow-wood trees (Terminalia sericea) dominated before giving way to wild cotton and fruit trees.[20]

Wild Bushmen and the Eastern Wilderness

East of the middle and southern floodplain lay a "mother of wildernesses," an area so hostile that one colonial official in the late 1920s asserted that even the wild bushmen who inhabited it found it a great challenge. Was it pristine Nature (or approximate to it) and could it be used as a benchmark? Even the "last wildernesses" that are home to such "stone age" hunter-gatherers as the Bushmen/San and the Pygmies are not necessarily true wilderness. Vansina rejects the idea that central Africa's rainforests are "pristine" and argues that they have their (human) history.[21]

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[17] Luiz de Mello e Athayde, "O Perigo de Despovoamento de Angola," pp. 229-230; AHU, Sala 8, Praca 115, Angola, Prejuizos causados pela guerra de 1914-18, Luanda, 14 August 1919. For more details, see Kreike, Re-Creating Eden, chapters 3-4. Kjekhus describes similar processes in late 19th century Tanzania, Kjekhus, Ecology Control, pp. 6-7, 126-180.

[18] Lau, Carl Hugo Hahn Tagebücher, vol iv, 18-20 July 1857; Wülfhorst, Aus den Anfangstagen, p. 4; Möller, Journey, pp 141-146. In 1967, the grass plains south of Ondangwa up to the area north of Oponono Lake/Ekuma was so barren of appropriate woody vegetation that no cattle inspection kraals could be constructed there, AGR 47, f. 6/2/1-1967, State Veterinarian to Director Agriculture, Ondangwa, 5 June 1967 and memo, Director of Agriculture, 15 February 1967.

[19] NAN, NAO 104, diary Jordan; NAN, KAB 1, (vi), Draft Report Kunene Water Commission, Olusandja, July [1927]; Lima, A Campanha, pp. 14-18, 21-23, 99, 102, 111-114.

[20] NAN, NAO 104, diary Jordan.

[21] J. Vansina, Paths in the Rainforest: Toward a History of Political Tradition in Equatorial Africa (Madison, WI, 1990), p. 46.

Bushman/San communities in the late 19th and early 20th century border region in south central Angola and north central Namibia (including Ovamboland) did not simply live by Nature, but in fact significantly shaped their environment. As Wilmsen and Gordon have demonstrated, the "San" or "Bushmen" of 19th and 20th century Botswana and Namibia were not "wild," i.e. isolated, small-scale, subsistence, nomadic hunter-and-gatherer societies. Gordon, for example, documents that Namibian Bushmen controlled Tsumeb copper mining and engaged in commercial hunting.[22] Ovambo kings supplied ammunition and the most advanced firearms to their Bushmen business partners and the king and the hunter each received half of the ivory.[23] Qualifying the region's Bushmen as Stone Age and subsistence hunter-gatherers thus seems untenable given the significant evidence that they were entrepreneurs involved in mining and in commercial elephant hunting in addition to hiring themselves out to Ovambo kings as bodyguards and executioners.[24]

The Bushmen/San environment similarly did not constitute "wilderness." The Bushmen who lived in or adjacent to the Ovambo floodplain were the main elephant hunters in the region and they may have significantly contributed to the demise of its elephant herds.[25] The decimation of the region's elephant population in the late 19th century, which was hastened by the 1897 Rinderpest epizootic, coincided with a dramatic decline in the fortunes of the region's San communities. The correlation between the two outcomes is another possible indicator of the extent to which the San had become dependent on the commercial hunt and the trade in game products.[26]

The wild Bushmen's home environment of was the northern extension of the Omaheke or Sandveld east of southern Ovambo floodplain and south of the Angolan-Namibian border, an area that later became known as eastern Ovamboland. Colonial reports from the 1920s and 1930s, when officials began to explore the area, describe it as a virgin wilderness.[27] Reports typically stress the area's hostile and desolate nature.

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[22] E. Wilmsen, Land Filled with Flies: A Political Economy of the Kalahari (Chicago and London, 1989); R.J. Gordon, The Bushmen Myth: The Making of a Namibian Underclass (Boulder, etc., 1993), pp. 15-43. For a classical study of the San, see R.B. Lee, The !Kung San: Men, Women, and Work in a Foraging Society (Cambridge, etc., 1979).

[23] Kreike, Re-Creating Eden, chapter 2.

[24] In 1928, King Martin of Ondonga in the southeastern floodplain employed bushmen as hunters, messengers, and spies, NAN, NAO 18 f. 11/1 (I), Annual Report Ovamboland 1928.

[25] Cf. Isenberg who argues that the Plains Indians contributed to the demise of the bison, Isenberg, The Destruction of the Bison and Foster, who links the extinction of large mammals in Central America to Indian overhunting, L.V. Foster, A Brief History of Central America, p. 10.

[26] Kreike, Re-Creating Eden, chs. 2-3, 7.

[27] Kreike, Re-Creating Eden, ch. 7.

Eastern Ovamboland was a flat plain that was intersected by occasional seasonal rivers, and marked by randomly occurring pans. In the far western parts, the vegetation included dense mopane and thorn bush. The 1935 Annual Report for Ovamboland described the western part of the region (up to Omundaunghilo) as "well wooded." Further east, the mopane belt ended, and sand camwood (ofufe or Baphia massaiensis) and (Kalahari) apple leaf (omupanda or Lonchocarpus nelsii) became the dominant bush species. The region's gray and sometimes red sands were covered by approximately 30 feet (10 meter) high "sparse forest consisting of almost only two kinds of trees, under which only high useless grass grows."[28] Northeast of Eenhana along the Angolan-Namibian border locations with reddish, more loamy soils had a different vegetation "thick low bush…often takes the place of the trees with the high trunks, which then only here and there jut out above the bush in the form of individual dead specimens." The reddish soil encircled the larger flats and sustained the "so-called elephant bush; this consists of dense patches of bush - not thornbush, several kilometres in diameter, which is extremely difficult to negotiate on horseback. Better grazing grows on the red sand than on the grey sand."[29]

Due east of Eenhana, along the track of the dirt road that was constructed in the 1920s and 1930s to open up the area for settlement, the vegetation principally consisted of "thick bush country which necessitated the removal of hundreds of large stumps and many more smaller stumps."[30] Near Epalala, a border clearing party counted 73 stumps in a 2-mile stretch. With the border line being cleared over a width of 30-60 feet, the figure gives an estimated tree density of 1-2 trees per 876 m2 or 11-22 trees per ha. Woody vegetation in the east was as resilient as the floodplain vegetation further west. Thick bush, shrubs and young trees in one border section that had not been cleared in four years rendered the border demarcation, which doubled as a road impassable.[31]

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[28] On the vegetation in the western parts, see NAN, RCO 9, f. 10/1916/1 (I). Annexure no. ii, Fairlie to RCO, Namakunde, 31 May 1916, A450 vol. 7 f. 2/18, Annual Report Ovamboland 1935, and NAO 36, f. 26/8 (ii), Annual Health Report Ovamboland 1937. On the extent of the mopane belt, see NAO 9 f.5/1/1, O/C NAO to NCO, Ondangwa, 26 July 1939.

[29] NAN, KAB 1 (iii), Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions at The Angola Boundary." On the importance of fire as a shaping force in eastern Ovamboland, see Kreike, "Recreating Eden," ch. 8.

[30] NAN, NAO 18 f. 11/1 (I), Monthly Reports Ovamboland, June 1926, December 1927, February, March, and May 1928; NAO 10 f. 5/7/1, ANC to NCO, 30 July 1940, "Report on Development Work undertaken in Eastern Ukuanyama during 1940" and O/C NAO to NCO, 15 March 1940; KAB 1 (ii), Submission to Administrator, Secretary and Attorney-General of SWA, 1927; NAO 105, Diaries NCO, Diary 1928, 16 March and 28 August 1928. See also Kreike, "Recreating Eden," ch. 8.

[31] NAN, NAO 17 f. 10/3 (i-ii), O/C NAO to NCO, Oshikango, 30 July 1934 and 20 February 1935, NCO to Secretary SWA, Ondangwa, 20 April 1935, 22 July 1937, and 29 August 1938; NAO 10 f. 5/7/1, ANC

Further east along the Eenhana road from Omukukutu-Okongo-Ekoka southwards, the country became more open, with thinner undergrowth, lighter sand and good grazing. Prominent trees were Transvaal teak (omuuva or Pterocarpus angolensis), cobalwood (omushii or Guibourtia coleosperma), wild seringa (omutundungu or Burkea africana), Rhodesian teak (omupapa or Baikiaea plurijuga), and omunhete (probably omunghete or mangetti or Ricinodendron rautanenii although it may also have been sickle bush or ongete or Dichrostachys cinerea). While mangetti was sparse at Omulamba and occurred occasionally further south, it was frequently encountered from Omgodi and Shau southeastwards. In contrast to Oshimolo north of the Angolan border, neither the jackalberry nor the real fan palm (omulunga or Hyphaene ventricosa) was present although the mangetti was more abundant than in Oshimolo. South-southeastwards of Ekoka the landscape became "park-like" in appearance with very little undergrowth and new species of trees. South and southeast of Otsholo, the country became even more open, with good grazing, and the area was marked by seasonal watercourses tat ran along a west-east axis. The entire area south of Omboloka, and between Namathudia and Oshishogolo, contained numerous and extensive clearings around pans. Between Oshishogolo and Otsholo, travelers often had to follow elephant trails through "thick bush" to get from one clearing to the next, and the vegetation between Oshishogolo and Omishilongo consisted of "thick elephant bush country with a lot of thorn bushes."[32] East of Oshishogolo, the bed of the Ombongolo or Ompungu seasonal watercourse was sparsely covered with short wild seringa (omtundungu or Burkea africana) and omuholo bush (probably omwoolo/omugolo or silver cluster leaf or Terminalia sericea). On its banks

> the indigenous trees that are usually found in Eastern Ovamboland are plentiful such as Omshi [omushii or Guibourtia coleosperma], Om[u]papa [Baikiaea plurijuga], Omu[u]va [Pterocarpus angolensis], Om[w]onde [Acacia erioloba or camel thorn], and further into the bush the Om[un]ghete [Ricinodendron rautanenii or mangetti], Om[u]fimba [Dialium englerianum] and the wild orange trees [omuuni or Strychnos cocculoides]. [33]

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to NCO, 30 July 1940, "Report on Development Work undertaken in Eastern Ukuanyama during 1940;" A450, 12 f. 3/21/5, SWA Commission: Minutes of Evidence (1935), vol. 12, Session at Ukualuthi, 13 August 1935, p. 655. See also NAO 17, f.10/3 (ii), NCO to Sec. SWA, Ondangwa, 22 July 1937.

[32] NAN, NAO 10 f. 5/7/1, ANC to NCO, 30 July 1940, "Report on Development Work undertaken in Eastern Ukuanyama during 1940" and 10 July 1942, "Proposed Extension of Ukuanyama Area: General Report Development Work Eastern Ukuanayama."

[33] NAN, NAO 10 f. 5/7/1, ANC to NCO, 6 September 1941, "Proposed Extension of Ukuanyama up to and including Ombongolo Muramba."

The "wilderness" of eastern Ovamboland that was home to many of the "wild" Bushmen/San in the 1920s and 1930s, however, boasted permanent San settlements built around human-constructed waterholes with vegetation that was heavily shaped by the San use of fire. In 1928, a South African official who traversed the wilderness region east of the Ovambo floodplain along the Angolan-Namibian boundary commented, "In winter… the grass fires have laid bare the grey sand and painted the tree trunks black." [34]

Fire was the most powerful land management tool that the San employed. A burnt and blackened landscape rapidly turned green after the first rains; fresh grasses and herbs proliferated after the old dried vegetation had been destroyed. Fire also accelerated the natural process of recycling nutrients by breaking down dead vegetation. Burnt areas not only attracted wildlife by facilitating the growth of fresh sprouts; regular burning also prevented tree cover from growing too dense and outshading grasses. Finally, burning kept insect and microorganism populations in check, many of which were vectors for human and animal diseases. The timing and frequency of the burning were important. If the burning was implemented too late in the season, i.e. after the rains had started, it might fail. If the burning was started too soon before the onset of the rains, the fires were difficult to control, and all vegetation would burn, driving wildlife away.[35] If an area was burned regularly, for example, once a year, the build-up of dry vegetative matter was relatively low, causing the fires to burn at lower temperatures. With high densities of dried biomass, fires would burn at much higher temperatures, affecting roots, seeds and bulbs in the soil, and causing damage to perennials, including trees. A burning regimen in general favored open savanna vegetation, keeping encroaching woody vegetation in check. The 1942 Annual Report for Ovamboland demonstrates an awareness of the existence of different types of fire. The report notes that a fire, which was "essentially a grass

[34] NAN, KAB 1 (iii), W. Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions at The Angola Boundary." On the idea that San hunter-gatherers did not use fire to manage vegetation, see B.R.T. Seward, "Threatened Dry-Forest Ecosystems," Piearce and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 273-278, especially p. 273-274.

[35] In 1928, for example, bush fires were started in late September, i.e. just before the onset of the first rains, NAN, NAO 17 f. 10/3 (i), Acting Secretary South West Africa, 2 October [or November?] 1928, to Sec. South West Africa.

fire," burnt a large area in the Andoni Flats (south of Ondonga), without trees or other vegetation suffering any real damage.[36]

Not only did burning in general favor herbs and grasses over woody vegetation, but it was also very species selective. Certain woody species thrive under burning regimens; the propagation of Transvaal teak and certain acacias, for example, is greatly facilitated by the use of fire.[37] In general, however, regular use of fires suppressed trees and bush and favored grasses, creating an open "park like" landscape. Refraining from burning favors dense bush and tree cover.

In addition to the use of fire, San communities changed the "wilderness" east of the Ovambo floodplain through constructing water holes that formed the basis for San settlements, some of which were permanent. Digging and maintaining water holes was extremely labor intensive. A waterhole had to be cleaned of excess sand and litter fall every year. The Assistant Native Commissioner of Ovamboland, Bourquin, distinguished between San camps which were temporary, and San villages: in late May 1940, his party failed to locate two temporary San camps and was forced to camp at Omboto where he discovered a "large permanent Bushmen settlement," or "the Bushmen village of old Ule, the leader of the group of that area."[38] In a subsequent report, however, although Ule is referred to as a "clan" leader whose authority extended over several San groups in the Omaheke, e.g. organized in a chiefdom, its inhabitants were thought to have been "untouched by civilisation and must be considered as typical wild bushmen living in their natural environment."[39] The San waterholes provided stepping stones for Ovambo floodplain migrants' expansion into eastern Ovamboland "wilderness."[40]

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[36] P.E. Stander, T. B. Nott, and M.T. Mentis, "Proposed Burning Strategy for a Semi-Arid African Savanna," *African Journal of Ecology*, 31, no. 4 (December 1993), pp. 282-289; see also, *Renewable Resources Journal*, 11, no. 1 (Spring 1993), "Special Report: Workshop on National Parks Fire Policy: Goals, Perceptions, and Reality," especially the contributions by N. Christensen, "Fire Ecology and the Management of Wilderness Ecosystems," and J.C. Billing, "Summary II: Linking Fire and Land Use Policy." See also Nkemi a Tchie and G.C. Gakahu, "Responses of Important Woody Species of Kenya's Rangeland to a Prescribed Burning," *African Journal of Ecology*, 27, no. 2 (June 1989), pp. 119-128; NAN, NAO 20 f. 11/1 (xv), Annual Report Ovamboland 1942.

[37] See, for example, E. N. Sabiiti and R.W. Fan, "Fire Behaviour and the Invasion of *Acacia sieberania* into Savanna Grassland Openings," *African Journal of Ecology*, 26, no. 4 (December 1988), pp. 301-313.

[38] NAN, NAO 10 f. 5/7/1, ANC to NCO, Oshikango, 30 July 1940, "Report on Development Work undertaken in Eastern Ukuanyama during 1940," and NAO 20 f. 11/1 (xiii), Monthly Report Ovamboland, May 1940.

[39] NAN, NAO 20 f. 11/1 (xv), Annual Report Ovamboland 1942.

[40] On San water holes see sketch maps accompanying NAN, NAO 17 f. 10/3 (i), Acting Union Government Representative to O/C NAO Namakunde, 25 February 1928 and NAO 17 f. 10/3 (i), Officer Commanding Oshikango, Oshikango, March [date illegible], 1932.

Despite the observation that San settlements were permanent and the explicit association of certain waterholes with San communities, colonial officials nevertheless considered “San” waterholes to be open access resources. Notwithstanding evidence to the contrary, colonial officials and ethnographers alike maintained that ownership of natural resources was a concept unknown to San culture.[41] For colonial officials, the very presence of “wild” San defined land as “wilderness.”

Wild Ovamboland and Wildlife

The abundance of wildlife in Ovamboland that was reported by late 1800s observers stands in stark contrast to the almost complete absence of wildlife in the late 1900s. If the abundance of wildlife is used as an indicator of an environmental optimum, then, measured in wildlife, the period may have been one of decline. For several reasons, it is difficult to say whether the decline was dramatic. First, reliable figures from before the last quarter of the 20th century are non-existent. Secondly, during the 1890s, some wildlife (and livestock) populations declined dramatically while other species expanded both in population and range during the 1920s and 1930s, defying a model of a simple linear decline from the 1890s to the 1990s. Thirdly, to some extent, the absence of wildlife in most of Ovamboland is the product of its being concentrated in and confined to the Etosha National Park. Fourthly, at least some wildlife species in the Ovamboland region (including Etosha Park) were more heavily hunted in the late 1800s than in the late 1900s.

During the early 1880s, the middle floodplain wilderness was a favorite hunting ground for Europeans. During the rainy season, the open meadow-like landscape abounded with waterfowl, guinea fowl, ostriches, giraffes, hartebeest and springbuck. The far southern part of the watershed around Etosha Pan was also prime wildlife habitat, with herds of wildebeest, hartebeest, zebra and springbuck. The same animals were found to the northwest on the eastern bank of the Kunene River, in a landscape that combined open expanses of water, swamps and dense bush. In addition, gemsbuck and eland were numerous and buffaloes, rhinos, kudu, impala, and wild boar drank from the river. The river itself “swarmed” with crocodiles and

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[41] NAN, NAO 10 f. 5/7/1, ANC to NCO, Oshikango, 8 October 1942. Lee acknowledges that the Dobe-San of the Botswana Kalahari Desert were not truly nomadic and notes that main San camps

hundreds of hippos. Further east into the interior towards Evale, the northernmost of the Ovambo floodplain kingdoms, the terrain consisted of dense forest interspersed with wide-open areas around pans that were populated by waterfowl and frequented by elephants, kudu and wild boar. North of Evale, a large wilderness of glades and dense forest boasted large numbers of elephant, various species of antelopes, and lions.[42]

By the close of the 19th century, however, wildlife populations were not in a natural state. Professional hunters associated with the Ovambo kings – prominent amongst them San hunters - engaged heavily in elephant hunting.[43] Moreover, Rinderpest, an exotic disease brought to Africa by colonial invaders reached the Ovambo floodplain in 1897, decimating wild and domestic animal populations.[44]

The decimation of browsing wildlife especially (Rinderpest did not affect, for example, zebra, a major grazer), in conjunction with the depletion of elephant herds may have been partly responsible for an apparent trend towards the development of a denser bush vegetation throughout the region. In 1881, the only dense forest noted in Ombadja was on the bank of the Kunene River; only here did travelers have to widen tracks in order to allow ox wagons to pass. In 1907, dense vegetation that was dominated by thorny species surrounded the big open plains of Ombadja and Portuguese invasion forces frequently had to cut paths through impregnable vegetation.[45] The recovery of the animal populations took at least two decades.[46]

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were located at a permanent waterhole, Lee, "What Hunters do for a Living," Lee and DeVore, eds., Man the Hunter, pp. 31, 35.

42 A. Wülfhorst, Shiwesa, ein Simeon aus den Ovambochristen (Barmen, 1912), pp. 8-9, 28; NAN, A233, J. Chapman, 1903-1916, pp. 79, 83-84; NAO 104, diary Jordan. For waterfowl, see B. Lau, ed., Carl Hugo Hahn Tagebücher 1837-1860, Diaries Part iv 1856-1860, entries 22 and 23 July 1857, pp. 1040-1045.

43 ACCSSp 475, A IV, P. Duparquet, "Notes sur les Bushmen," [Duparquet] to "Monsieur le Directeur," s.l., s.d. and Funchal, 17 June 1881; NAN, NAO 104, diary Jordan.

44 NAN, A233, J. Chapman, 1903-1916, pp. 45-47, 159-160, 167-169; SWAA Native Affairs Vol. 456 f. A50/92 F, Secretary for South West Africa, "Native Cattle", Replies to Questionnaire by Dr. G. Schmid, Government Veterinary officer, n.p. [1932], to Secretary for External Affairs, Pretoria; "Ainda o Desastre do Humbe," and "A Peste Bovina em Angola," Portugal em África, vol. 5, no. 5 (March 1898), 51, 128-136 respectively; H. Marquardsen, Angola (Berlin: D. Reimer, 1920), pp. 99-101; CNDIH, Avulsos, Caixa 4121 "Humbe," 32-4.6 Humbe, Circumscricão Civil: Agricultura 1891-1913, relatorio 1906; A.P.G. Schachtzabel, Angola: Forschungen und Erlebnisse in Südwestafrika (Berlin: Die Buchgemeinde, 1926), pp. 89-99; AVEM, RMG 2630 C/k 7, Wulfhorst, Referat: "Giebt es in unser Ovambomission eine Frauenfrage?" Omupanda, October 1903.

45 NAN, NAO 104, diary Jordan; "Campanha do Cuamato," Portugal em Africa, 14 (September 1907), 165, pp. 446-47. See also CNDIH, Avulsos, Caixa 3703, Processo Missão de Estudos no Sul de Angola, 1914-15, Relatorio do Mez de Outubro [1914].

46 A. de Quadres Flores, Recordações do Sul de Angola, 1914-1929 (Guimarães, Depositoria: Livraria L. Oliveira [1952]), p. 200; NAN, NAO 18 f. 11/1 (i), Hahn, Notes on Ovamboland, Windhoek, 15 May 1924.

Early colonial conservation measures should be analyzed in the context of the dramatic decline in certain wildlife populations that resulted from commercial overhunting and disease. The South African colonial administration outlawed hunting at the Etosha Pan when it created the Namutoni and Okakweyo Game Reserves (the predecessors of the Etosha National Park and also referred to as Game Reserves numbers 2 and 5). The Namutoni Game Reserve was declared as early as 1916. By 1921, beacons marked the reserve's boundary northwest of Namutoni, where a game warden was stationed. The colonial administration prohibited hunting "Royal Game" including elephants and lions even outside of the game reserves.[47]

But the boundaries of the game reserves were ill defined and the new restrictions on hunting were contested. King Martin of Ondonga claimed areas near Etosha Pan as "traditional" hunting grounds and sent his men there to hunt during the early 1920s.[48] The violent removal from office of King Iipumbu of Uukwambi by the South African army in 1932 was in part legitimized by accusations that the king had engaged in poaching.[49] Poaching both inside and outside the game reserves continued to be a problem until at least the mid-1950s.[50]

The introduction of firearms in Ovamboland in the second half of the 19th century, especially rifled percussion cap muzzleloaders and subsequently breechloaders and high-powered rifles, dramatically increased the effectiveness of hunting. The northern floodplain kingdom of Oukwanyama possessed 3,000 firearms in the early 1880s, mostly muzzle loaders. But by 1910, its inhabitants had amassed

[47] NAN, RCO 3 f. 2/1916/2, RCO to O/C 1st South African Mounted Rifles (SAMR), 17 and 25 September 1916; RCO 8 f. 9/1920/8, Game Warden to Sec. SWA, Namutoni, 9 September 1921 and RCO to Sec. SWA, n.d; NAO 19-21 f. 11/1 (iv, x, xii-xiv, xix), Monthly and Quarterly Reports Ovamboland, 1931, 1935, 1937, 1939-1941, 1946; NAO 60-61, f. 12/1 (i-ii), Quarterly Reports Ovamboland, 1947-1949, 1952-1954.

[48] Timotheus Nakale, interview by author, Ekoka laKula, 21 February 1993; NAN, RCO 3 f. 2/1916/2, RCO to O/C 1st South African Mounted Rifles (SAMR), 17 and 25 September 1916; RCO 8 f. 9/1920/8, Game Warden to Sec. SWA, Namutoni, 9 September 1921 and RCO to Sec. SWA, n.d; NAO 19-21 f. 11/1 (iv, x, xii-xiv, xix), Monthly and Quarterly Reports Ovamboland, 1931, 1935, 1937, 1939-1941, 1946; NAO 60-61, f. 12/1 (i-ii), Quarterly Reports Ovamboland, 1947-1949, 1952-1954; NAO 103 f. 51/2(ii), NCO to CNC, Ondangwa, 26 August 1954; NAO 92 f. 36/3(iii), Hota 36/3/165: Statement 16 August 1954.

[49] NAN, A450 vol. 7 f. 2/12, Administrator SWA to Prime Minister Pretoria, Case of Ipumbu, Windhoek, 6 September 1932 and NAO 9 f. 5/2, NCO to Sec. SWA, Ondangwa, 23 October 1930.

[50] Timotheus Nakale, interview by author, Ekoka laKula, 21 February 1993; NAN, NAO 19-21 f. 11/1 (iv, x, xii-xiv, xix), Monthly and Quarterly Reports Ovamboland, 1931, 1935, 1937, 1939-1941, 1946; NAO 60-61, f. 12/1 (i-ii), Quarterly Reports Ovamboland, 1947-1949, 1952-1954; NAO 103 f. 51/2(ii), NCO to CNC, Ondangwa, 26 August 1954; NAO 92 f. 36/3(iii), Hota 36/3/165: Statement 16 August 1954.

an estimated 10,000 firearms in majority breechloaders including the large caliber Martini-Henry and high-powered Mauser and Lee-Metford rifles.[51]

Combined with the disarmament of the population of Ovamboland, colonial conservation measures probably greatly reduced the hunting of large game during the first decades of colonial rule. In the 1920s and 1930s all but the chiefs and headmen were forced to surrender their firearms. The elite either hunted themselves, or they sponsored professional hunters who used guns or bows and horses to hunt large game and produce dried meat (biltong). The population at large, however, was left with the less efficient bows and arrows and their dogs to hunt the occasional herds of larger game that strayed close to the villages as well as migratory birds. Egyptian geese, wild ducks and other migratory birds passed through Ovamboland during the rainy season and often bred in large numbers between Oponono Lake and Etosha Pan.[52] Game meat was an important source of sustenance for villagers in the oshilongo as well as for refugees in the ofuka wilderness who were trying to rebuild lives and livelihoods. Young boys trapped and killed rodents and birds while herding livestock near their homes. Rodents and birds were especially numerous during the rainy season, when they invaded crop fields, vegetable gardens and grain stores.[53]

The post-Rinderpest recovery of wildlife populations, the reduction of commercial and subsistence hunting, and the settlement of former wilderness areas explains why qualitative and quantitative data on wildlife populations during the 1920s and 1930s suggest an increase in the numbers of some wildlife species and/or

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[51] Kreike, Re-creating Eden, pp. 26, 31-32.

[52] NAN, RCO 8 f. 9, RCO to Sec. SWA, 27 October 1918 and Extracts from RCO's Personal Diaries, entries for March 1917, for example 10 March and RCO 4 f. 3/1919, RCO to Sec. SWA, 24 September 1921 Tour to Northwestern Ovamboland and f. 3/1916/2, Ipumbu to Manning, Ukwambi, 2 January 1918; NAO 19-20 f. 11/1 (v, ix, xiii), Monthly Reports Ovamboland, December 1932, February-March 1936, and January 1940; NAO 69 f. 25/6, ANC, "Dietary: Oukwanyama, Ovamboland," appendix to NCO to CNC, Ondangwa, 4 October 1948 and NAO 60-61, f. 12/1 (i-ii), Quarterly Reports Ovamboland, January-March 1950, January-March and April-June 1954; NAO 90 f. 36/1, Statements Johannes Shekudja, Ondangwa, 18-19 March 1952; NAO 21, f. 11/1 (xix), Quarterly Report Ovamboland, January-March 1946 and NAO 61 f. 12/1 (ii), Quarterly Reports Ovamboland, July-September 1953 and April-June 1954.

[53] Interviews by author: Kanime Hamyela, Omutwewondjaba, 15 June 1993 and Mateus Nangobe Omupanda (Namibia), 24 May 1993; Kreike, "Recreating Eden," chs. 3-4; AVEM, RMG 2515 C/h 31, H. Welsch, Quartalbericht, Omatemba, 30 March 1916 and RMG 2518 C/h 34, Gehlmann, Quartalbericht, Ondjiva, 30 May 1914; NAN, NAO 18 f. 11/1 (I), Monthly Report Ovamboland, March 1925 and Hahn, Notes on Ovamboland, Windhoek, 15 May 1924; NAO 19 f. 11/1 (iv-v), Monthly Reports Ovamboland, September-October 1931 and January 1932; NAO 36-37 f. 26/8 (i-ii), Annual Health Reports 1933 and 1937; NAO 66 f. 21/15, Rodent Inspector Ovamboland to District Surgeon Ovamboland, Ondangwa, 18 June 1948 and Tribal Secretary Ondonga to NCO, Okaloko, 20 July 1954; NAO 89 f. 35/22, NCO to David Sakeus, Ondangwa, 28 January 1949; NAO 49 f. 1/4, Farewell address Eedes, Ohangwena, 12 June 1954.

the expansion of their range. During the 1870s and 1880s, elephants, for example, were found north and east of the Ovambo floodplain, but during the 1920s, 1930s, and 1940s, they (re)appeared in the floodplain and to its west and south along wildlife migration corridors (see map 3).[54]

The only figures available about the wildlife population of Ovamboland (which included Etosha Park up to the 1970s) are estimates for 1930 and for 1938-1943. A comparison of the 1930 figures with the figures for 1938-1943 suggests a decline in the number of large game, including giraffe, zebra, kudu, gemsbok, wildebeest, hartebeest, springbuck, duiker, and hyena. For most of these species, the decline was dramatic: the number of giraffes fell from 160 to 30 animals; the zebra population from 12,500 to 1,500; kudus from 3,000 to 500; gemsbok from 3,000 to 650; wildebeest from 7,000 to 2,500; and hyena from 800 to 220 animals. Eland and steenbok increased in numbers from 200 to 400 animals and 4,000 to 4,500 animals respectively. The small populations of wild boar (200) remained the same. Lions experienced a minor decline, from 50 to 35-45 animals, while the cheetah population remained stable at 50 animals and the number of leopards doubled, to 150 individuals. Between 1938 and 1943, most animal species maintained their numbers at approximately the same levels. The giraffe population recovered to surpass its 1930 level, and zebra, eland, Roan antelope, wildebeest, duiker, lion and cheetah populations grew. In contrast, kudu, hartebeest, and steenbok populations declined over the period.[55]

By the late 1960s, no large game remained in the former wilderness areas that in the late 1800s had separated the Ovambo floodplain polities. Eland, kudu, gemsbok, hartebeest, wildebeest and springbuck, however, continued to roam the western and southern margins of the floodplain, while elephants continued to cause damage in remote villages and predators remained a threat at isolated cattle posts.[56]

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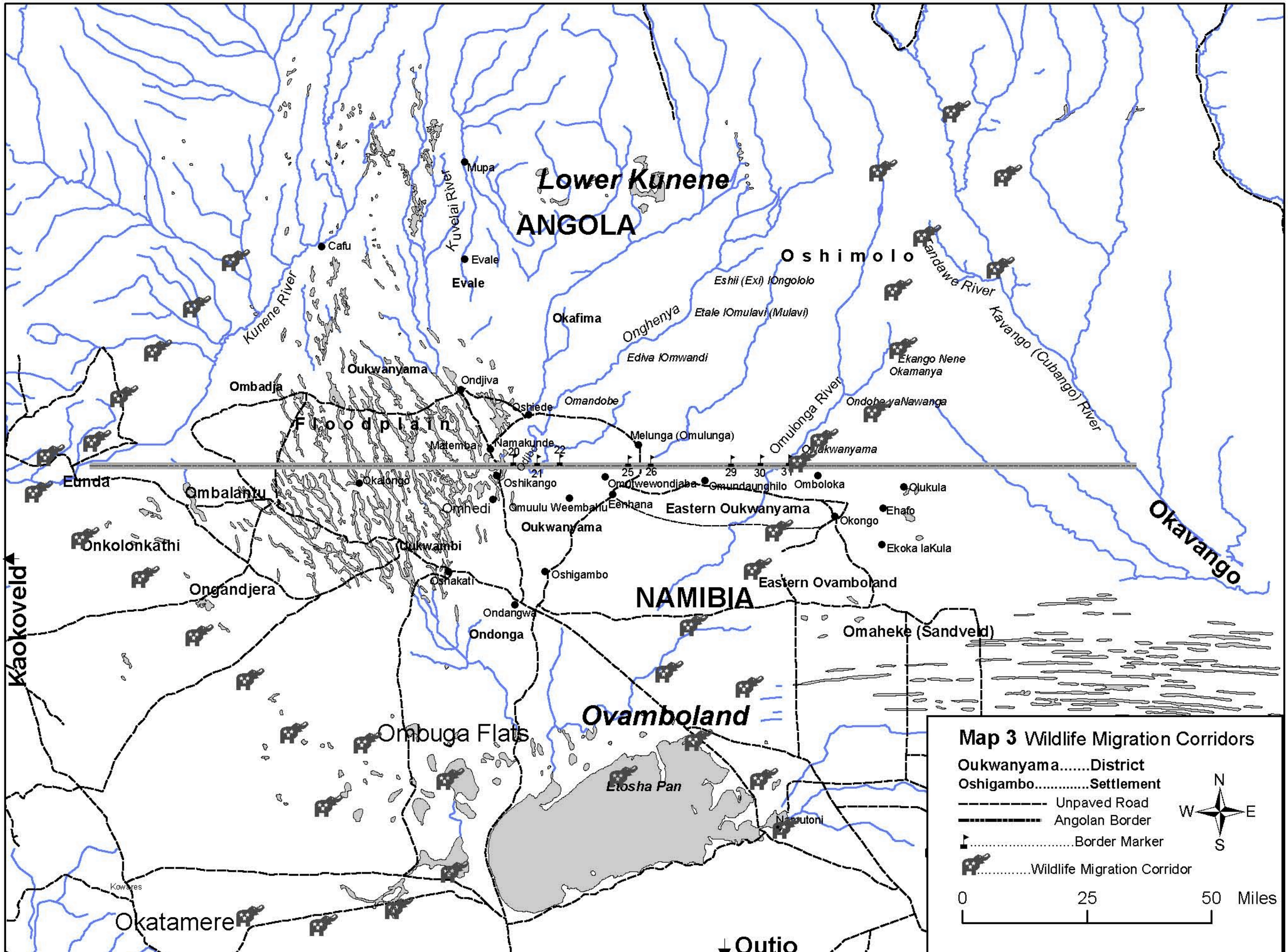
[54] Kreike, Re-creating Eden, p. 26; NAN, NAO 18, 20-21, f. 11/1 (ii, x-xix), Monthly & Quarterly Reports Ovamboland, 1929, 1931, 1937, 1939-1946;WAT 145 f. 81/22(xii), Director Water Affairs to Director Water Affairs Windhoek, Ondangwa, 5 July 1965. On a similar recovery of elephant herds in 1920s-1940s Kenya, see MacKenzie, The Empire of Nature, pp. 149-151.
[55] NAN, A450, 14, f. 4/2, Commander SWA Police Namutoni to O/C, NAO, Namutoni, 11 August 1930 and Annual Reports Ovamboland 1938-1943.
[56] NAN, WAT ww17 (ii), Davis, “Tour of Northern Territories”; BON 1 f. N1/26/2, Commissioner-General SWA to Minister Bantu Administration and Development, [Windhoek], 21 January 1966; AHE (BAC) ½ f. (16) N1/1/5/3, Bantu Affairs Commissioner, “Hoofman: Johannes Shekudja,” 11 March 1968 and N1/1/5/7, Bantu Affairs Commissioner, Form Vilho Weyulu, 11 March 1968; OVA 54 f. 6/19/14-7 (I), Ovambo Government Items nrs. 38, 41, and 42.



Map 3 Wildlife Migration Corridors
Oukwanyama.......District
Oshigambo.............Settlement
Unpaved Road
Angolan Border
Border Marker
Wildlife Migration Corridor
0
25
50
Miles
N
S
E
W
Lower Kunene
ANGOLA
Mupa
Kuvelai River
Cafu
Evale
Evale
Okafima
Kunene River
Oshimolo
Eshii (Exi) lOngololo
Etale lOmulavi (Mulavi)
Onghenya
Ediva lOmwandi
Candawe River
Kavango (Cubango) River
Ekango Nene
Okamanya
Ondobe yaNawanga
Omulonga River
Oukwanyama
Ombadja
Ondjiva
Oshiede
Omandobe
Floodplain
Namakunde
Matemba
Melunga (Omulunga)
Oukwanyama
20
21
22
25
26
29
30
31
Eunda
Okalongo
Oshikango
Omafwewondjaba
Omundaunghilo
Omboloka
Olukula
Ombalantu
Omhedi
Omuulu Weembaht
Eenhana
Eastern Oukwanyama
Ehafo
Okongo
Oukwanyama
Ekoka laKula
Onkolonkathi
Oukwambi
Oshakati
Oshigambo
Eastern Ovamboland
Okavango
Ongandjera
NAMIBIA
Ondangwa
Ondonga
Omaheke (Sandveld)
Kaokoveld
Ovamboland
Ombuga Flats
Etosha Pan
Namutoni
Kowares
Okatamere
Outjo

Conclusion

The study of change conventionally depends on identifying a benchmark, a point of departure that preferably is free from the disturbance or innovation that is brought about by the agent(s) of change. In the framework of the modernization, declinist, and inclinist paradigms, the benchmark for environmental change is usually a state of Nature (or a state of more Nature) on a Nature-Culture axis. Even though much of Ovamboland was wilderness in the late pre-colonial era, by the close of the 19th century, the area was neither pristine nor in a state of Nature. Much of its wilderness had either been oshilongo in a recent past (the kingdom of Haudanu in Okalongo) or it had been transformed by hunting, herding, fire, and settlement. The "wild" Bushmen and the wildlife that roamed the wilderness were not unambiguously pristine and Natural either. The Bushmen were responsible transforming much of the wilderness environment.

Moreover, on the eve of the colonial era the wildlife populations for many species were at an unnatural low as a result of heavy hunting and the exotic Rinderpest epizootic. In fact, the highest population levels for the region's wildlife may have occurred not in the late 1800s pre-colonial era but in the late 1920s and 1930s colonial era, defying a simple narrative of linear descent from a pre-colonial Natural paradise to a colonial and/or postcolonial environmental disaster area. Wildlife populations declined dramatically in most of Ovamboland after the 1940s, but the extent to which this is due to the confinement of large game to the Etosha Park, poaching and hunting, or human encroachment upon wildlife habitat is unclear. All three factors were likely contributors but it is far from certain which factors played a major role and when and where. What is obvious, however, is that the environmental history of Ovamboland from the late 1800s to the late 1900s offers no clear temporal or spatial benchmark for analyzing environmental change. If there is no clear benchmark, then it may be fruitful to revisit analyses and conclusions that project unambiguous environmental linear change in late 1800s to late 1900s Ovamboland because they may be explicitly or implicitly based on a past or present benchmark.

The next two chapters further highlight the issues raised by the Palenque Paradox (the urban ruins of Palenque in primordial forest), especially the portrayal of the process of environmental change as unilinear and irreversible along a Nature-Culture continuum that identifies Nature as the point of departure. The chapters principally employ a macro-level scale of analysis, focusing on some of the major catalysts for environmental change: population pressure, culture, and market forces.

CHAPTER 5
TREE CASTLES:
FORESTS AND POPULATIONS

Population pressure has been identified as the major force for environmental change in the 20th century.[1] Yet, while macro-level analysis of the interaction between human populations and the environment demonstrates that population dynamics relate to environmental change, the correlation does not necessarily originate from a direct causal relationship. The impact of an increase in human population density, for example, does not necessarily result in linear environmental degradation. The lack of a direct, mechanistic, and causal relationship between population and environmental conditions highlights the importance of factoring the consequences of human interactions with environmental resources into analyses of environmental change.

Malthus argued that population increased at a far greater rate than food production, and neo-Malthusian analysis identifies that population growth as the major cause of deforestation in Africa, Asia and Latin America. Boserup and others, on the other hand, stress that population growth can have the opposite effect because intensification and technological innovation can permit the same resource base to support a larger population without environmental degradation.[2] Both approaches portray "population" and "forest" as undifferentiated and organic entities. Moreover, the relationship between the two variables is depicted as being a mechanical, linear, one-way, and unequal interaction, i.e., human populations are dominant and act upon the forest.[3] The population pressure model to some extent approximates cultural

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[1] Myers, Deforestation Rates, pp. 20-23, 45-47; Williams, Deforesting the Earth, pp. 168-209, 334-379, 460-466.

[2] Malthus, An Essay on the Principle of Population.. See also Ehrlich, The Population Bomb; Ehrlich and Ehrlich, The Population Explosion; K.M. Cleaver and G.A. Schreiber, Reversing the Spiral: The Population, Agriculture, and Environment Nexus in Sub-Saharan Africa (Washington, D.C.: World Bank, 1994). On Boserup-inspired approaches see Boserup, Conditions of Agricultural Growth; P. Pingali, Y. Bigot, and H.P. Binswanger, Agricultural Mechanization and the Evolution of Farming Systems in Sub-Saharan Africa (Baltimore: The John Hopkins University Press, 1987); J.C. Okafor and E.C.M. Fernandes, "The Compound Farms of South-Eastern Nigeria: A Predominant Agroforestry Homegarden System with Crops and Small Livestock," Nair, Agroforestry Systems in the Tropics, pp. 411-426; Tiffen, Mortimore and Gichuki, More People, Less Erosion; A.R. Quisumbing, K. Otsuka, with S. Suyanto, J.B. Aidoo, E. Payongayong, Land, Trees and Women: Evolution of Land Tenure Institutions in Western Ghana and Sumatra (Washington, D.C.: International Food Policy Research Institute, 2001), pp. 43-79; and S.F. Siebert, "Beyond Malthus and Perverse Incentives: Economic Globalization, Forest Conversion and Habitat Fragmentation," Bradshaw and Marquet, How Landscapes Change, pp. 19-21.

[3] For critiques of the population pressure models, see, for example, D.D. Cordell and J.W. Gregory, eds., African Population and Capitalism: Historical Perspectives (Boulder, Co.: Westview Press, 1987), pp. 14-15; J. Koponen, "Population: A Dependent Variable" and G. Maddox, "Environment and Population Growth in Ugogo, Central Tanzania," Maddox, Giblin, and Kimambo, Custodians of the

determinism, as opposed to environmental determinism. The underlying causes of population growth, however, are sometimes couched in terms of biological determinism; for example, in The Population Bomb Ehrlich writes: "our urge to reproduce is hopelessly entwined with our other urges."[4] In essence, while humans (or "culture") are advanced as the cause of environmental change, they are not really considered to be independent agents; rather, they are hostages to biological urges.

Malthusian and Boserupian explanations are particularly influential in the case of modern Africa because the continent has the highest rates of natural population increase. Two issues, however, complicate matters. First, a number of the African countries that are listed amongst those with the highest deforestation rates, including Gabon, Congo (Brazzaville), and the Democratic Republic of Congo, are underpopulated.[5] Second, research suggests that Africa's population began to grow only in the 1940s or 1950s, although environmental degradation related to population growth, notably deforestation and soil erosion, became major concerns in the late 1920s and 1930s.[6] Population movements, however, led to the relative redistribution of the existing population, with concentrations of specific groups of people and subsequent population pressure in some areas, and depopulation and decreasing population pressure in others. Thus, until the 1940s or 1950s, population movement in Africa may have been a more critical variable than population growth, and indeed migrations continue to play a major role in the population dynamics of modern Africa and consequently in environmental changes.[7]

Land, pp. 19-42 and 43-65 respectively; Fairhead and Leach, Reframing Deforestation, pp. 13, 178; Mazzucato and Niemeijer, Rethinking Soil and Water Conservation, pp. 124-164.

4 Ehrlich, The Population Bomb, pp. 31-32. For a critique, see J. Koponen, "Population: A Dependent Variable" and G. Maddox, "Environment and Population Growth in Ugogo, Central Tanzania," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 19-42 and 43-65 repectively.

5 Myers, Deforestation Rates, pp. 20-23, 45-47; Westoby, Introduction to World Forestry, p. 109.

6 Koponen, "Population" and Maddox, "Environment and Population," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 19-42 and 43-65 respectively; V. Notkola and H. Siiskonen, Fertility, Mortality and Migration in SubSaharan Africa: The Case of Ovamboland in North Namibia, 1925-90 (Houndsmills and London: MacMillan Press, 2000), ch. 9; R. Headrick, Colonialism, Health and Illness in French Equatorial Africa, 1885-1932, edited by D.R. Headrick (Atlanta, Georgia: ASA Press, 1994), pp. 89, 194-5, 385-394.

7 Iliffe highlights migrations and the colonization of new environments as the main characteristics of the history of Africa, see J. Iliffe, Africa: The History of a Continent (Cambridge: Cambridge University, 1995). For examples of studies that emphasize the environmental impact of migrations, see, McCann, Green Land, Brown Land, pp. 19-22 and 96-101; Maddox, "Environment and Population," Maddox, Giblin, and Kimambo, Custodians of the Land, pp. 43-65, especially p. 44; S. Miehr, "Acacia albida and other Multipurpose Trees on the Fur Farmlands in the Jebel Marra Highlands, Western Darfur, Sudan," Nair, Agroforestry Systems in the Tropics, pp. 353-384; J.F. Kessy, Conservation and Utilization of Natural Resources in the East Usambara Forest Reserve: Conventional Views and Local Perspectives (Wageningen: Wageningen Agricultural University, 1998), p. 60; Colchester and

In pre-WW2 Ovamboland, environmental change was driven more by population movements than by natural population growth. Insecurity and security concerns are key explaining why, how, where, and when populations movements are associated with deforestation. In the late 1800s throughout the early 1920s a general climate of insecurity caused people to concentrate in nucleated wooden fortifications – tree castles - for purposes of defense. The fortifications were extensive and elaborate and consumed enormous amounts of wood. From the 1920s onward, improved political security allowed people to fan out from population centers into the surrounding wilderness. As settlers moved into the wilderness, however, they faced a new threat: wild animal populations that had rebounded from 1890s lows. To protect lives and livelihoods, the settlers retained the practice of constructing fortified homesteads, contributing to a high consumption of woody vegetation and deforestation.

Tree-Castles and Insecurity on the Eve of Colonial Conquest

In the late 1800s and early 1900s, the Ovambo floodplain and the surrounding areas were subject to raiding and warfare linked to the slave trade and colonial expansion, a situation that was aggravated by periodic droughts and pestilence. Insecurity in Ovamboland as elsewhere in Africa driving this continent-wide era of troubles, caused populations to concentrate in fortified defensible sites under the leadership of strong military leaders. Ovamboland's elite of kings and big men used ivory and cattle to acquire guns and horses that provided an effective means of defense against raids, by, for example, the Nama from central Namibia and the Portuguese from across the Kunene River. The guns and horses also provided the means to raid others, which led to retaliatory raids and escalating violence. As a result, in the course of the 1800s through 1914, not only outlying farms, fields, and villages but also entire districts and a complete middle floodplain kingdom (Haudanu's) were abandoned and turned into ofuka-wilderness. In addition, from the 1880s to the mid 1910s, the decline in animal populations that resulted from commercial hunting and the Rinderpest epizootic further contributed to an afforestation trend. Ivory hunting led to a sharp decline in elephant

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Lohmann, The Struggle for Land, especially the contributions by M. Colchester (pp. 1-15), L. Lohmann (pp. 16-34), R. Plant (pp. 35-60), M. Colchester (99-138), and G. Monbiot (pp. 139-163); L.C. Gray, "Investing in Soil Quality: Farmer Responses to Land Scarcity in Southwestern Burkina Faso," Bassett and Crummey, African Savannas, pp. 72-90, especially 73 and 76-77.

numbers and the Rinderpest killed wild and domestic grazers and browsers. As a result, bush vegetation may have outstripped the capacity of browsing animals.[8]

The inhabitants of the safe havens invested an enormous amount of resources and labor in defensive works. Woody vegetation was the main construction material for elaborate fortresses shaped in the form of circular labyrinth palisades or enclosures. Communities constructed the palisades using 9-12 feet (three to four meters) high poles buried three feet (one meter) in the soil, resulting in fortifications that were impregnable to spears, arrows, and even modern small arms. In the kingdom of Okafima, in the far northeastern floodplain, the royal fort was sufficiently large to provide shelter to all of its 1,500 inhabitants. In the southwestern part of the floodplain – including Ombalantu and Eunda - huge baobabs functioned as medieval keeps. In Ombalantu, people constructed their homesteads in close proximity to the forts. When an attack was feared, women and children sought safety in the hollow trunk of the baobabs, where water was usually stored, while livestock was driven inside the palisade around the baobab. Some of the baobab castles contained a mud-plastered outer palisade and an inner palisade. Archers positioned themselves on platforms behind loopholes. The well-known Ombalantu baobab that is now a national monument is a good example of such a former keep. A South African official: "had a doorway cut in and used the room, in which upwards 50 people can stand, as a store." The construction and maintenance of the fortifications required large quantities of wood and labor. When the Kwanyama King Weyulu moved his palace fortress over a short distance in late 1895, seventy men were engaged in cutting and transporting new poles while others laid out the ground plan.[9]

Not only did kings and other notables reside in formidable tree castles, but the homesteads of the local populations were also protected by a palisade enclosure called <u>omiti</u>, which typically consisted of wooden poles. Even the typical homesteads required great effort to construct, and they contained from 20 to 70 open or closed "huts." In 1850s Ondonga, the first homestead that the missionary Hahn encountered measured

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[8] See Kreike, <u>Re-creating Eden</u>, chapters 1-4.

[9] Kreike, <u>Re-creating Eden</u>, chapters 2-3; NAN, WAT ww17 (ii), S. Davis, "Tour of Northern Territories-Some Random Comments and Thoughts;" A 450, 4, f. 1/30 Hahn to A.W. Hoernle [Ondangwa?], 21 September 1936; RCO 4, RCO to GRN, [Ondangwa], 29 February 1916; RCO 8 f. 9, RCO to Sec. SWA, Ondonga, 27 October 1918 and Extract from RCO's Personal Diary, 10 March 1917; NAO 104 Anderson to Hahn, 13/4/44 Johannesburg 1882, extract diary W.W Jordan copied from the Cape Quarterly Review vol. II. 882 pp. 519-539; AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892 and RMG C/h 52, Speiker, Visitationsbericht der Station Namakunde, Namakunde 13-18 July 1906; Möller, <u>Journey</u>, pp. 110-112, 117; Lima, <u>A Campanha</u>, pp. 181-183; CNDIH, Avulsos, Caixa 3439, Ribeiro da Fonseca, "Relatório do reconhecimento," Cuamato, 26 September 1913; OMITI 4.4.38. On Dayak village fortresses, see Knapen, <u>Forests of Fortune?</u>, pp. 86-88.

approximately 60 feet (20 meters) across and consisted of poles and stalks planted in the earth forming a small labyrinth. There were separate huts for each of the wives and separate compartments for livestock. In the early 1890s northern floodplain, bundled thorn branches were sometimes used to make palisades instead of poles; in Ondonga and Uukwambi, where poles and branches were in shorter supply, palisades constructed from bundles of grain stalks were common.[10] A thorn bush fence surrounded the palisaded homestead and its fields.[11]

Wood was also a principal construction material for the huts. Whereas a hut in a royal enclosure could measure 15 "paces" across, in most homesteads, a hut measured only a few "paces." The huts had pole frames and they were covered with grass roofs. The walls consisted of poles or sticks that were covered with clay or cattle manure in the northern floodplain, while grain stalks were more commonly used for the walls in the southern floodplain. Roofs fashioned without walls served as sleeping quarters during warm nights and similar structures covered the grain storage baskets, which were sealed with clay and elevated above the ground in a pole-supported ring. All the constructions were round.[12] In addition, most tools and utensils, ranging from cups to clubs, were carved from wood.[13]

Since trees were a main source of the raw materials to enhance physical security in the Ovambo floodplain, it may not be a surprise that trees were also considered to be important spiritual sources of safety. In the northern floodplain kingdom of Oukwanyama, the sites of the palaces of the former kings – where the kings were buried – were revered as sacred groves. The sites were associated with rain ceremonies and they functioned as places of sanctuary. In 1882, a large fig tree close to the homestead of the Uukwambi king was associated with a former Queen Mother and was sacrosanct. The mopane tree figured in a multitude of ceremonies.[14]

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[10] Lau, Carl Hugo Hahn Tagebücher, vol. iv, 22 July 1857; AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892; Möller, Journey, p. 126. On the great labor investment required, see, for example, AVEM, RMG C/h 52, I. Speiker, Visitationsbericht der Station Namakunde, Namakunde 13-18 July 1906; A. Wülfhorst, Moses, Eine Erstlingsfrucht aus den Ovambo, pp. 14-15. The homestead was called eumbo in Oukwanyama and egumbo in Ondonga.

[11] See, for example, NAO 104, Jordan diary and Lima, A Campanha, pp. 136-140, 159.

[12] Lau, Carl Hugo Hahn Tagebücher, vol iv, 22 July 1857; NAN, NAO 104, Anderson to Hahn, diary Jordan; AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892; Möller, Journey, pp. 110-112; Wülfhorst, Aus den Anfangstagen, p. 14.

[13] NAO 104, diary Jordan; AGCSSp, Duparquet 1879 journal, August 24 and September 22, 1879.

[14] C. Mittelberger, "Entre os Cuanhamas: O Que Precede a Chuva (Estudo Etnografico)," Portugal em Afrika, xix (1962) part 1, pp. 222-233; AVEM, RMG 2630 C/k 7, Carl Sckär, Beitrag zu den Sitten und Gebräuchen der Ovakuanjama [1899] and "Kurze Geschichte der Ovakuanjama [1912]"; Märta Salokoski, "Symbolic Power of Kings in Pre-Colonial Ovambo Societies" (Helsinki, University of

Trees sometimes lent their name to entire villages: for example, Omupanda in Namibia, which was founded in the early 1900s, was named after a large omupanda (Lonchocarpus capassa and/or L. nelsii) tree that offered shelter and functioned as a court.[15]

Portuguese Violence and Population Flight into Ovamboland

Colonial conquest and pacification caused massive destruction and large-scale population displacement across Africa. In the northern Ovambo floodplain, the violence and terror caused by the Portuguese colonial conquest and "pacification" of the Ombadjas, Evale, and Kafima from 1909 to 1915 and of Oukwanyama from 1915 to 1917 made tens of thousands flee south into the South African controlled middle and southern floodplain. Many refugees from the northern floodplain initially re-settled in the Neutral Zone, a territory disputed between the South Africans and Portuguese that between 1915 and 1927 was co-administered by the two colonial powers until it was ceded to Portugal in the latter year (see map 4). The transfer of the Neutral Zone to Portugal triggered yet another large-scale migration to the middle floodplain area south of the new colonial boundary that was demarcated in 1927. Many refugees who had settled in the Neutral Zone moved again, this time into the South African occupied part of the Ovambo floodplain.[16]

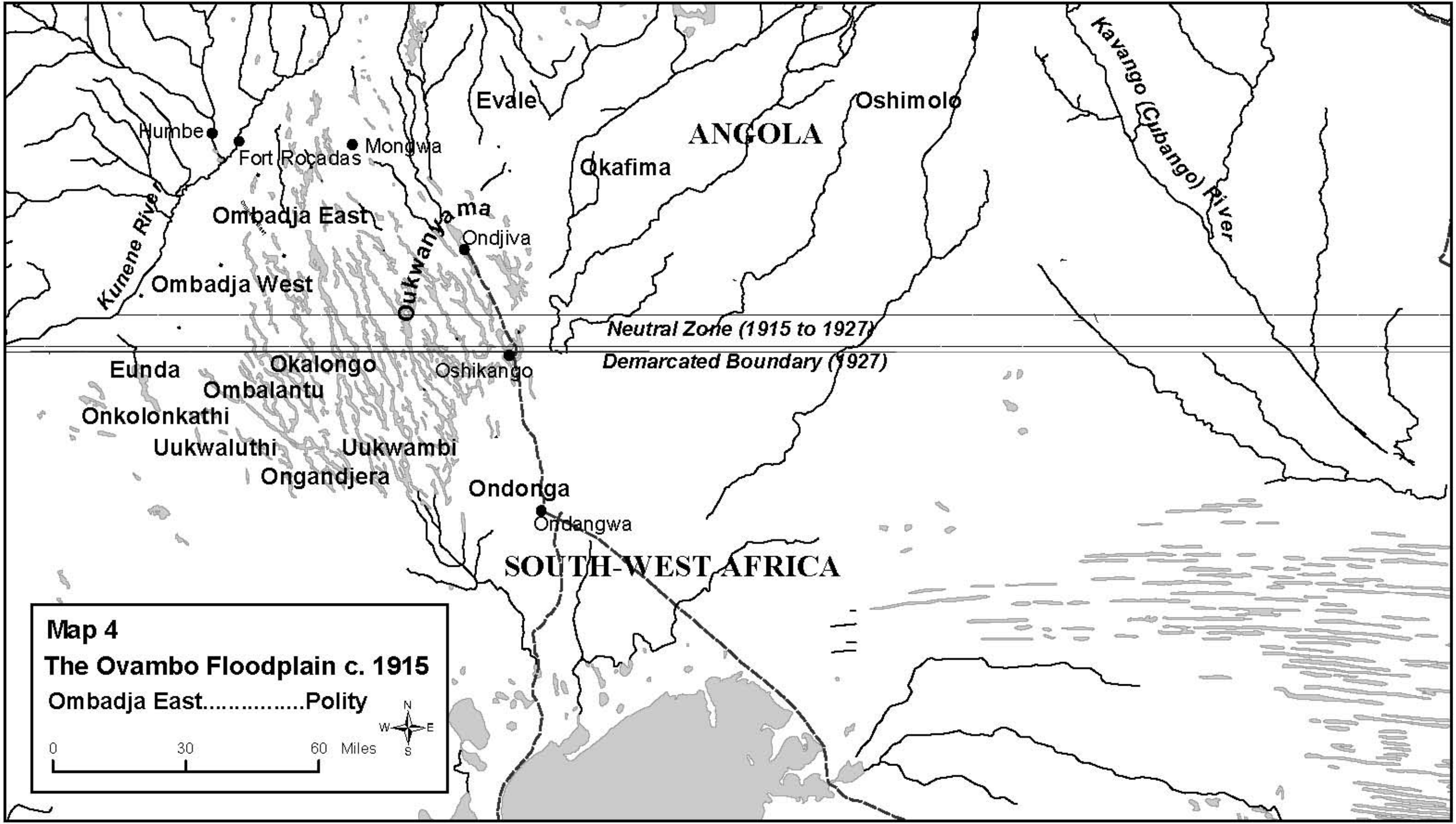
In 1916, only a few of the refugees had managed to construct fortress-like homesteads and the impact of the refugee movement on the vegetation was as yet marginal: "this country is a vast flat, covered with more or less thick bush, grass and tall antheaps....there are also large dry uninhabited stretches....Except for [the Oukwanyama king] Mandume's and some principal headmen's stockaded kraals the natives live separated in unimportant little huts scattered about in the bush."[17]

Helsinki: Licensiate Thesis in Sociology/Social Anthropology, 1992), p. 336; NAN, A450 vol. 9 f. 2/39, Hahn, "Rough Notes," pp. 57-58.

[15] Mateus Nangobe, interview by author, Omupanda (Namibia), 24 May 1993. Omu(u)lu Weembaxu in Namibia derived its name from its scrub vegetation, see, AVEM, RMG 2630 C/k 7, Carl Sckär, Beitrag zu den Sitten und Gebräuchen der Ovakuanjama (E. No. 77, am 9/8/[18]99. Cf. Turvey 1977, p. 101, who defines the word omuulu as thick bush, thicket, scrub country.

[16] Kreike, Re-creating Eden, chs. 1-4.

[17] NAN, UNG, UA 1, RCO to Deputy Secretary for the Protecterate, Ondonga [Ondangwa], 31 May 1916. Interviewees also recall that their farms initially were small, see, for example, Paulus Nadenga, interview by author, Oshomukwiyu, 28 April 1993.



Evale
Oshimolo
ANGOLA
Kavango (Cubango) River
Humbe
Fort Roçadas
Mongwa
Okafima
Ombadja East
Oukwanyama
Ondjiva
Kunene River
Ombadja West
Neutral Zone (1915 to 1927)
Demarcated Boundary (1927)
Eunda
Okalongo
Oshikango
Ombalantu
Onkolonkathi
Uukwaluthi
Uukwambi
Ongandjera
Ondonga
Ondangwa
SOUTH-WEST AFRICA
Map 4
The Ovambo Floodplain c. 1915
Ombadja East................Polity
0
30
60
Miles
N
W
E
S

By 1933, however, a substantial share of Ovamboland's population consisted of refugees from the northern floodplain polities of Oukwanyama, the Ombadjas, Evale and Okafima. Refugees from the northern floodplain escaped to Ondonga and Ongandjera and also sought sanctuary in the wilderness of the middle floodplain. The South West African tribal district of Oukwanyama, which was practically non-existent in 1915, in 1933 counted 41,215 inhabitants, or 38% of Ovamboland's total population of 107,861. By 1938, its population had increased to 52,580.[18]

The impact of flight on the population of what became north central Namibia was visible in the 1991 Namibian census data. Of the survivors of the generation born before 1917, 18% claimed to be foreign born. Of those born between 1917 and 1926, 15% were foreign born, a figure that decreased to 11% for people born between 1927 and 1936; 9% for those born between 1937 and 1946; 8% for those born between 1947 and 1976; and less than 5% for those born after 1976.[19] The impact of the population exodus on the Angolan side of the border was also in evidence, especially in the Ombadjas in the 1990s. The 1890s expanses of villages, fields, and fruit trees were overgrown by bush by the late 1920s; by the 1990s, it was ofuka-wilderness. Except in memory, little or no traces remain of the once thriving Ombadja rural landscape, for, unlike the stone constructions of Palenque's and Great Zimbabwe's downtowns, the Ombadja infrastructure was made of highly perishable materials.[20]

Internal Migrations in South Africa's Ovamboland

A second settlement movement into the wilderness was the result of internal migrations within Ovamboland. By the mid-1920s, the southern and middle floodplains had become a much more secure location and security considerations no longer compelled people to seek safety in numbers. As a result, settlers struck out into the wilderness areas that separated the former old kingdoms that had been transformed into colonial districts (see map 5).

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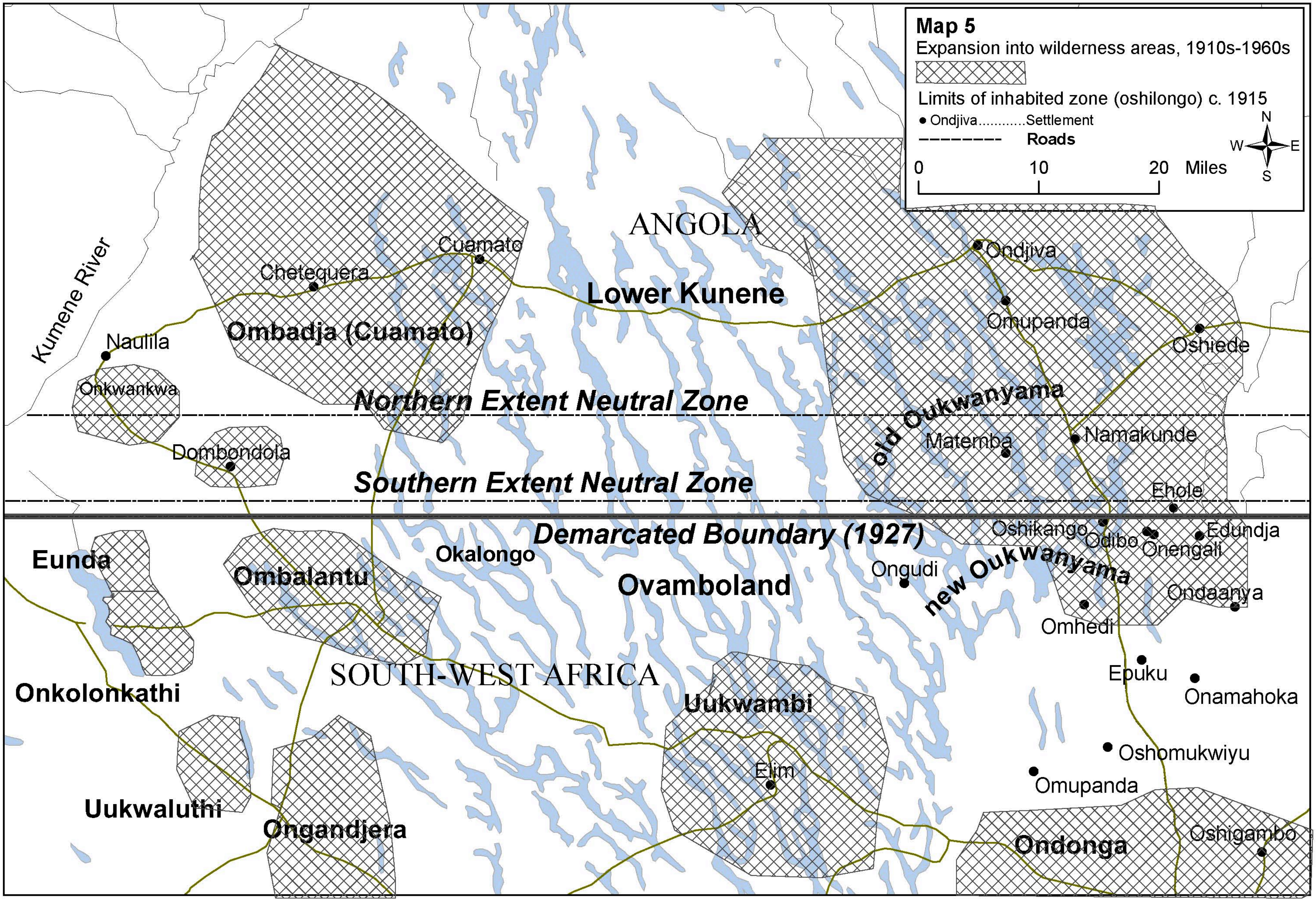
[18] Kreike, Re-Creating Eden, ch. 4.
[19] Derived from Republic of Namibia, 1991 Population and Housing Census (Windhoek, 1993), Report A, Statistical Tables, vol. i, table A03.
[20] Kreike, "Recreating Eden," chapters 3-4; NAN, KAB 1, (vi), Draft Report Kunene Water Commission, Olusandja, July [1927]; RCO 5, f. 4/1919/18, Pearson to Manning, T'Chipa, 22 December 1917; Lea Paulus, interview by author, Onandjaba, 17 June 1993. During cross-border operations against the South West African People's Organization (SWAPO), the uninhabited bush land of the former Ombadja oshilongo proved virtually impenetrable, see W. Steenkamp, Borderstrike: South Africa hits SWAPO bases in Angola (Durban/Pretora, 1983), pp. 106-107.



Map 5
Expansion into wilderness areas, 1910s-1960s
Limits of inhabited zone (oshilongo) c. 1915
Ondjiva............Settlement
Roads
N
W
E
S
0
10
20
Miles
ANGOLA
Kumene River
Cuamato
Chetequera
Lower Kunene
Ondjiva
Omupanda
Oshiede
Naulila
Ombadja (Cuamato)
Onkwankwa
Northern Extent Neutral Zone
old Oukwanyama
Namakunde
Matemba
Dombondola
Southern Extent Neutral Zone
Ehole
Demarcated Boundary (1927)
Oshikango
Odibo
Onengali
Edundja
Eunda
Okalongo
Ombalantu
Ongudi
Ovamboland
new Oukwanyama
Ondaanya
Omhedi
SOUTH-WEST AFRICA
Epuku
Onamahoka
Onkolonkathi
Uukwambi
Oshomukwiyu
Elim
Omupanda
Uukwaluthi
Ongandjera
Ondonga
Oshigambo

Again this was a phenomenon that was not unique to Ovamboland. During the 1920s, 1930s, and 1940s, individuals and groups of Africans throughout the continent fanned out from defensible sites with dense settlement to occupy "wilderness" expanses.[21]

The vast ofuka-wilderness of the middle floodplain was transformed between 1915 and 1950. By 1928, bush dominated the middle floodplain, although the flood channels themselves were mostly bare of woody vegetation.[22] The large majority of the area's modern villages date to the post-1915 era. Woody vegetation to construct farms and fences was abundant in 1930s (Namibian) Omupanda and 1940s Oshapwa and included sickle bush (ongete or Dichrostachys cinerea), wild seringa (omutundungu), tamboti (omuhongo/omunghongo or Spirostachys africana) and other thorn trees and abundant mopane in the latter (it was closer to Uukwambi), although silver cluster leaf bush (omwoolo or Terminalia sericea) was scarce. In the mid-1920s, however, the construction of the Anglican mission at Odibo was delayed because poles had to be hauled from six miles away. In the 1940s, such middle floodplain villages as Omupanda, Oshapwa, and Oshomukwiyu, for example, contained only a few households, but Odimbo, seven miles (10 km) north of Oshomukwiyu was already densely settled. Ombadja refugees founded a small cluster of villages during the 1920s further west and on the other side of a large ofuka-wilderness.[23] Refugees from

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[21] Iliffe, A Modern History of Tanganyika, pp. 315-317. For other examples of such population dispersals, see Mandala, Work and Control in a Peasant Economy, pp. 95-96; McCann, Green Land, Brown Land, pp. 147-156; W.E.A. van Beek and P.M. Banga, "The Dogon and their Trees," D. Parkin and E. Croll, eds., Bush Base: Forest Farm: Culture, Environment and Development (London & New York, 1992), pp. 57-75; S. Miehr, "Acacia albida and other Multipurpose Trees on the Fur Farmlands in the Jebel Marra Highlands, Western Darfur, Sudan," Nair, Agroforestry Systems in the Tropics, pp. 353-384; P.A. Maack, "'We Don't want Terraces!' Protest and Identity under the Uluguru Land Usage Scheme," Maddox, Giblin, and. Kimambo, Custodians of the Land, pp. 152-170, especially 155; Richards, Indigenous Agricultural Revolution, p. 54; Mazzucato and Niemeijer, Rethinking Soil and Water Conservation, p. 82. Similar processes marked Southeast Borneo and the Jimi Valley of Papua New Guinea. Knapen, Forests of Fortune?, pp. 252-253 and F. van Helden, "Resource Dynamics, Livelihood and Social Change on the Forest Fringe: A View from the Highlands of Papua New Guinea," Wiersum, Tropical Forest Resource Dynamics, p. 87.

[22] NAN, KAB 1 (iii), Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions at The Angola Boundary"; RCO 9, f. 10/1916/1 (ii), RCO to Sec. Protectorate, 18 February 1917; RCO 10, f. 15/1916/1, RCO and Hahn, Preliminary memo re. Ovamboland and Chief Mandume, [1916].

[23] Kreike, "Recreating Eden," chapters 2-4; NAN, NAO 18 f. 11/1 (I), Monthly Reports Ovamboland, June and July 1927; NAN, A450, 9 f. 2/32, Newspaper clipping of an article by G.W. Tobias [1925]; NAO 16 f. 10/2, UGR to O/C NAO, Namakunde, 28 February 1929; NAO 44 f. 37/1, NCO to Sec. SWA, Ondangwa 20 April 1931; NAO 10, f. 5/7, O/C NAO to NCO, Oshikango, 19 June 1935; interviews by author: Mateus Nangobe, Omupanda, 24 May 1993; Joseph Shuya, Oshapwa, 23 June 1993; Paulus Nandenga, Oshomukwiyu, 28 April 1993 and Paulus Wanakashimba, Odimbo, 10-11 February 1993.

the northern floodplain also settled throughout the southern floodplain, including in Ondonga's eastern Oshigambo area.[24]

In March 1917, the inhabitants of Ombalantu huddled in farms concentrated around baobab forts. In 1918, the formidable Uukwaluthi baobab castle was abandoned, its walls crumbling, and the "[Eunda] Headman Shituthi…informed us he like others made no further forts as…[the] necessity for such protection had died out."[25] The Ongandjera headman Petrus explained the now dispersed settlement pattern to a 1935 colonial commission: "[b]efore we had the Union [of South Africa] Government here we had a lot of trouble and each man had to try and save his property himself. But now every man is free and can go where he likes."[26]

To chiefs, headmen, and by extension the colonial officials who relied on them to administer Ovamboland, the scattering of settlements constituted a challenge for at least two reasons. First, subjects who moved into <u>ofuka</u>-wilderness beyond the old settled cores districts were difficult to control. Second, settlers from neighboring districts moved into <u>ofuka</u>-wilderness and claimed it as their own. As the wilderness belts were reduced and land became scarce, kings and headmen staked their claims to previously unsettled land in what may also have had elements of a "land speculation" frenzy: the more land a king or a headman could amass to allocate, the more followers

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[24] CNDIH, Caixa 4130, Governo do Distrito 31-20 1, Relatorio sobre a occupação 18 June 1909 and Avulsos Caixa 3439, Ribeiro da Fonseca, Relatorio do reconhecimento, Cuamato, 26 September 1913; NAN, RCO 4, RCO to British Resident Namakunde, 13 December 1915 and to GRN, [Ondangwa], 29 February 1916; RCO 5, f. 4/1919/18, Pearson to RCO, T'Chipa, 1 March 1920; A450, 7, f. 2/18, Native Affairs Report Ovamboland 1924 and vol. 10, f. 2/40, document marked in right top corner "By Shovala 17/9/35;" NAO 18 f. 11/1 (I), Monthly Report Ovamboland, September 1926; NAO 106, Diaries NCO, Diary 1935-1938, 9 September 1935 and 30 June 1936; NAO 9, f. 5/1, UGR to O/C NAO, Namakunde, 28 August 192 and Bourquin, memo "Re Headman Filemon Shipena of Elope-Ondonga," [22 January 1942; NAO 51, f. 3/3, Shimoshili to Master Nakale [Eedes], Olupembana, Uukwambi, 13 January and 2 June 1948; Nauyoma Kapeke [to NCO], Uukwambi [received Ondangwa, 3 April 1948]; NAO 51, f. 3/2, NCO to CNC, Ondangwa, 20 July 1948 and appendix "Foreign natives in Ovamboland: summary: Ondonga tribal area, Chief Kambonde to NCO, Okaroko June 1948; NAO 90, f. 136/1 (I), statement Aihuki Tolongele, Ondangwa, 5 May 1948; NAO 91, f. 36/1 (iii), statement Agustinhu Kapetango [March 1954?]; NAO 92 f. 36/3 (iii), affidavit Gallation Shidive, Ondonga, 25 February 1954; NAO 91, f. 36/1 (iii), statements Thomas Kupila, 5 May 1954 and Titus Muatelai Kakonda, Ondangwa, 10 May 1954.

[25] NAN, RCO 8, f. 9, extract from RCO's Personal Diary, 13 March 1917 and RCO to Sec. SWA, 27 October 1918, extracts diary, 9-10 October 1918.

[26] NAN, A450 vol. 12, f. 3/21/5, SWA Commission: Minutes of Evidence, Sitting at Ongandjera, Headman Petrus, p. 700; RCO 4, f. 3/1919, NCO to Sec. SWA, report on Ipumbu, Ondonga, 6 January 1922. Ondonga was more secure somewhat earlier and the resulting colonization of wilderness areas occurred earlier, see RCO 3, f. 2/1916/1, appendices to British Consul, Luederitzbucht, 14 February 1913.

he could attract (and followers could be taxed and mobilized for labor), and the more grazing areas and water he controlled for his and his followers' livestock.[27]

What the colonial officials of Ovamboland began to consider "illegal settlement" in the "wilderness" areas on the margins of the settled area came to be seen as a major problem by both the colonial administration and local kings and headmen. The annual report for 1941 stressed that "[t]he large number of kraals established in the bush areas, during recent years, is very noticeable." In 1946, the Ovambo kings and headmen urged Hahn to strengthen their authority outside the settled zones proper and the Native Commissioner was more than sympathetic:

> [t]he leading natives one and all complain of the growing inclination of their subjects to establish themselves outside the proper tribal area in unauthorised bush country. They are taking steps to have these people moved to where there are fixed settlements and proper tribal control….They have also intimated that the punishment for veld and bush fires [these were tools to clear new land] should be made more severe. To this I have readily agreed.[28]

In 1947, an Ombalantu headman requested the personal intervention of the Native Commissioner because he was unable to control people from cutting down trees to clear new farms and fields.[29]

"Intertribal" conflict about "wilderness" territory was endemic in the 1930s, 1940s, and early 1950s, and kings and headmen often called on the Native Commissioners to support their claims. During the 1920s, disagreement about settlement in the ofuka-wilderness that separated Oukwanyama and Uukwambi turned violent when the Uukwambi king burned down an Oukwanyama farm in the area. The Ondonga and Uukwambi kings demanded that a "definite and visible line [be] demarcated" to prevent any further Oukwanyama expansion southwards towards their territories. In 1941, the colonial administration resorted to drastic measures to discourage encroachment on "wilderness" borderland: it evicted six households that had settled in the "uninhabited bush" areas of Uukwambi and Onkolonkathi and destroyed the homesteads. By 1948, conflicts between Ombalantu and Uukwaluthi settlers who encroached on disputed "bush" border territory were frequent.[30] In 1953,

[27] See, for example, NAN, A450, 7, f. 2/18, Annual Report Ovamboland 1937 and NAO 99, f. 42/11 (iii), Headmen Ombalantu to NCO, Ombalantu, 9 August 1951.
[28] NAN, NAO 21, f. 11/1 (xix), Quarterly Report Ovamboland, April-June 1946.
[29] NAN, NAO 98, f. 42/11 (I), Muanyagapo Mbunda to NCO, Ombalantu, 8 April, 14 July, and 30 August 1947 and NCO to Muanyagapo Mbunda, Ondangwa, 15 April 1947.
[30] NAN, RCO 4, f. 3/1919, NCO to Sec. SWA, report on Ipumbu, Ondonga, 6 January 1922; Manning's memo re. Ipumbu, 19 December 1921and annexes 1-3, and Manning and Native

however, the Native Commissioner reported to his superior that "[a]ll the tribal borders in Ovamboland are marked by trees being blazed, by Omurambas [seasonal watercourses] or by sections of roads. Many disputes about these borders have arisen....[i]t would be useless and costly to fence these borders."[31]

The colonization frontiers cut into the ofuka-wilderness even though water was in short supply and the construction of new farms and fields was laborious and difficult.[32] One resource that initially seemed available in unlimited quantities in the ofuka-wilderness was wood. Even in the Oshigambo Valley of eastern Ondonga, which saw a rapid increase of its population as a result of the influx of refugees, land and wood including mopane, wild seringa (omutundungu) and silver cluster leaf (omwoolo) were still abundant in the early 1920s.[33]

Eastern Ovamboland: Settlement beyond the Floodplain

To relieve the congestion in Ovamboland, the colonial administration encouraged the colonization of what became known as "eastern Ovamboland" east of and outside of the floodplain (see map 6). Refugees from the northern floodplain and migrants from the middle and southern floodplain had four incentives to take on the challenges of colonizing the east. First, settlement in the eastern ofuka allowed groups and individuals more "freedom" from the political, social, and cultural constraints in the floodplain. In the floodplain, kings, headmen, clan elders, and colonial officials increasingly held sway after the colonial government carved up the wilderness areas between the former polities and divided them amongst the various chiefs and headmen.[34]

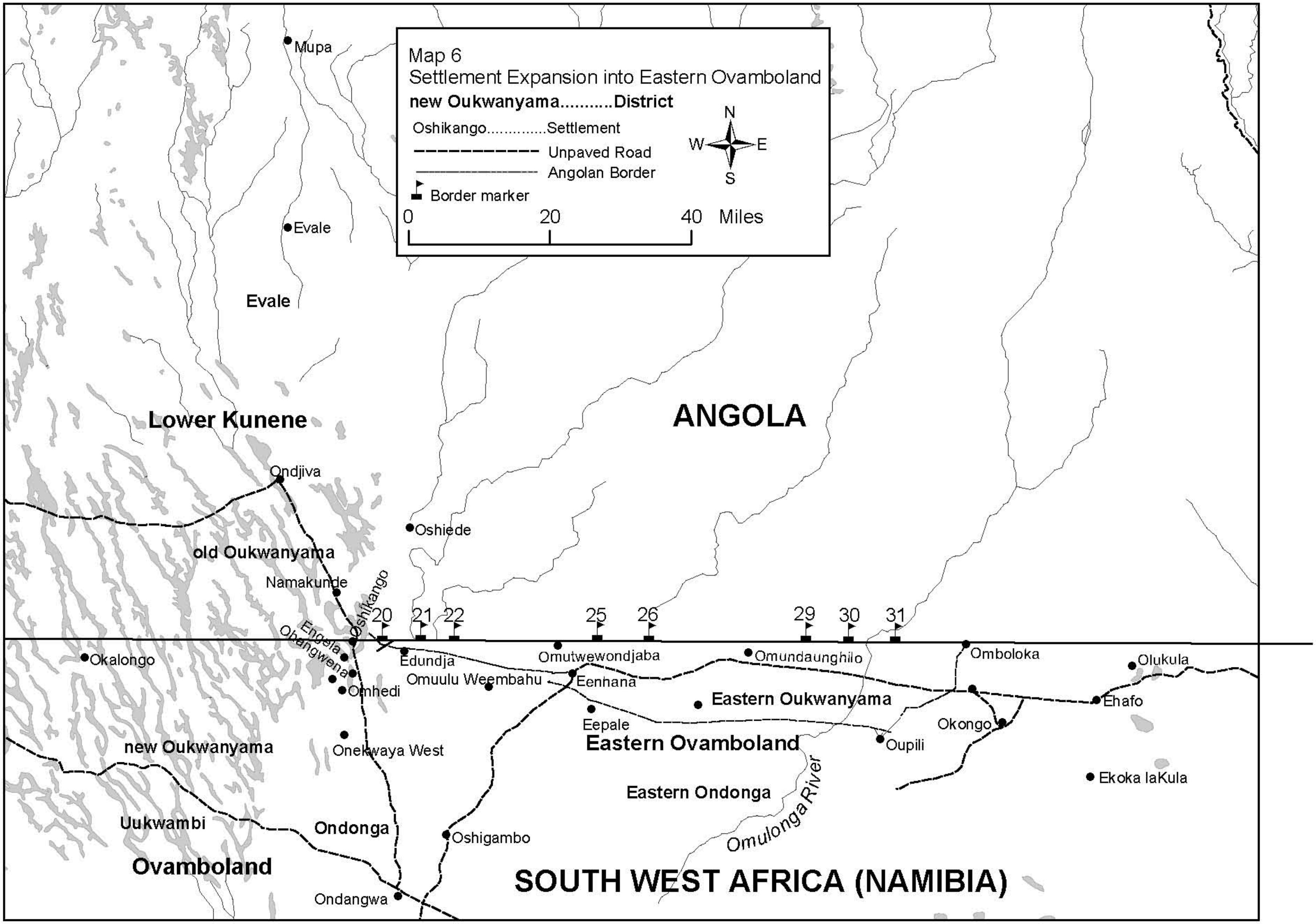
Commissioner SWA to Sec. SWA, 1 August 1923 and sketch maps; NAO 10, f. 5/4, Olli Suikkanen (for Sheja) to Hahn, Ongandjera, 6 July 1932 and Administrator to NCO, Windhoek, 25 April 1931 f. 5/7/1, ANC to NCO, 31 October 1940; NAO 18 f. 11/1 (I), Monthly Reports Ovamboland, November 1926 and June-July 1927; NAO 19 f. 11/1 (vi), Monthly Report Ovamboland, February 1933; NAO 20 f. 11/1 (xiv), Monthly Reports Ovamboland, January-February 1941; NAO 21, f. 11/1 (xix), Quarterly Report Ovamboland, April-June 1946; A450 7, f. 2/18, Annual Report Ovamboland 1941; NAO 98 f. 42/11 (I), Dalengelue Aitana to NCO, Ombalantu, 21 January 1948 and NCO to headman Dalengelue Aitana, Ondangwa, 26 January 1948 and NAO 99, f. 42/11 (iii), Council of Headmen to NCO, Ombalantu, 15 and 17 January 1952; NAO 51, f. 3/5, Meeting at Ukualuthi, 17 February 1955.

[31] NAN, NAO 59 f. 9/17, NCO to CNC, Ondangwa, 7 August 1953.

[32] NAN, A450, 9, f. 2/38, "Tribal laws and customs of the Ovambos"; NAO 91, f. 36/1 (iii), subfile 6/1/68, ANC to NCO, Oshikango, 29 October 1953; NAO 100 f. 42/11 (iv), Chief Kambonde to NCO, Ondonga, 8 August 1952 and Statement Holongo Amshelelonanda at Ondangwa, 4 July 1952.

[33] Interviews by author: Paulus Nadenga, Oshomukwiyu, 28 April 1993 and Nahandjo Hailonga, Onamahoka, 4 February 1993.

[34] Kreike, "Recreating Eden," ch. 8.


Map 6
Settlement Expansion into Eastern Ovamboland
new Oukwanyama..........District
Oshikango.............Settlement
Unpaved Road
Angolan Border
Border marker
N
W
E
S
0
20
40
Miles
Mupa
Evale
Evale
Lower Kunene
ANGOLA
Ondjiva
Oshiede
old Oukwanyama
Namakunde
Oshikango
Engela
Ohangwena
20
21
22
25
26
29
30
31
Okalongo
Edundja
Omutwewondjaba
Omundaunghilo
Omboloka
Olukula
Omuulu Weembahu
Eenhana
Omhedi
Eastern Oukwanyama
Ehafo
Okongo
Eepale
Eastern Ovamboland
Oupili
new Oukwanyama
Onekwaya West
Eastern Ondonga
Ekoka laKula
Uukwambi
Ondonga
Omulonga River
Oshigambo
Ovamboland
SOUTH WEST AFRICA (NAMIBIA)
Ondangwa

A second reason was the abundance of game resources in eastern Ovamboland. In addition, as the middle floodplain became more and more congested, especially during the 1930s and 1940s, and grazing and arable land became in short supply, the availability of forages and grazing in the east became a third reason that people with large herds of cattle were motivated to move. Quick access to arable land became a fourth motivation to migrate to the east.[35]

The settlers faced enormous challenges in eastern Ovamboland, not least because of the lack of water resources and the wild animals that threatened their lives, their livestock, and their crops. Moreover, the pioneers were isolated from social networks, which hampered the recruitment of new settlers.[36] What the frontier villages had in abundance, however, was game as food, forages for their livestock and especially forest and tree resources.

The eastern frontier leapfrogged along three parallel axes. The northern-most route was the border road/clearing that marked the Angolan-South West African boundary. The Eenhana road was a second axis of advance. The Ondonga-Kurungkuru road that was cleared during the 1920s formed a third route to penetrate the eastern wilderness.[37] The settlement of Omboloka during the late 1930s was a critical juncture in the colonization of eastern Ovamboland. Colonial sponsoring facilitated the digging of wells at Omboloka, which rapidly became a key stepping stone for the establishment of new villages further east.[38]

Tree Castles and Deforestation in the 1920s to 1940s

The pace and the extent of forest clearing in Ovamboland in the 1920s and 1930s astounded some colonial officials and missionaries. When South African officers occupied the territory in 1915, only Ovamboland's southern floodplain had been densely settled, while the middle floodplain up to the border with the Portuguese colony and the vast expanses east of the floodplain appeared to be virgin wilderness.[39] The most massive population movements from the Portuguese-occupied northern

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[35] Kreike, "Recreating Eden," ch. 8.
[36] Kreike, Re-creating Eden, chapter 7. See also NAO 9, f. 5/2, NCO to Sec. SWA, Ondangwa, 6 December 1932 and NAO 19 f. 11/1 (vii), Monthly Report Ovamboland, October 1934.
[37] NAN, NAO 18 f. 11/1 (I), Monthly Reports Ovamboland, June 1926, December 1927, February, March, and May 1928; NAO 10 f. 5/7/1, ANC to NCO, 30 July 1940, "Report on Development Work undertaken in Eastern Ukuanyama during 1940" and O/C NAO to NCO, 15 March 1940; KAB 1 (ii), Submission to Administrator, Secretary and Attorney-General of SWA, 1927; NAO 105, Diaries NCO, Diary 1928, 16 March and 28 August 1928. See also Kreike, Re-creating Eden, chapter 7.
[38] Kreike, Re-creating Eden, chapter 7.

floodplain into the middle floodplain took place during the 1910s and 1920s: refugees and migrants started from scratch and new farms retained a make-shift appearance for years as the inhabitants attempted to eke out a livelihood in the ofuka-wilderness. Moreover, the scale of settlement and the subsequent large demand for construction materials in some areas may have quickly depleted the preferred wood resources, leading to the use of alternatives. The latter was more likely a problem in the southern floodplain, which received a large influx of refugees, especially in Ondonga, where wood resources already had been in more limited supply before 1916. Subsequently, in the 1930s, the South African colonial administration temporarily restricted the further influx of Angolan immigrants, especially into the new colonial Oukwanyama district in the middle floodplain. In the 1940s, the Ondonga king threatened to evict a large number of Angolan "squatters" from his district because of land shortages.[40]

The refugees and migrant who settled the wilderness areas of Ovamboland continued to construct elaborate fortified homesteads that consumed large amounts of woody vegetation. In 1925, an Anglican missionary wrote:

> [t]he kraals are built of poles standing 8 feet high on end, and closely tied together and supported by horizontal poles. Their diameter varies up to 100 yards, and some even larger. This ... is ... of great strength against raiding parties, but very wasteful of wood.[41]

And the District Surgeon for Ovamboland observed in 1937:

> The kraal is a relic of the olden days…and…was always built with a defensive purpose in view. It is more or less circular and averaging from 20 to 120 yards in diameter according to the status of the kraal head. It is generally surrounded by a stockade of poles about 8 to 9 feet high.[42]

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[39] Kreike, Re-creating Eden, chapter 2.
[40] NAN, NAO 19 f. 11/1 (vii), Monthly Report Ovamboland, September 1934; KAB 1 (iii), Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions at The Angola Boundary;" A450 7, f. 2/18, Annual Report Ovamboland 1940; A450, 10, f. 2/40, Draft Annual Report Ovamboland 1942; Kreike, Recreating Eden, chapters 3, 4, and 6. See also NAO 51 f. 3/2 Tribal Affairs Ondonga, Chief Kambonde to NCO, Okaroko June 1948 and Ondangua tribal area: found 20/3/50; NCO to Chief Kambonde, Ondangwa, 29 August 1949; NCO to CNC, Ondangwa, 25 February 1949; [CNC] to Sec. SWANLA Grootfontein, [Windhoek], 16 September 1948; Cope to Sec. SWANLA, n.p., 9 August 1948; Sec. SWA to Administrator SWA, [Windhoek], 3 August 1948; NCO to CNC, Ondangwa, 20 July 1948 and appendix "Foreign natives in Ovamboland: summary: Ondonga tribal area;" Public Service Inspector to Sec. SWA, Windhoek, 30 June 1948; NCO to Recruiting Officer SWANLA, Ondangwa, 10 July 1948; Recruiting Officer SWANLA to Sec. SWANLA, Ondangwa, 22 June 1948; For concerns about water shortages, see ch. 2.
[41] NAN, A450, 9 f. 2/32, Newspaper clipping of an article by Tobias [1925].
[42] NAN, NAO 36, f. 26/8 (ii), Annual Health Report Ovamboland 1937.

Anglican missionaries prophesized that "[the] waste of timber in a matter of 25 to 50 years will extend the thirst belt and affect the rainfall and it is the duty of the Government and missionaries to encourage tree planting."[43] A newly appointed Assistant Native Commissioner for Oshikango in 1931 expressed shock concerning the extent of deforestation in the Oukwanyama district.[44]

While some openly warned about the dangers of environmental degradation, Native Commissioner Hahn denied in public that the threat was serious. In confidential correspondence to his superiors, however, Hahn acknowledged evidence of land degradation but did not believe it to be a priority. Hahn also noted in a 1930s manuscript on agriculture: "[l]and is steadily deteriorating & the time will come when something will have to be done. There is yet time."[45] In response to the Assistant Native Commissioner's 1931 report, Hahn assured his superior in Windhoek that he would limit "wasteful" tree use.[46] In a 1941 report to his superior, Hahn conceded that the construction of homesteads was "responsible for the cutting of many trees, poles, saplings and brushwood, and this cannot be stopped unless the whole system of kraal building is altered." But Hahn advised against the application of the regulations to control timber cutting as issued under the Native Trust and Land Act No. 18 of 1936 in Ovamboland for three reasons. First, he emphasized that the inhabitants of Ovamboland traditionally were allowed to cut trees freely for "domestic uses" and that "[a]ny interference with such a right would definitely, at their present state of development not be understood and lead to discontent and disturbances." Second, he argued that introducing timber fees for cutting wood to construct homesteads as occurred in the Union of South Africa was impossible because Ovamboland's economy was not sufficiently monetized. Third, he emphasized that the situation in Ovamboland differed from that in the Union of South Africa.[47] Indeed, South Africa's conservation regulations were not enforced in Ovamboland. Native Commissioner Hahn was of the opinion that "traditional" Ovambo conservation practices made such regulations superfluous. His successor Eedes considered Ovamboland to be so unique

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[43] NAN, A450, 9 f. 2/32, Newspaper clipping of article by Tobias [1925]; NAO 26 f. 21, Report Ovamboland Cotton Prospects appendix to Alec Crosby to Bishop of Damaraland, St. Mary's Mission, 11 January 1924; NAO 104 f. SWA Commission 1935, W.E. Cawthorne, Priest in Charge Holy Cross Mission Ovamboland, 14 August 1935, to the Chairman, The Constitutional Commission, Windhoek.
[44] NAN, SWAA 3 f. A1/2 (I), O/C Oshikango to NCO, Oshikango, 17 March 1931.
[45] NAN, A450, 10 f. 2/40, "Agriculture."
[46] NAN, SWAA 3, f. A1/2 (I), NCO to SEC. SWA, Ondangwa, 20 April 1931.
[47] NAN, SWAA 3 f. Administration, Forestry: Indigenous Forests Ovambo A1/2 (I), NCO to CNC, Ondangwa, 2 June 1941.

that enforcing the regulations was inappropriate.[48] The only notable tree conservation measure implemented was to require the missions to request permits in order to cut down trees. [49]

Not only did Hahn oppose the introduction of conservation measures to limit the clearing of woody vegetation for the construction of new homesteads, but, he also encouraged the continued or renewed construction of fortified homesteads. In 1934, for example, the Native Commissioner urged Ovambo leaders to construct and maintain larger homesteads:

> [n]atives have been encouraged to build bigger and more substantial kraals. In certain tribal areas it has been found that kraals are becoming smaller and smaller and more dilapidated…. It is in keeping with native order that the chief and headmen live in big and strongly built kraals…It is the big native kraals occupied by wealthy and influential natives which retain tribal order and discipline.[50]

Native Commissioner Hahn blamed Christianity for a decrease in household size and a commensurate decline in homestead size and quality: in Christian monogamous households, he argued, a man could only maintain a part of the former grand homestead because "[e]ventually the poles rot away…and he, being alone, cannot fetch new ones, so he uses corn stalks and bushes and his kraal develops into an eyesore."[51]

The continued construction of palisaded and fenced homesteads, however, was not only a matter of tradition or Hahn's encouragement, it also continued to serve a practical purpose. As refugees from the northern floodplain polities and migrants from the southern floodplain moved into the wilderness, they came into increased contact with wild animals whose numbers were recovering from the late 1800s lows. Confronted with lions and leopards preying on their livestock, elephants raiding crop fields, and colonial officers who were obsessed with protecting large game, and deprived of firearms, heavily palisaded homesteads and elaborately fenced fields continued to provide security.[52]

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[48] NAN, NAO 101 f. 43/7, NCO to CNC, Ondangwa, 17 April 1948 and Social and Economic Planning Advisory Council (van Eck), Report No. 9 (1946) (UG 40 of 1941), pp. 16-28, 50-54.
[49] NAN, BAC 131 f. HN 8/17/4, Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, [Ondangwa?] 28 January 1957 and FMS to Bantu Commissioner Ondangwa, Oniipa, 16 and 27 January, 1957.
[50] NAN, A450, 7, f. 2/18, Annual Report Ovamboland 1935.
[51] NAN, A450, 7, f. 2/18, Annual Report Ovamboland 1937.
[52] Interviews by author: Kanime Hamyela, Omutwewondjaba, 15 June 1993; Timotheus Nakale, Ekoka laKula, 21 February 1993; and Mateus Nangobe Omupanda (Namibia), 24 May 1993; Kreike,

Colonial Fears about Overpopulation and Deforestation in the 1950s

In the 1950s, a new generation of colonial scientists again raised the alarm about overpopulation. The medical officer for Ovamboland in 1953 painted the specter of overpopulation, deforestation and deteriorating health conditions:

> The habitable areas are limited chiefly by the terrain and the water supply. Hence the density of the population is already becoming a problem in some areas. Scarcity of durable and suitable building materials for the construction of kraals, and the overgrazing of areas denuded of trees, will amongst other things interfere with the water supply and multiply the danger of fly and tick borne diseases.[53]

In 1956, the administration's newly appointed Agricultural Officer concluded that the two most populous and largest districts of Ovamboland – Oukwanyama and Ondonga – were overpopulated and in the throes of deforestation. Worst off was the area around Ondangwa, which was already denuded of trees. The most densely settled parts of Uukwambi, Ombalantu, Onkolonkathi and Eunda were "populated to their full capacity. Any further increase of kraals, fields, and livestock will result in overpopulation."[54]

Two years earlier, when the highest South African colonial official for Namibia, the Administrator for South West Africa, visited Ovamboland, he admonished the audience at a "tribal meeting" in Oukwanyama: "You should not cut these beautiful trees. Cut the ugly or dry trees."[55] In 1956, when the colonial administration for the first time addressed all of Ovamboland's chiefs and headmen in a single meeting, the officials advised against clearing new homesteads in wilderness areas because the areas were to become forest reserves: "[c]hiefs and headmen are instructed not to allot sites in wooded areas, but only in strictly residential areas."[56] Forest reserves, where

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"Recreating Eden," chs. 3-4; AVEM, RMG 2515 C/h 31, H. Welsch, Quartalbericht, Omatemba, 30 March 1916 and RMG 2518 C/h 34, Gehlmann, Quartalbericht, Ondjiva, 30 May 1914; NAN, NAO 18 f. 11/1 (I), Monthly Report Ovamboland, March 1925 and Hahn, Notes on Ovamboland, Windhoek, 15 May 1924; NAO 89 f. 35/22, NCO to David Sakeus, Ondangwa, 28 January 1949; NAO 49 f. 1/4, Farewell address Eedes, Ohangwena, 12 June 1954; NAO 19-21 f. 11/1 (iv, x, xii-xiv, xix), Monthly and Quarterly Reports Ovamboland, 1931, 1935, 1937, 1939-1941, 1946; NAO 60-61, f. 12/1 (i-ii), Quarterly Reports Ovamboland, 1947-1949, 1952-1954; NAO 103 f. 51/2(ii), NCO to CNC, Ondangwa, 26 August 1954; NAO 92 f. 36/3(iii), Hota 36/3/165: Statement 16 August 1954.

[53] NAN, NAO 65 f. 21/14 Annual Health Report Ovamboland 1953.

[54] NAN, BAC 133 f. HN 8/21/4/1, Van Niekerk, Travel Report Ovamboland for June 1956 to CNC, Ondangwa, 19 November 1956 and Agricultural Officer to NCO, "Report of travel to the northwestern part of Ovamboland from 20-22 June 1956," Ondangwa, 4 July 1956.

[55] NAN, NAO 64 f. 19/1 (i), Minutes of Ukwanyama Tribal Meeting [12 July 1954].

[56] NAN, BAC 44 f. 1/15/4/17, Minutes of the first general meeting of Chiefs and Headmen of all tribes in Ovamboland, Ondangwa, 22 August 1956; BAC 133 f. HN 8/21/4/1, Agricultural Officer to NCO, "Report of travel to the northwestern part of Ovamboland from 20-22 June 1956" Ondangwa, 4 July 1956 and Agricultural Report Ovamboland 1955/1956.

tree felling was prohibited and only dead wood could be gathered for domestic purposes, however, did not materialize until decades later. Proclaiming the remaining wooded wilderness areas as forest reserves floundered in the face of disputed claims over wilderness areas between various chiefs and headmen, which prevented the delimitation of the borders of the colonial districts.[57]

Ovamboland's colonial chiefs and headmen continued to have an interest in limiting further settlement in the remaining wilderness areas because people in those areas were more difficult to exploit and control. In this respect, their interests coincided with those of the colonial administration, but collided with the interests of subjects who wanted a farm of their own. For example, during a meeting in Ondonga in 1961, when the Bantu Commissioner warned the headmen that trees and forest should be protected against deforestation, Amtenya Shenuka reacted: "regarding new homesteads in the forests. There are many young people without homesteads."[58] The Ondonga King proclaimed at the same meeting that further expansion in western and northern directions would be prohibited to ensure future wood supplies; new homesteads could only be made in the eastern and southern directions where sufficient land was available. An Uukwaluthi headman pointed out that laws existed that prohibited clearing the forest in the border areas between the different colonial districts and complained that "[p]eople move away and they should return to their land in the inhabited area, where spots to make homes are abundant without the need to cut down the forest." The Uukwaluthi king agreed and admonished: "Listen well…. no forests can be eradicated."[59]

Although Ovamboland's kings and headmen supported colonial officials' attempts to conserve <u>ofuka</u>-wilderness forests, they were not on the same page regarding forest conservation policies within the <u>oshilongo</u>. Chiefs and headmen were eager to attract followers by offering farmland in order to expand their income base for labor, taxes and levies (including land fees). They therefore resisted imposing limits on the number of households and farm plots per village. In the 1950s, albeit with some reluctance, even such an otherwise staunch pillar of the colonial

[57] NAN, BAC 133 f. HN 8/21/4/1, Van Niekerk, Travel Report Ovamboland for June 1956 to CNC, Ondangwa, 19 November 1956 and Agricultural Officer to NCO, "Report of travel to the northwestern part of Ovamboland from 20-22 June 1956," Ondangwa, 4 July 1956.
[58] NAN, BAC 131 f. HN 8/17/2, Quarterly Report Meeting held at Outanga, Oundonga [Ondonga], 27 December 1961.

administration as the Oukwanyama senior headman Gabriel Kautwima permitted land clearing in Omhedi's omufitu forest (supposedly a village forest reserve) to accommodate more households.[60]

Moreover, wood within the oshilongo could be used to construct and maintain farms, although felling trees for homestead poles formally was limited to "only the useless and, where possible dead trees....Each application should be referred to the Headman."[61] In 1961, in Uukwambi, growing trees could not be cut down for poles or other purposes.[62]

Traditional Conservation and Scientific Conservation

Although they acknowledged the existence of traditional conservation practices, colonial experts feared that wood use at the village level was not sustainable. As evidence, they pointed to a decrease in the practice of rotating homesteads within the farm plot and replacing its deteriorated palisade poles, arguing that "in the past" the poles had been substituted every two years. In addition, it was reported that homesteads were no longer renewed in some areas, while in areas where trees were scarce or absent, people used grain stalks instead of poles. Agricultural officers predicted that without colonial intervention, people would have to shift to grain stalks and manure as alternative sources of fuel in 10-15 years' time. They emphasized that the use of grain stalks and manure as fuel was already common in the deforested South African Native Reserves of the Ciskei and Transkei. Indeed in 1957, grain stalks were used as a fuel in the treeless parts of Ovamboland. Ovamboland's

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59 NAN, BAC 131 f. HN 8/17/2, Quarterly Report Meeting held at Outanga, Oundonga [Ondonga], 27 December 1961. The same problem occurred in Ongandjera, BAC 44 f. 1/15/4/17, Quarterly Meeting Ongandjera, 28 December 1961.

60 NAN, BAC 44 f. 1/15/4/17, Minutes of the first general meeting of Chiefs and Headmen..., Ondangwa, 22 August 1956; BAC 133 f. HN 8/21/4/1, Agricultural Officer to NCO, "Report of travel to the northwestern part of Ovamboland from 20-22 June 1956," Ondangwa, 4 July 1956, Van Niekerk, Travel Report Ovamboland for June 1956 to CNC, Ondangwa, 19 November 1956, and Agricultural Report Ovamboland 1955/1956; NAO 64 f. 19/1 (i), Minutes of Ukwanyama Tribal Meeting [12 July 1954]; BAC 131 f. HN 8/17/2, Quarterly Report Meeting held at Outanga, Oundonga [Ondonga], 27 December 1961 and HN 8/17/4, Minutes of Quarterly Meeting in Uukwambi, 18 September 1961; BAC 44 f. 1/15/4/17, Quarterly Meeting Ongandjera, 28 December 1961; AHE (BAC) ½ f. (16) N1/1/5/3, Minutes of a meeting at Okalongo, 11 January 1965; Joshua Mutilifa interview by author, 8 March 1993.

61 NAN, BAC 44 f. 1/15/4/17, Minutes of Meetings held at Four Centers in the Ukuanyama Tribal Area, June 7-21, 1957. In 1970, a Ovambo Homeland administration committee recommended that residents should continue to be allowed to cut down trees to construct and maintain farms, NAN, OVJ 15 f. j.12/1, "Minutes of the elected Committee on land ownership and [land]use" Oshakati, 4 December 1970, appendix to Secretary of the Interior to Secretary Justic and Labor, Ondangwa, 9 November 1973.

62 NAN, BAC 131 f. HN 8/17/4, Minutes of Quarterly Meeting in Uukwambi, 18 September 1961.

agricultural officer, however, was optimistic that further degradation could be averted with the introduction of scientific conservation methods: "Ovamboland is very rich in terms of indigenous trees and if the trees are exploited in the right way they can meet fuelwood requirements for many more years." [63]

Enforcing South African tree conservation measures in Ovamboland outside of declared forests proved a major challenge, especially after the area became classified as a Homeland. In 1978, the forester for the Ovambo Homeland complained that there was no legislation to protect its indigenous trees. He suggested issuing a list of protected species that included acacia species, Rhodesian teak (omupapa), Ovambo mahogany (omutaku or Entandrophragma spicatum), (Kalahari) apple leaf (omupanda) and tamboti (omuhongo) in addition to fruit trees. But he proposed to exclude mopane and others because they were used to construct homesteads and tools "and the cutting of such trees as a result can not be managed."[64] After some squabbling between the Department of Plural Relations (formerly Bantu Affairs and before that Native Affairs), which insisted that enforcement responsibilities lay with the traditional authorities, and the Department of Agriculture, the latter pushed through an administrative announcement in 1979 that included a list of species that could not be "cut, damaged, or destroyed" without a permit.[65]

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[63] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Reports Ovamboland 1955/1956 and 1956/1957; BAC 131 f. HN 8/17/4, Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957. On the South African situation, see Social and Economic Planning Advisory Council (van Eck), Report No. 9 (1946) (UG 40 of 1941), p. 16. On the use of grain stalks for construction, see Erkkilä and Siiskonen, Forestry in Namibia, pp. 147, 152 and Erkkilä, "Living on the Land," pp. 40-41.

[64] NAN, OVJ 18 f. 23/20/2, Forester Owambo Government to Secretary, [Ondangwa], 18 August 1978. The non-fruit trees on the proposed list were: Faidherbia albida [old: Acacia albida (omuyele)], Acacia erioloba (omumbonde), Acacia sieberana (omuyele), baobab, Albizia anthelmintica (omupopo), Baikiaea plurijuga (omupapa), Burkea africana (omutundungu), Boscia albitrunca (omunkuuzi/omunghudi), Combretum imberbe (omukuku), Entandrophragma spicatum (omutaku), Lonchocarpus capassa and L. nelsii (both omupanda), Ochna pulchra (omweguuki), Phetophorum africanum (omupalala), Pterocarpus angolensis (omuuwa), Securidaca longipendunculata (omutiwongobe), and Spirotachys africana (omuhongo or tamboetie).

[65] The South African colonial ministries of Bantu Affairs (Plural Relations) and Agriculture were at odds about the autonomy of tribal authorities in regards to tree conservation. The Ministry of Agriculture disputed whether homeland governments had the authority to decide whether or not they would enforce tree conservation regulations, see, NAN, OVA 58 f. 7/7/1-7, Secretary Justice to Secretary Agriculture and Forestry, Ondangwa, 24 October 1978 and to Secretary of Plural Relations and Development Pretoria, Ondangwa, 31 August 1978; Secretary Agriculture and Forestry to Secretary of Justice Ondangwa, Ondangwa, 25 August 1978; Forester Owambo Government to Secretary Agriculture and Forestry , Ondangwa, 18 August 1978; OVJ 18 f. 23/20/2, Forester Owambo Government to Secretary, [Ondangwa], 18 August 1978; Department of Agriculture and Forestry, Administrative Announcement 1979; and Secretary Department of Justice Ondangwa to Secretary Agriculture and Forestry Ondangwa, Ondangwa, 24 October 1978. These rules did have effects on trees in the village commons and even on-farm trees. One interviewee recalled that cutting down a tree both inside or outside one's farm fence required the permission of the village headman, "because there

Missions and the colonial administration itself were also important wood consumers and they competed with villagers for the same species, although they preferred the larger trees that could be cut into timber. A 1931 report by the Assistant Native Commissioner noted that in the preceding decade, four large missions and 100 outstations and schools had been constructed in Oukwanyama alone, consuming at least 2,800 trees. A single 1955 request for seven Finnish Mission stations required cutting down 1,260 mopane, 140 tamboti (omuhongo) and 60 Lowveld cluster leaf (omuhama or Terminalia prunioides) trees.[66] Missions supposedly used dead trees to construct churches and schools, but in reality, dead trees of the preferred species were increasingly scarce in many places by the 1950s. In the Oniipa area, for example, dry tamboti was rare by the late 1950s, although in 1955 it could still be obtained in Uukwambi, and the Finnish Mission Society (FMS) requested permission to cut down green lowveld cluster leaf and mopane.[67] In addition, German missionaries in early 1900s Oukwanyama, for example, urged Christian heads of homesteads to construct more huts so that older boys and girls had separate sleeping quarters in order to improve "morals."[68] Missionaries also encouraged square constructions instead of round ones, thus increasing wood consumption.

In 1957, the administration required 22,000 large and 175,000 small mopane trees in order to fence the Angolan-South West African border and the agricultural officer duly noted that the colonial administration "has a large responsibility in the eradication of trees."[69] Indeed, the 175,000 small mopane trees alone would have been sufficient to construct 175-350 good-sized and well-palisaded homesteads.[70]

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is a rule that no tree can be cut down." The interviewee added that the rule pertained only to trees that shoot their leaves early, including jackalberry, omupapa, omutundungu, marula, birdplum, and palm (all trees that were on the conservation "treelist") but that male trees were excepted and could be cut down. The latter is an illustration of how these regulations were actually manipulated at the village level. See Joseph Nghudika, interview by author, Onamahoka, 3 February 1993.

[66] NAN, SWAA 3 f.A 1/2 (I), O/C Oshikango to NCO, Oshikango, 17 March 1931; BAC 131 f. HN 8/17/4, Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957 and FMS to Bantu Commissioner Ondangwa, Oniipa, 16 January 1957. See also Sec. SWA to Administrator SWA, [Windhoek], 27 March 1955 and Superintendent FMS to NCO, Oniipa, 27 January 1957.

[67] NAN, BAC 131 f. HN 8/17/4 (1955-1963), Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango [Ondangwa?] 28 January 1957.

[68] AVEM, RMG 2518 C/h 34, A. Hochstrate, Quartalbericht 1 January-31 March 1913, Ondjiva, 1 April 1913.

[69] NAN, BAC 131 f. HN 8/17/4, Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957. Regarding the Finnish Mission, see ibid, FMS to Bantu Commissioner Ondangwa, Oniipa, 16 and 27 January, 1957.

[70] See below.

Population Growth in Ovamboland

How "real" were the mid-1950s colonial fears about overpopulation? Population figures supplied by the Ovamboland administration must be used with care. Before the 1960s, the administration of Ovamboland conducted an actual population count on only three occasions: in 1933, in 1938, and in 1951. All other figures in Ovamboland's reports until the mid-1950s were based on these three censii. In the annual reports, officials either simply repeated the numbers from the last report, or they added a percentage to the figures each year based on the assumption that the population was growing at a certain rate.[71] According to colonial figures, the population nearly doubled from 107,861 to 200,253 people between 1933 and 1951, and subsequently tripled to 618,669 individuals between 1951 and 1991.[72] Interestingly, the figures suggest a relative decline in population growth after 1951: had the population increased at the same rate between 1951 and 1991 (a 40 year period) as it had in the less than two decades leading up to 1951, the population in 1991 would have been 800,000 people.

Although fertility figures (the number of live-born children per woman) are rare, data for the Oukwanyama district for the 1930s provide some clues to understanding the area's population dynamics. The 1938 census recorded 4,600 infants (defined in the census as children of 2 years of age and under), suggesting that on average approximately 2,300 children were born in 1936 and 1937. The population

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[71] For the 1933 census, see NAO 24 f. 15/2 (ii), 1933 Census; NAO 19 f. 11/1 (vi), NCO to Sec. SWA, Ondangwa, 15 February 1934; and NAO 23 f. 15/2, NCO to Sec. [SWA], "Population Census 1946," Windhoek, 8 March 1946. The 1938 population figures were based on an actual census although, for example, the census was never completed in Ondonga, NAN, NAO 20 f. 11/1 (vii), Annual report Ovamboland 1938 and NAO 24 f. 15/2 (iv), 1938 Census. The 1951 population figures for Ovamboland were also based on an actual count, NAO 61 f. 12/2 (I), Annual Report Ovamboland 1951. See also the back of a document that contains receipts for census enumerators in 1950, NAO 101 f. 43/1, loose notes on back of NC Windhoek to NCO, 6 February 1952, "Census Duties, Ondonga Tribal Area, NCO, October-November 1960, receipts enumerators. All other figures presented in reports were based on these censii. For example, the population figures in the 1942 annual report for Ovamboland were based on the 1933 census for Ondonga and Uukwaluthi districts and on the 1938 census for the remainder of the districts, A450 vol. 7 f. 2/18, Annual Report Ovamboland 1942. In 1946, the Native Commissioner explained the difficulties of conducting an actual census in Ovamboland and eventually submitted estimates for the population of Ovamboland on the census sheets, NAO 23 f. 15/2, NCO to Sec. [SWA], "Population Census 1946," Windhoek, 8 March 1946 and Final Return Census 1946, Province of South West Africa, Ovamboland, 15 May 1946. In 1948 Native Commissioner Eedes simply reproduced the figures supplied in the previous annual report, NAO 61 f. 12/2 (I), Annual Report Ovamboland 1948. For the "updating" of population estimates, see, for example, NAO 61 f. 12/2 (I), Annual Report Ovamboland 1950.

[72] NAN, NAO 24 f. 15/2 (ii), 1933 Census; NAO 24 f. 15/2 (iv), 1938 Census; NAO 61 f. 12/2 (I), Annual Report Ovamboland 1951; Republic of Namibia, 1991 Population and Housing Census (Windhoek, 1993). In 1938, the populations of the Ondonga and Uukwaluthi districts were not counted; the 1933 numbers were used instead.

of Oukwanyama increased by 11,000 persons between 1933 and 1938, and 2,300 births per year would account for the increase, although these figures do not reflect mortality. Infant mortality was high, and actual natural increase was much lower than the above figures at first glance seem to suggest. The 1934 figures for Oukwanyama, for example, recorded 663 births, 245 infant deaths and 295 other deaths. Natural increase of the population thus was only 123 people, i.e. 0.3 percent based on the population figures for 1933.[73] In 1933/1934, Ovamboland was still in the aftermath of a severe drought, which must have depressed the number of births and increased mortality, so the figure may be on the low side. It nevertheless suggests that the population increase of 11,000 people in Oukwanyama district between 1933 and 1938 was principally due to immigration rather than to natural increase. Figures for Ombalantu, Ongandjera, and Onkolonkathi also suggest that in-migration may have been an important source of population growth between 1933 and 1938. No comparable figures are available for Ondonga, but even if Oukwanyama was the only colonial district where migration determined population dynamics, its overall impact was critical: in 1933, the district accounted for nearly 40 percent of the total population of Ovamboland.[74]

Figures from the 1991 census suggest that natural population increase was significant in the 1940s and 1950s. Only eight percent of the survivors born between 1947 and 1976 were foreign born, a percentage that is lower than that for the older age groups.[75] Ovamboland had a young population in 1991: over one third of the population had been born after 1976 and the survivors from the 15-24 age class were twice as numerous as survivors from the 25-34 age class.[76] The data from the 1991 Namibian census also indicate that the fertility of women born between 1932 and 1946 was notably higher than that of the older age groups. In turn, the average number of live-born children for women born between 1927 and 1931 – although lower than the 1932-1946 age group – was substantially higher than that of the 65+ group that had been born in 1926 or earlier. The women with the higher number of live-born children are likely to have begun to give birth in the late 1940s and early

[73] NAN, NAO 23 f. 15/2 (I), O/C Oshikango to NCO, 30 March 1938 and NAO 24 f. 15/2 (iii), O/C Oshikango to NCO, Oshikango, 14 May 1935.

[74] For the census figures, see NAO 23, f. 15/2, Ovamboland Census 1933 and NAO 24 f. 15/2 (iv), 1938 Census. For the 1936 data on births and mortality, see NAO 23 f. 15/2, Mateus Angolo [Ongandjera] to Songola [Native Commissioner Hahn], 28 December 1936 and Festus Hango [to Hahn], n.d.

[75] Namibia, 1991 Census, Report A, Statistical Tables, vol. i, table A03.

1950s and they subsequently would have produced a baby boom until well into the 1960s.[77]

Population Pressure and Woody Vegetation Consumption

An analysis of population census data alongside information about the amounts of wood required to build a homestead allows for estimates of the required wood consumption for construction. In 1935, for example, a full-size Ovambo "kraal" was constructed at the Windhoek show grounds. The kraal required 5,000 poles that were eight-nine feet (2.40-2.70 meters) long with a diameter of three-eight inches (7.5-20 cm). In addition, 250 tamboti (omuhongo) poles were used for the outer palisade. The construction also consumed mopane twigs for 20 hut frames, 10 sacks of mopane bark and palm leaf to tie the poles together, 126 bundles of thatching grass, and 20 bundles of millet stalks.[78]

The kraal built for the Windhoek show was very likely modeled after a kraal for a major headman and was thus likely to have been significantly larger than the average kraal. Alternative figures that can be used to estimate wood consumption to construct homesteads are available in data from the 1960s.[79] Of a group of households that applied for compensation after being evicted from their land in 1967, seven had a palisade made of grain stalks. The stalk palisade for four of the homesteads was 50 meters long, one had a 100-meter long stockade, and two had stockades that were 150 meters long. The remaining 42 homesteads had palisades made of poles or branches. In this group, the stockade in nine of the homesteads was between 25-50 meters (75-150 feet) long, 12 had a palisade measuring between 51 to

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[76] Namibia, 1991 Census, Report A, Statistical Tables, vol. i, table A03.
[77] Namibia, 1991 Census, Report A, Statistical Tables, vol. iv, table F01. The increase in the averages of the total number of children born alive per age group as derived from the table is clearly discernible in the figures for Enumeration Areas Oshakati and Ondangwa (that cover Ovamboland). The average for the 65+ group in Oshakati, 6.17, increased to 6.4 for the 60-64 group (born between 1927 and 1931) and rose to 6.7 for the 50-59 and 50-54 group, and 6.53 for the 45-49 group. The average percentage for the Ondangwa area for the 65+ group was 5.98, 6.5 for the 60-64 age group and approximately 7 for the age groups 55-59, 50-54, and 45-49.
[78] NAN, NAO 27 f. 21/2 NCO to Sec. SWA, Ondangwa, 26 January 1935. The homestead constructed for the show was not of average size; the number of huts indicates that it was for a headman. The show homestead contained 20 huts whereas the hut of a headman at Ogongo, for example, contained 19 huts, AHE (BAC) 1/346 f. (15) N8/19/4/4 (I), Bantu Affairs Commissioner to Chief Bantu Commissioner, Ondangwa, 30 December 1965 and Chief Bantu Commissioner SWA to Secretary Bantu Administration and Development, Windhoek, 11 January 1966. A 1955 report estimated each homestead required "thousands" of trees, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956.
[79] Native Commissioner Hahn used Senior Headman Nehemiah Shovaleka's homestead at Omhedi in Oukwanyama as a showcase.

100 meters (150-300 feet), and 14 had palisades of between 101 and 250 meters (300-750 feet) in length (see Table 5.1).[80]

Table 5.1 Estimates of Wood use to Construct a Homestead and Palisade[81]

Description	*Location*	*Year*	*Wood required*	*Source*
Average homestead plus palisade and fence	Ovambo	1891	600 (poles and saplings)	Schintz in Erkkilä and Siiskonen
Homestead plus palisade	Windhoek show grounds	1935	5,250 (poles)	NAN
Palisades of 49 removed homesteads		1967	250-1,000 (poles) each	NAN
Homestead and palisade and fences (based on measurements in 6 homesteads)		1996	55 cubic meters of wood (approximately 865-2720 poles per homestead for the palisade alone)	Erkkilä

Using the 100 meters (300 feet) palisade as the average, the construction of the 18,386 homesteads found in Ovamboland in 1933 would have required 18,386,000 poles. Of course, all the palisades of the 18,386 homesteads were not constructed at once. Most of the homesteads in Ovamboland's Oukwanyama district, for example, were non-existent before 1915. Except for a dozen villages, the pre-colonial kingdom of Oukwanyama had been located north of the modern Angolan-Namibian border. In 1933, Ovamboland's Oukwanyama district boasted 6,689 homesteads. If approximately 6,000 homesteads were constructed between the years 1915 and 1933, i.e. in 17 years, based on an average 100 meter palisade consisting of 1,000 poles, the total number of stems cut would have been 6,000,000 or an average of approximately 353,000 stems per year. These figures do not include wood consumption for constructing the hut frames or the hut walls, or the fence frames or the fence materials themselves. Nor do these figures include wood consumption for firewood and wood to craft tools and other artifacts.

In 1991, census enumerators counted a total of 554,208 inhabitants living in 100,043 households in Ovamboland, with 90,918 "traditional" homesteads.[82] If it is presumed that homesteads continued to be constructed in the same way as in the 1930s and 1960s (the 1991 census did not provide any information about palisades), estimates of wood consumption would require more than quadrupling the 1933-based numbers.

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[80] NAN, OVA 53 f. 6/18/2-7 (iii), Sec. SWA to Sec. Agriculture Owambo, Windhoek, 24 June 1974, Appendices A-C.

[81] NAN, OVA 53 f. 6/18/2-7 (iii), Sec. SWA to Sec. Agriculture Owambo, Windhoek, 24 June 1974, Appendices A-C. Erkkilä, "Living on the Land," pp. 85-90. See also Erkkilä and Siiskonen, Forestry in Namibia, pp. 152-154.

[82] Namibia, 1991 Census, Report A, Statistical Tables, vol. v, table H01.

The initial construction of the 90,000 homesteads counted in 1991, requiring 1,000 poles each, thus required 90 million poles.[83] Wood continued to be the main source of construction materials in the early 1990s. Amongst the 313 households in the OMITI survey that had a palisaded enclosure, two out of every three households used wooden poles to build huts. Woody vegetation was an important source of fencing materials for 40 percent of the households.[84]

Woody Vegetation Resources by the Close of the 20th Century

Poles and firewood were scarce in Ombalantu by the early 1970s. By the early 1990s, the same applied to much of the central floodplain in the peri-urban area around Ondangwa and Oshakati. Households in villages close to the border had access to abundant wood resources in Angola's northern floodplain. In villages further south and closer to Ondangwa and Oshakati, including, for example, Oshomokwiyu, Omupanda, and Eko, however, firewood was in such short supply that people dug out and used old tree stumps and tree roots. In Oshomokwiyu, the only non-fruit trees left in the landscape consisted of sparse heavily coppiced mopane stumps and some mopane bush.[85] While a bundle of firewood from Angola fetched two Rand in border villages in 1993, it fetched five Rand in the Namibian border town of Oshikango; a bundle of firewood was sufficient to meet a household's cooking fuel requirements for two or three days.[86] By the early 1990s, mopane, tamboti (omuhongo), silver cluster leaf (omwoolo), lavender feverberry (omubango or Croton gratissimus), African wattle (omupalala or Peltophorum africanum), red bushwillow (omunaluko/onaluko or Combretum apiculatum), wild pear (omuwe or Ochna pulchra), and wild seringa (omutundungu or Burkea africana) were used as firewood.[87] Southwest of Oshakati, one of Ovamboland's two largest towns, the only trees were fruit trees and people used palm fronds and dried dung as fuel.[88]

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[83] Namibia, 1991 Census, Report A, Statistical Tables, vol. v, tables H01 and H02.
[84] OMITI 4.3.1, 4.3.11, and 4.3.6.
[85] NAN, OVA 57 f. 7/2-7, Dr. H.A. Lueckhoff, "Report on a visit to South West Africa, November 3-15, 1969," appendix Regional Forester to Director-in-Chief Department of Bantu Administration and Development Pretoria, Grootfontein, 3 April 1970 and interviews with author: Paulus Nandenga, Oshomukwiyu, 28 April 1993; Kulaumoni Haifeke, Oshomukwiyu, 11 May 1993; Lea Paulus, Onandjaba, 17 June 1993; Johannes Abraham, Odibo, 20 May 1993; Personal observations by the author, Oshomukwiyu, 27 April and Eko, 25 May 1993.
[86] Johannes Abraham, informal interview by the author, Odibo, 20 May 1993.
[87] Johannes Abraham, informal interview by the author, Odibo, 20 May 1993.
[88] Personal Communication Joseph Hailwa, District Forester, 24 March 1992 and Namibian Institute for Social and Economic Research (NISER), Namibian Energy Assessment: Household Energy

Despite an undeniable shortage of wood resources in parts of Ovamboland, the dire predictions that Ovamboland would degenerate into a desert had not materialized by the close of the 20th century.[89] Why? First, such predictions were often overdrawn. Dr. Lueckhoff's warning that Ovamboland was transforming into an inhospitable desert, for example, was based on a tour through Ovamboland in late 1969 - during the height of the dry season! He pointed to "treeless plains" northeast of Oponono Lake as evidence and considered its sparse trees as relic vegetation of a previously more abundant tree cover. Yet, earlier descriptions of the area depict it as grass plains with little woody vegetation.[90] Colonial officials also presumed that "Africans" had a negative attitude towards trees and they explicitly attempted to re-educate African subjects on the value of trees, for example, in 1972, when the administration embraced reforestation under the South African "Our Green Heritage" environmental awareness campaign.[91]

Second, woody vegetation became less exclusively a source of construction materials (and protection). The fate of the baobab may in fact suggest a trend for other woody species that served "protective" functions. Although the baobab castle represented the starkest example of the critical safety functions of woody vegetation early in the 20th century, by the end of the same century, its use as a stronghold was a mere memory. The importance of woody vegetation as an almost exclusive source for

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Consumption, Distribution and Supply Survey of the Owambo Region of Northern Namibia and Katatura, Windhoek. Windhoek: University of Namibia, 1992. Erkkilä concluded that woody biomass consumption for Ovamboland as a whole was sustainable, see Erkkilä, "Living on the Land," p. 100, table 12.

[89] See the above. Cf. NAN, WAT ww17 (ii), S. Davis, "Tour of Northern Territories-Some Random Comments and Thoughts," for example warned that Ovamboland could become denuded of trees. A 1970 report concluded that soil erosion in the densely settled areas of Ovamboland was "shocking" and warned that without appropriate action, large areas would become desert, OVA 57 f. 7/2-7, Dr. H.A. Lueckhoff, "Report on a visit to South West Africa, November 3-15, 1969," appendix Regional Forester to Director-in-Chief Department of Bantu Administration and Development Pretoria, Grootfontein, 3 April 1970. In contrast ,another 1970 report concluded that deforestation was not an urgent problem but that measures were required in the long term to prevent a shortage of firewood, OVA 49 f. L6/8/4/1 (I), Meeting of the Sub-Committee on Village Planning and Development and Agricultural Planning of the Planning and Coordinating Committee on 2 September 1970. In the early 1970s, extension officers in Oukwanyama included warnings against cutting down trees because of the danger of desertification in their extension messages, see, for example, OVA 61, Monthly Reports Agricultural Officer: Moses Nandjebo [Ohangwena] (Oukwanyma), 1973-1975. Interviewees often emphasized the present-day lack of trees for construction and fuel, see, for example, Kulaumoni Haifeke, interview by author, Oshomukwiyu, 11 May 1993.

[90] NAN, OVA 57 f. 7/2-7, Dr. H.A. Lueckhoff, "Report on a visit to South West Africa, November 3-15, 1969," appendix Regional Forester to Director-in-Chief Department of Bantu Administration and Development Pretoria, Grootfontein, 3 April 1970.

[91] NAN, OVA 57 f.7/6/1-7, Director of Agriculture Ovamboland to Secretary Bantu Administration Pretoria, [Ondangwa], 11 October 1972 and Secretary Bantu Administration to Director of Agriculture Ovamboland Government, Pretoria, 6 November 1972.

construction materials and tools had been declining since the 1950s, when wood began to be replaced by alternative materials. Of the surveyed households that retained a palisade in 1993, in 13% of the cases (or, 50 out of 313) the materials were of non-wood origins.[92] Almost ten percent of the households used millet stalks and seven percent used bricks, palm fronds, or wire.[93]

The situation is different, however, for other building materials. Clay bricks and bricks made from a mixture of clay and cement are increasingly common in even the most remote rural areas of north central Namibia. In 1966, of the 48 homesteads that were razed to make room for Ogongo Agricultural College, 10% contained brick buildings.[94] In 1967, 231 households received compensation for losses in connection with widening the Ruacana-Ondangwa and Oshivelo-Ondangwa-Oshikango roads. The homesteads of almost half (110) of the households contained one or more brick constructions and 24 (10%) had used corrugated iron as a construction material, mainly for the roofs.[95] In 1993, wood was still a critical material, and two out of every three OMITI survey households had at least one hut made with a wall of wooden poles. But two out of every three households also had at least one additional hut made with brick walls. The brick walls consisted predominantly of mud bricks; only one out of every ten households had one or more cement brick huts. Wood and mud walled huts were mentioned by one of every three respondents in the 1993 OMITI survey, and corrugated iron by one of every six.[96] Indeed, late in the 1993 rainy season, in the villages of Eko and Omupanda, where construction wood was in very short supply, boys could be observed making bricks during the school holidays, typically using earth taken from termite mounds, but also using cement.[97] When the homestead is relocated to another site within the farm plot, the mud bricks quickly break down,

[92] OMITI 4.3.1.
[93] OMITI 4.3.1.
[94] NAN, AHE (BAC) 1/346 f. (15) N8/19/4/4 (I), Bantu Affairs Commissioner to Chief Bantu Commissioner, Ondangwa, 30 December 1965 and Chief Bantu Commissioner SWA to Secretary Bantu Administration and Development, Windhoek, 11 January 1966. On bricks, see also WAT ww17 (ii), S. Davis, "Tour of Northern Territories-Some Random Comments and Thoughts" and Kaulikalelwa Oshitina Muhonghwo, Ondaanya, 2 February 1993.
[95] NAN, OVA 53 f. 6/18/2-7 (iii), Sec. SWA to Sec. Agriculture Owambo, Windhoek, 24 June 1974, Appendices A-C.
[96] OMITI 4.3.11. The 1991 census underrepresented the use of non-wood construction materials for huts. The census identifies 598 homesteads in the category "Kraal/Hut" with cement block constructions but it has no category for clay brick constructs. See Republic of Namibia, 1991 Population and Housing Census, Report A, Statistical Tables, vol. v, table H04. Erkkilä and Siiskonen assert that only minor changes in construction have occurred in the 20th century, see Erkkilä and Siiskonen, Forestry in Namibia, pp. 150, 153.
[97] Author's personal observations, Eko, 25 May 1993.

further enhancing the quality of the soil at the site of the former building. The shortage of construction material was especially obvious in the Ondangwa-Oshakati area, which was sparsely forested earlier in the 20th century. In 1993, millet and sorghum stalks were a common construction material for huts (mentioned by 4% of the OMITI sample) and for palisades.[98]

Based on his research in the western part of eastern Ovamboland, just beyond the floodplain in the old district of Oukwanyama, Erkkilä concluded that, contrary to conventional wisdom, wood consumption in Ovamboland was sustainable. He estimated that each household in Ovamboland used 55 cubic meters of wood, including 25 cubic meters for the outer pallisade, 10 cubic meters for the inner palisade, 10 cubic meters for the farm fences, 5 cubic meters for the huts, and 5 cubic meter for the livestock fences. Allowing for wood wastage (including de-barking) Erkkilä set total wood consumption per household at 65 cubic meters, amounting to 45 tons (oven-dried). Wood consumption for Ovamboland as a whole came to 600,000 tons but he assumed a total woody biomass of 33,481,000 tons and an annual increment of 819,000 tons. He acknowledged that wood production in central Ovamboland fell short of consumption, but the shortfall was compensated for by production in other regions.[99]

Conclusion

Despite dire predictions, north central Namibia has not degenerated into a desert. Although wood was in short supply in the central areas in the late 20th century, environmental change in north central Namibia cannot be reduced to a unilinear, progressive, and irreversible process of deforestation based on the hypothesis of population explosion. In fact, one recent study argues that current levels of wood use are sustainable for Ovamboland as a whole.

In addition, framing environmental change as an irreversible progression from a state of (more) Nature to a state of Culture obscures dramatic environmental changes that occurred between the late 1800s and the late 1900s. During the 1800s to the early 1900s, Ovamboland actually experienced a net gain of “Nature” at the

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[98] On the use of millet stalks, see OMITI 4.3.11. Millet stalks are not included as a category of building materials in the 1991 census. See Namibia, 1991 Census, Report A, Statistical Tables, vol. v, table H04.

expense of Haudanu's middle floodplain kingdom and other vestiges of "Culture." During the 1920s through the 1950s, the reverse was generally true, except in the western part of the northern floodplain (in Angola), where "Nature" gained terrain as abandoned village environments (including the southern districts of the Ombadjas) turned into bush land. Thus, in less than two centuries the Ovambo floodplain experienced several Palenque-esque environmental transformations.

The chapter highlights the critical role of population movements and their impact on the making and unmaking of human-settled areas (oshilongo) and uninhabited "forest," "bush," or "wilderness" areas (ofuka). Colonial violence and the demarcation of colonial boundaries led to massive flight from the Portuguese occupied northern floodplain oshilongo into the South African occupied middle floodplain, an area that was largely ofuka. The subsequent settlement of the middle floodplain wilderness by the refugees from the northern floodplain and the settlement of the wilderness zones that had separated the pre-colonial polities from one another by refugees from the northern floodplain and migrants from the old southern floodplain oshilongo heartlands dramatically changed Ovamboland's environment.

The chapter suggests that the impact of population density on the forest environment is ambiguous and that population should not be regarded merely as a quantitative and biological factor, but rather as a qualitative factor that impacts on forest resources through social and political processes. Until the 1940s, the "population" factor in Ovamboland exerted its most important influence through migrations and flight, and not through the mechanics of any "population bomb." Even after the 1940s, where and how people impacted on local natural resources was as important as how many people affected the environment of Ovamboland. Moreover, throughout the period of study, security and insecurity concerns contributed critically to how much woody vegetation was consumed and why.

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[99] Erkkilä, "Living on the Land," pp. 51, 100, table 12. Cf. Erkkilä and Siiskonen, Forestry in Namibia, p. 154. While Erkkilä and Siiskonen estimate wood use per household at 50-70 cubic meters, Kessy estimates that a three-bedroom home used 2.4 cubic meters of wood, Kessy, Conservation, p. 109.

CHAPTER 6
THE CATTLE COMPLEX:
CULTURE, COMMERCE AND DEFORESTATION

> Despite the limited potential within Owambo [Ovamboland] the natural resources are being used at a fraction of their potential and much of this involves the misuse and deterioration of natural grazing. Livestock production practices are primitive because of a lack of knowledge and training and the absence of an acceptable market, thus minimising the annual offtake…[I]n the absence of any acceptable market outlets it is not possible to persuade cattle owners to adopt accepted commercial practices of animal husbandry.[1]

The above quote from an influential late 1980s colonial report emphasizes the role of human agency in environmental degradation. Human mismanagement of the environment is a core premise of both the modernization and declinist paradigms. But whereas the declinist view is that modernity engenders destructive environmental behavior, the modernization paradigm identifies tradition as the culprit. A focus on human management of domestic animals serves to highlight some of the tensions in the analysis of environmental change offered by the modernization, declinist, and inclinist paradigms.[2] For example, available data does not reveal the consistent increase of livestock that would be necessary to support a thesis of a livestock "population bomb." Rather, in the context of other data, the figures suggest that the region's livestock population was subject to radical fluctuations, with overall numbers declining in the 1980s, a situation that defies linear models of environmental change. Contradictions and ambiguities in the data, however, can be eased if the history of animal use and management in the region is disaggregated to the levels of individual villages and households.

This chapter analyzes how colonial policies relative to wildlife, forest conservation, and animal health transformed cattle from the region's prime export commodity into a source of subsistence that colonial officials and experts considered to be irrationally managed and an environmental threat. The chapter first discusses the relevance of the cattle complex concept for understanding the environmental history of Ovamboland. It highlights how colonial officials constructed domestic animals as

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[1] [Keith Morrow], "A Framework for the Long Term Development of Agriculture within Owambo," August 1989. See also Erkkilä and Siiskonen, Forestry in Namibia, pp. 50, 218, 228.

[2] For an emphasis on management see P. Blaikie and H. Brookfield, Land Degradation and Society (London & New York: Methuen, 1987), pp. 3, 27-48, chapters 6, 7 and 8, pp. 100-121, 112-142, and 143-156 respectively. See also Gibson, McKean, and Ostrom, People and Forests, especially the chapters by E. Ostrom (pp. 1-26), M.A. McKean (pp. 27-55), A. Agrawal (pp. 57-85), C.C. Gibson and

an environmental threat and concludes with an assessment of the interaction between domestic animals and woody vegetation.

The Cattle Complex

Prominent in explanations of overstocking in Africa is the idea that cattle are not considered to be primarily economic assets or commercial articles that can be readily bought and sold, but are seen as cultural objects, for example as signs of wealth, status, prestige, or piety. Herskovits coined the expression "cattle complex" to describe this phenomenon.[3] As it relates to environmental degradation, the cattle complex argument explains that because of the animals' high cultural value, the management objective is to maximize the number of cattle by minimizing the consumption and sale of cattle, resulting in the equivalent of a cattle population explosion that leads to overgrazing, deforestation, and desertification. The argument suggests that if livestock managers were to behave "rationally" and respond to market opportunities, the overstocking-degradation cycle would be broken.[4] Yet, whereas tradition is considered the root of overstocking in Africa (the "cattle complex") because it precludes rational livestock management and sale, in Latin America, it is precisely the commercialization of cattle that is held responsible for severe environmental degradation. The theory – popularly referred to as "the Hamburger Connection" – argues that in order to meet the (international) demand for cheap beef, cattle ranchers in Latin America encourage landless peasants to clear forest lands to create new cattle pastures.[5] In fact, in general, the commercialization of natural

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C.D. Becker (pp. 135-161), and G. Varughese (pp. 193-226); Mazzucato and Niemeijer, Rethinking Soil and Water Conservation, pp. 124-164.

[3] M.J. Herskovits, "The Cattle Complex in East Africa" (D.Phil. Thesis, Columbia University, n.d).

[4] See I. Scoones, "Range Management Science & Policy: Politics, Polemics & Pasture in Southern Africa," and W. Beinart, "Soil Erosion, Animals, and Pasture over the Longer term: Environmental Destruction in Southern Africa," Leach and Mearns, The Lie of the Land, pp. 34-53 and 54-72 respectively. See also D.M. Swift, M.B. Conghenour, and M. Atsedu, "Arid and Semi-Arid Ecosystems," T.R. McClanahan and T.P. Young, eds., East African Ecosystems and their Conservation (New York and Oxford: Oxford University Press, 1996), pp. 243-272, especially pp. 261-269. On livestock "overpopulation," see Le Houérou, The Grazing Land Ecosystems of the African Sahel, pp. 90-128 and F.H. Beinroth, "Land Resources for Forage in the Tropics," A. Sotomayor-Ríos and W.D. Pitman, eds., Tropical Forest Plants: Development and Use (Boca Raton, etc.: CRC Press, 2001), pp. 3-15, especially 13. For India, see D.N. Jha, The Myth of the Holy Cow (London: Verso, 2002; first published New Delphi: CB, 2001).

[5] Jepma, Tropical Deforestation, pp. 104-105; Westoby, Introduction to World Forestry, p. 111; S.C. Slonich and B.R. DeWalt, "The Political Ecology of Deforestation in Honduras," Sponsel, Headland, and Baily, Tropical Deforestation, pp. 187-215; M.P. Lehman, "Deforestation and Changing Land Use Patterns in Costa Rica," Steen and Tucker Changing Tropical Forest, pp. 58-76. See also S. Hecht, "Land Speculation and Pasture-Led Deforestation in Brazil," Colchester and Lohmann, The Struggle for Land, pp. 164-178.

resources and human-environment relations is overwhelmingly seen as a major cause for environmental degradation in declinist analysis, whereas the combination of tradition as a cause of degradation and commercialization as a solution is more grounded in the modernization paradigm.[6] Ironically, in Ovamboland, animal resources – and this was more true for cattle than for almost any other animal except the elephant – were more highly commercialized before the imposition of South African colonial rule in 1915 than they were afterwards. At the very least, this suggests that in Ovamboland, as was the case in Lesotho and western Kenya, the cattle complex was not an ancient inheritance, but rather a very recent (re)invention of tradition.[7]

In the context of the Ovamboland case study the explanatory powers of the overstocking hypothesis are diffuse. Similar to the population pressure model, time series of domestic animal population figures are largely estimates and do not permit the identification of clear, unilinear trends.[8] Assessing the impact of domestic animals on the environment is difficult: for example, the scientific concept of carrying capacity – the number of animals an environment can sustain without structural degradation – is highly contested.[9] An increase in the ratio of unpalatable species in grazing, either poisonous plants or woody plants (the latter is referred to in southern Africa as bush encroachment) was and is frequently used as an indicator of

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[6] The commercialization model explanation is especially dominant in and characteristic of US environmental history see, for example Cronon, Changes in the Land pp. 97-98 and White, The Middle Ground, pp. 94-139.

[7] J. Ferguson, The Anti-Politics Machine: "Development," Depolitization, and Bureaucratic Power in Lesotho (Minneapolis and London, 1994) and D.W. Cohen and E.S. Atieno Odhiambo, Siaya: The Historical Anthropology of an African Landscape (London, etc. 1989), p. 76.

[8] Le Houérou uses the 1950 and 1983 livestock statistics for the Sahel countries to demonstrate that the numbers more than doubled. Where he adds figures for 1968 and 1973, the trends become less linear, showing, for example, that Burkina Faso's cattle population dropped dramatically between 1968 and 1973 and that the 1983 figures have not very dramatically surpassed the 1968 level. What is obvious from these statistics is that concentrating on the numbers for 1950 and 1983 alone suggests steady linear growth. Including the 1968 and 1973 figures, however, shows that cattle numbers experienced dramatic increases and declines between 1950 and 1983. See Le Houérou, The Grazing Land Ecosystems of the African Sahel, pp. 124-126, tables 24-28. For small stock specifically, Beinart found that during the early 1970s until the late 1980s, small stock numbers on the whole were lower than at any time since the first decade of the century and the numbers were relatively stable, see Beinart, "Soil Erosion, Animals, and Pasture," Leach and Mearns, The Lie of the Land, p. 66.

[9] For critical assessments of the concept of carrying capacity, see S. Stanford, Management of Pastoral Development in the Third World (Chichester etc., 1983), pp. 104-105; I. Scoones, "Range Management Science & Policy: Politics, Polemics & Pasture in Southern Africa," and Beinart, "Soil Erosion, Animals, and Pasture," Leach and Mearns, The Lie of the Land, pp. 34-53 and 54-72 respectively; P.D. Little, "Rethinking Interdisciplinary Paradigms and the Political Ecology of Pastoralism in East Africa," and W.A. Munro, "Ecological 'Crisis' and Resource Management Policy in Zimbabwe's Communal Lands," Bassett and Crummey, African Savannas, pp. 161-177 (especially 163-164) and pp.

environmental degradation.[10] Poisonous plants, however, are often a "natural part of high condition range communities." They cannot be defined as "bad" or interpreted as an indication of degradation simply because they happen to be poisonous to livestock.[11] Moreover, some "poisonous" plants are at the same time important dry season sources of nutrients, including sorghum, oak, and the one-time agroforestry "miracle tree," Leucaena leucocephala. While oak and Leucaena leucocephala are poisonous when they form the bulk of livestock diets, careful livestock management can prevent overfeeding on these plants.[12]

In addition, bush encroachment or an increase in "undesirable" woody plants can also be construed as a first phase in plant succession in a climax vegetation model, and, in general, as reforestation or afforestation, that is, environmental improvement.[13] Again, oak offers an intriguing example because of the contradictions that it exposes. In Europe and North America, the oak was and is venerated as a cultural and natural symbol. It was highly valued as a timber tree, and it was important forage for livestock (it served as a source of pig feed in the past and as small stock forage in the Mediterranean basin today) and wildlife (in the US). Yet it is also a grasslands invader, even though studies that acknowledge this characteristic do not refer to the oak as a bush encroacher. The outcome of oak invasions on a savanna

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178-204 (especially p. 195), respectively. Compare Le Houérou, The Grazing Land Ecosystems of the African Sahel, pp. 124-128.

[10] Le Houérou lists both deforestation and woody plant invasion of pastures (what in South Africa would be called bush encroachment) as effects of overgrazing, seemingly without concern for the inherent contradiction, Le Houérou, The Grazing Land Ecosystems of the African Sahel, pp. 90-128.

[11] W.A. Laycock, J.A. Young, and D.N. Uechert, "Ecological Status of Poisonous Plants on Rangelands," and M.H. Ralphs and L.A. Sharp, "Management to Reduce Livestock Loss from Poisonous Plants," L.F. James, M.H. Ralphs, and D.B. Nielsen, eds., The Ecology and Economic Impact of Poisonous Plants on Livestock Production (Boulder and London: Westview, 1988) pp. 27-42 (especially 27-28) and pp. 391-405 (especially 393), respectively.

[12] On oak poisoning and livestock management as a critical prevention, see K.T. Harper, G.B. Ruyle, and L.R. Rittenhouse, "Toxicity Problems associated with the Grazing of Oak in Intermountain and Southwestern USA," and Ralphs and Sharp, "Management to Reduce Livestock Loss," James, Ralphs, and Nielsen), The Ecology and Economic Impact, pp. 197-206 and 391-405 respectively. On sorghum (Sorghum bicolor) see W.W. Hanna and S. Torres-Cardona, "Pennisetums and Sorghums in an integrated Feeding System in the Tropics," A. Sotomayor-Ríos and W.D. Pitman, eds., Tropical Forest Plants: Development and Use (Boca Raton, etc.: CRC Press, 2001), pp. 193-200, especially 195-196. On Leucaena, R.M. Lawton, "Browse in Miombo Woodland," H.N. Le Houérou, ed. Browse in Africa: The Current State of Knowledge (Addis Ababa: ICLA, 1980), p. 30 and H.M. Shelton and J.L. Brewbaker, "Leucaena leucocephala: The most widely used Forage Tree Legume," R.C. Gutteridge and H.M, Shelton (eds.), Forage Tree Legumes in Tropical Agriculture (Wallingford, UK: CAB International, 1994), pp. 97-108. Huxley notes that many plants contain chemicals that have poisonous effects if they are digested in large quantities by livestock, Huxley, Tropical Agroforestry pp. 39-50.

[13] F.H. Beinroth, "Land Resources for Forage in the Tropics," Sotomayor-Ríos and Pitman, Tropical Forest Plants, pp. 3-15.

landscape is also not described as bush encroachment. The omission may be due to the existence of what could be defined as a western "oak complex."[14]

Animal Commodities

On the eve of the 1897 Rinderpest, large numbers of cattle and goats were kept in the inhabited zones in the northern and southern Ovambo floodplain. Cattle were a major export from the Ovambo floodplain in the late 1870s through the early 1890s. The kings of Oukwanyama were the main suppliers of cattle to European traders and cattle from the kingdom could be in international markets even beyond the Cape Colony and the Transvaal, including as far away as Luanda, St. Helena, and Gabon. The kings of Oukwanyama alone may have supplied an annual average of 600 head of cattle in the decade or so before the 1897 Rinderpest epizootic and on average 2,000 head annually in the decade or so following the Rinderpest, even though the epizootic dramatically decimated cattle herds.[15]

Cattle were kept near the villages in the oshilongo during the rainy season, but to conserve precious water and forage resources, herdsmen drove the animals to cattle posts in the ofuka for the duration of the June/July to December dry season. Five dry season cattle post areas could be distinguished around the turn of the 19th to 20th century,. The Etosha Pan and the Ombuga Flats to the south of the Ovambo floodplain served mainly as a cattle post area for the inhabitants of the Ondonga kingdom. The Kaokoveld and Outjo areas to the west and southwest of the floodplain, which included the western part of the modern Etosha National Park, served Eunda, Onkolonkathi, Uukwaluthi, and Uukwambi. The Kunene and Kuvelai River valleys to the north and northwest of the floodplain were important cattle post areas for herdsmen from Ombadja, Evale, and Oukwanyama. Herdsmen from Oukwanyama also used cattleposts east of the northern floodplain at Oshimolo and in the Kavango

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[14] The Kermes oak (Quercus coccifera) is a basic component of the expansive Meditteranean shrublands that are a source of forage to small stock. In Greece, the brushland is so dense that it lowers available forage, V.P. Papanastasis and L.G. Liacos, "Productivity and Management of Kermes Oak Brushlands for Goats," Le Houérou, Browse in Africa, pp. 375-381. The chaparral of Arizona, which is dominated by oak bush would in Africa, for example, be seen as the result of bush encroachment. On the chaparral and the invasive properties of oak species in the US, see W.H. McWilliams et al., "Distribution and Abundance of Oaks in North America," McShea and Healy, Oak Forest Ecosystems, pp. 13-33. See also K.T. Harper, G.B. Ruyle, and L.R. Rittenhouse, "Toxicity Problems associated with the Grazing of Oak in Intermountain and Southwestern USA," L.F. James, M.H. Ralphs, and D.B. Nielsen (eds.), The Ecology and Economic Impact of Poisonous Plants on Livestock Production (Boulder and London: Westview, 1988), pp. 197-206. On the symbolic significance of the oak, see, for example, Thomas, Man and the Natural World, pp. 220-221.

(Cubango) River Valley. The westernmost part of the Sandveld to the east of the floodplain and south of Oshimolo was an alternative cattle post area for herdsmen from Ondonga.[16]

The increased movements of people and animals that accompanied trade, hunting, exploration, missionary work and raiding throughout late 19th century southern Africa facilitated the spread of new animal diseases in the Ovambo floodplain. Lungsickness reached South Africa in 1853 with a shipment of Frisian bulls from Europe. Transport oxen spread the disease across the region. The scourge politically, economically and socially devastated the Xhosa in South Africa. By 1876, the disease had infected cattle in Ongandjera in the southern Ovambo floodplain and it remained endemic in the region.[17] Rinderpest reached the Ovambo floodplain in 1897, decimating wild and domestic animal populations and causing the collapse of hunting, pastoralism, and trade.[18] In addition, manure shortages affected crop

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[15] Kreike, Re-Creating Eden, chs. 2-3.

[16] Lau, Carl Hugo Hahn Tagebücher, Part iv 1856-1860, entry 28 July 1857, p. 1057. NAN, NAO 104, diary Jordan; R.P. Duparquet, Saint Michel, d'Oukouanyama, 7 December 1884, L'Annales de la Congregation, 1 (April 1886), 2, pp. 59-61; H. Capello & R. Ivens, De Angola a Contra-Costa: Descripção de uma Viagem atravez do Continente Africano (Lisbon: Impr. Nacional, 1886), p. 228; AVEM, RMG 2599 C/i 19, Beersmann, Omburo, 6 January 1892; Kreike, "Recreating Eden: Agro-Ecological Change, Food Security and Environmental Diversity in Southern Angola and Northern Namibia, 1890-1960," Ph. D. Dissertation, Yale University, 1996, p. 39-40. On Ondonga, see Siiskonen. Cf. Williams & Hayes. Möller, Journey in Africa, p. 114 and note 123. On the cattleposts, see ch. 3 and Kreike, Recreating Eden, ch. 7. Charles John Andersson, The Lake Ngami: or, Explorations and Discoveries during Four Years' Wanderings in the Wilds of South-Western Africa (Cape Town, 1987) (Reprint of 1856 edition), p. 184, as cited by Harri Siiskonen, Trade and Socioeconomic Change in Ovamboland, 1850-1906 (Helsinki: SHS, 1990) p. 55, footnote 32; AGCSSp 466-A-VII, R.P. Duparquet, Carnets de Notes 7: Journal de 9 Juin 1882 au 1 Outobre 1882 et Voyage aux Ambuellas 31 Juillet 1883 au 1 Outobre 1883: entry 24 Sept. 1883, p. 108 and Portugal em Afrika, 14 (September 1907), 165, pp. 443-448; NAN, RCO 4 f. 3/1916/4, RCO to Sec. SWA, n.p., 3 November 1917;RCO 8 f. (9), RCO to Sec. SWA, 27 October 1918, Diary Extracts Official Tour Northwestern Ovamboland, 8 October 1918; RCO 9 f. 10/1916/1 (ii), RCO, 1 December 1916, Intelligence Report by Hahn on Trip to North Eastern Portion Ondonga; RCO 8 f. 9, RCO to Sec. SWA, Ondonga, 27 October 1918, "N[orth] W[est] Ovamboland: Official Tour, entry 8 October 1918"; AGR 127 f. 7/2 (i), O/C NAO to CNC, Ohopoho, Kaokoveld, 16 June 1941 and Statement Native Constable Alpheus Kandundu, Ohopoho, 14 June, 1941; A450, vol. 25 Notebook D 24, pp. 34-35 and vol. 8 f. 2/21, [Hahn], [Ondonga], 5 January 1935; KAB 1 (iii), Volkmann, 30 October 1928, "Report on the Agricultural and Political"; OVA 53 f. 6/19, Cabinet Commissioner-General Ondangwa, Minutes 5 November 1973.

[17] NAN, A233, J. Chapman, 1903-1916, pp. 61-62 and J.P. Peires, The Dead will arise: Nongqawuse and the Great Xhosa Cattle killing Movement of 1856-7 (Johannesburg: Ravan Press, 1989), pp. 70-73.

[18] NAN, A233, J. Chapman, 1903-1916, pp. 45-47, 159-160, 167-169; SWAA Native Affairs Vol. 456 f. A50/92 F, Secretary for South West Africa, "Native Cattle", Replies to Questionnaire by Dr. G. Schmid, Government Veterinary officer, n.p. [1932], to Secretary for External Affairs, Pretoria; "Ainda o Desastre do Humbe," and "A Peste Bovina em Angola," Portugal em África, vol. 5, no. 5 (March 1898), 51, 128-136 respectively; H. Marquardsen, Angola (Berlin: D. Reimer, 1920), pp. 99-101; CNDIH, Avulsos, Caixa 4121 "Humbe," 32-4.6 Humbe, Circumscricão Civil: Agricultura 1891-1913, relatorios anos 1906; A.P.G. Schachtzabel, Angola: Forschungen und Erlebnisse in Südwestafrika (Berlin: Die Buchgemeinde, 1926), pp. 89-99; AVEM, RMG 2630 C/k 7, Wulfhorst, Referat: "Giebt es in unser Ovambomission eine Frauenfrage?" Omupanda, October 1903.

production and consequently the inhabitants of the northern Ovambo floodplain suffered a series of famines during the early 1900s.[19]

Goats were the second most numerous livestock, especially in the northern floodplain. Goats were kept in separate kraals and young boys herded the goats during the rainy season to prevent them from damaging crops. Small stock was kept in the villages throughout the year. Goats were mainly browsers: bushes and trees sprouted new leaves before grasses and herbs became available. Thus, goat milk was a critical source of food early during the rainy season or during droughts when little food other than stored grain was available. Sheep herds were small in number and largely confined to the western polities. By the turn of the century, floodplain households also kept chickens.[20] Traders and travelers introduced horses, mules, and donkeys in the late 19th century; horses were a highly valued weapon of war. The number of horses remained limited, however, because they had to be imported, and because horsesickness was prevalent in Ovamboland, which decimated horses during the rainy season.[21]

Human settlement has a critical impact on animal use and management and in turn war and violence dramatically affected settlement patterns during the early decades of the 20th century. Portuguese colonial conquest and pacification followed in the wake of the Rinderpest, causing massive death and destruction in the northern floodplain as well as further decimating livestock herds. Cattle meat was critical for the survival of the refugees from the northern floodplain who found shelter from the violence of war in the ofuka-wilderness areas in the middle floodplain.[22]

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[19] Kreike, "Recreating Eden," p. 2-3; Schachtzabel, Angola, p. 99; Marquardsen, Angola, pp. 99-101. Recovery from the Rinderpest was slow, see de Quadres Flores, Recordações, p. 200; NAN, NAO 18 f. 11/1 (i), Hahn, Notes on Ovamboland, Windhoek, 15 May 1924.

[20] NAN, NAO 104, diary Jordan; Lau, Carl Hugo Hahn Tagebücher, Part iv 1856-1860, entry 22 July 1857, p. 1040; AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892; Wülfhorst, Shiwesa, p. 2; CNDIH, Avulsos, Caixa 3439, Ribeiro da Fonseca, "Relatório do reconhecimento," Cuamato, 26 September 1913; Paulus Nadenga, interview by author, Oshomukwiyu, 28 April 1993; NAO 18 f. 11/1 (i-iii), Monthly Reports Ovamboland, September 1927 and November-December 1930; A450, 7 f. 2/12, RCO to Secretary SWA, Ondangwa, 15 November 1921.

[21] Kreike, "Recreating Eden," p. 38; NAN, NAO 104, diary Jordan; NAO 18 f. 11/1 (I), Monthly Reports Ovamboland, January-February, April 1925, August 1926, and February and August 1927; A450, vol. 7 f. 2/18, Monthly Report Ovamboland December 1924 and Annual Report Ovamboland 1940.

[22] Kreike, Re-creating Eden, chapter 4..

Livestock as an Environmental Threat

Whereas wildlife was the primary preoccupation of colonial officials in terms of animal conservation in the 1930s and 1940s, during the 1940s and 1950s, their attention shifted to (the increase of) livestock. The 1935 annual report for Ovamboland observed that goat numbers were very low and noted with some concern "[that] goats do not thrive well." Early 1940s annual reports, however, singled goats out as "the most miserable species in South West Africa if not in the Southern Hemisphere" and identified the animals as an environmental and health "curse."[23] Water and grazing conflicts in the shrinking wilderness areas between the districts of Oukwanyama and Ondonga, Ongandjera and Uukwaluthi, Ombalantu and Ongandjera, and Ombalantu and Uukwaluthi during the early 1940s droughts added to the concerns about livestock pressures on Ovamboland's environment and during the 1950s, "overstocking" became a central theme in colonial reports.[24]

Health anxieties in the 1930s and 1940s contributed to transforming indigenous cattle from an asset to a liability. Outbreaks of cattle diseases in Ovamboland, especially lungsickness, which was endemic, and, after the Second World War, foot and mouth, contributed to the creation of a colonial image of "Ovambo cattle" as a contagion that threatened commercial white cattle ranching in the colony of South West Africa. Pre-Second World War plans for cattle vaccination against lungsickness were quickly abandoned in the face of resistance by Ovamboland's cattle owners. Measures to restrict cattle movements between Ovamboland and Kaokoland to the west, Okavango to the east, and the Namutoni game reserve (Etosha) to the south, including shooting trespassing cattle, had somewhat more of an impact. A prohibition to export cattle or cattle products from Ovamboland into the Police Zone (South West Africa/Namibia south of Ovamboland) predated the 1940s. After the late 1940s outbreaks of foot and mouth disease, however, the prohibition resulted in the creation of a permanent veterinary cordon, the so-called Red Line between Ovamboland and the remainder of Namibia to its south.

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[23] NAN A450 vol. 7 f. 2/18, Annual Reports Ovamboland 1935, 1940, and 1941. Goats have an especially bad reputation as forest destroyers, an assumption that needs to be revisited, see Williams, Deforesting the Earth, p. 83. Grove notes that the association of deforestation and goats dates back to the early days of the development of the environmental crisis concept in the 18th century, see Grove, Green Imperialism, pp. 95-120.

[24] NAN, A450 vol. 7 f. 2/18, Annual Reports Ovamboland 1941 and 1943; BAC 133 f. HN 8/21/4/1, Agricultural Officer to NCO, "Report of travel to the northwestern part of Ovamboland from 20-22 June 1956," Ondangwa, 4 July 1956 and Agricultural Report Ovamboland, 1956/1957.

The Red Line was intended to prevent the contamination of livestock in the white farming areas south of Ovamboland.[25]

A Livestock Population Explosion?

Ovambo livestock was not only reincarnated as a disease time bomb, but it was also re-imagined in neo-Malthusian terms as an animal population time bomb. Colonial statistics (see table 6.1) served to demonstrate that in less than 50 years, the cattle population had increased by a factor of nine, goats by a factor of four (from 1925-1979), and donkeys by a factor of 20 (from 1946-1990).

[25] NAN, NAO 19-20 f. 11/1 (xi-xvi), Monthly Reports Ovamboland, January, November-December 1936, July-August 1938, March-May 1939, August-September 1940, March-July 1941, 1946-1950; AGR 127 f. 7/2 (i), Report Bourquin submitted to Hahn, appendix to NCO to CNC, Ondangwa, 1 May 1939; AGR 25 f. 2/10, Senior Veterinary Surgeon to Sec. SWA, Windhoek, 13 November 1941; NAO 11 f. 5/7/2, O/C NAO to NCO, Oshikango, 19 September 1939; NAO 15 f. 8/3 (ii), Veterinary Officer to Director Agriculture, "Investigation: Foot and Mouth Disease: North western Ovamboland," January 18, 1946; NAO 106, Diary NCO 1949-1954, entry 13 February 1950; NAO 59 f. 9/17 (i), Kaibi Mundjele to NCO, Ombalantu, 2 May 1950, NCO to Ombalantu Headmen, 9 May 1950, ANC to Kwanyama Headmen, 29 November 1950, and NCO to Chief Kambonde, 29 November 1950; OVA 49, f. 6/9/1 (I), Chief Agricultural Officer to Director Agriculture, Ondangwa, 25 June 1969; AGR 47, Meeting on Foot and Mouth Outbreak in Ovamboland, 29 January 1967; OVA 57 f. 7/2-7, Dr. H.A. Lueckhoff, Report on Visit to SWA, 3-15 November 1969, appendix to Regional Forestry Officer to Chief Director Bantu Administration, Grootfontein, 3 April 1970. On lungsickness, NAO 18 f. 11/1 (i), Monthly Report Ovamboland, March 1925 and NAO 59 f. 9/17 (i), Dr. M. Zschokke, "Survey of Cattle Diseases in Ovamboland: October 1948," 5 November 1948.

Table 6.1 Livestock Statistics for Ovamboland, 1925-1991[26]

Year	*Cattle estimated*	*Cattle inoculated*	*Goats estimated*	*Goats dipped*	*Donkeys estimated*	*Sheep estimated*	*Pigs estimated*
1925	60,000		80,000				
1935	140,000		168,000		3,050	13,000	
1942	123,960		103,500			8,150	
1946	250,000		120,000		6,000	300	
1950	84,000		119,000		7,700	6,050	
1956		200,000*	400,000			10,000	
1957		385,983	440,000			11,000	
1958		333,303					
1959			439,455				
1960	368,630		450,000		31,382		
1963		277,052	399,650				
1965	370,000						
1966	285,041-400,000		195,000			4,000	
1967	350,000-420,000	400,000	315,000-360,000			2,500- 3,500	
1968	453,000	390,542	360,000	120,000		5,500	
1969	466,000-535,158		305,871-350,000	229,000#	30,000	4,841-5,000	
1970	516,000-567,000	565,000	338,000-347,000			9,000	
1971	520,094	520,094	294,459-338,000			9,000	19,139
1972	500,944		284,967			6,938	23,271
1973	451,410		325,115			6,460	
1974	488,345		342,446			7,788	34,739
1975	530,552		411,621			3,556	
1976	524,999	440,224	482,146			8,359	28,351
1977			300,000				
1980	400,000	278,000	340,000			7,000	
1981	525,000						
1985	350,000		230,000			7,000	
1990	350,000		360,000		120,000	12,000	
1991	350,000		360,000			12,000	

* Oukwanyama and Ondonga excluded
# Oukwanyama, Ongandjera, Ombalantu, and Uukwaluthi only

[26] Compiled from NAN, A450 vol. 7 f. 2/18, Annual Reports Stock 1935 and Annual Reports Ovamboland 1935, 1942; BAC 133 f. HN 8/21/4/1, Agricultural Reports Ovamboland 1955/1956, 1956/1957; BAC 131 f. HN 8/17/4, Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957; AGR 44, f. 6/2/1, Zschokke, Ondangwa, 2 September 1958; WAT 1, f. 3 (I), "Cattle in Northern Native Territories..., 30 June 1960, Ovamboland; AHE (BAC) 1/352 f. (14) N8/21/4, Annual Reports Agriculture Ovamboland for 1966 and 1968; OVA 9 f. 6/9/1 (I), Statistics 1967, appendix to Director-in-Chief Economic Affairs to Director Agriculture, Ondangwa, 25 March 1969 and Chief Agricultural Official to Director Agriculture and Works, Ondangwa, 25 June 1969, "Regarding Questionnaire" and Director Agriculture and Forestry to Director-General Department of Cooperation and Development Pretoria, [Ondangwa], 5 May 1981; OVE 10 f. 6/1/3, table 6.1.3; OVA 40 f. 6/5/1-7 and (I), Ovambo Government, Report "Verhoging van die Beesvleis produksie…," 5 August 1971 and questionnaire appended to Secretary Economic Affairs to Secretary of Agriculture and Forestry, Ondangwa, 10 November 1973; OVA 26, f. 4/4/1-7, "Owambo Livestock Practices," appendix to Secretary Department of Agriculture to Secretary Department of Bantu Administration, Ondangwa, 10 March 1977; AGR 897, f. 138/2/1 (I), De Basson, "Numbers Ovamboland," 24 February 1963; OVA 6, f. 2/8/2-7 (ii), Annual Report Veterinary Service Owambo 1975-1976; OVA 26, f. 4/4/1-7, "Owambo Livestock Practices," appendix to Secretary Department of Agriculture and Forestry to Secretary Department of Bantu Administration and Development, Pretoria, Ondangwa, 10 March 1977; Kreike "The Ovambo Agro-Silvipastoral System,"

In addition to cattle and goats, floodplain households kept a small number of sheep and pigs. The combined western districts of Ongandjera, Uukwaluthi, and Onkolonkathi contained two thirds of the sheep population.[27] In contrast, pigs were more commonly kept in Oukwanyama, where 30-40% of the total population of pigs could be found.[28] During the 1950s-1960s, the number of poultry kept in Ovamboland was estimated at 70,000 to 80,000 animals, but this estimate seems low in the context of a 1964 figure of 50,000 chickens for the district of Oukwanyama alone.[29] During the 1970s, the number of dogs, which were used extensively for hunting and to guard farms, was estimated at 30,000 to 40,000 animals, with half that number located in Ondonga and Oukwanyama.[30]

The livestock figures overall are clearly guesstimates. The figures for the 1960s and 1970s are more reliable because they were partially based on the actual numbers of vaccinated animals. Yet vaccination figures almost certainly underestimated the total number of cattle for at least three reasons: (1) Ovamboland cattle kept by households in Angola on a semi-permanent basis under cattle lending agreements would not have been vaccinated in Namibia; (2) cattle may still have been located at the cattle posts, i.e. far away from vaccination centers (including at cattle posts in Angola) at any time of the year; (3) cattle owners and cattle holders were apprehensive about vaccinations and it is therefore unlikely that *all* cattle was driven to the vaccination centers. A 1967 airborne survey revealed the presence of a large number of homesteads in southeastern Ovamboland that had not been subject to any veterinary inspections.[31] Overall, the figures suggest a steady increase of Ovamboland's cattle population from the mid-1950s to the mid-1980s, followed, however, by a sharp decline.

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p. 39, table 1. The 1966-1975 figures from the 1977 report seem sanitized and may have been derived from a formula that reflected presumed drought and disease losses of cattle.

[27] NAN, A450 vol. 7 f. 2/18, Annual Report Ovamboland 1942; BAC 133 f. HN 8/21/4/1, Agricultural Officer Ovamboland, Agricultural Reports Ovamboland 1955/1956 and 1956/1957; AHE (BAC) 1/352 f. (14) N8/21/4, Annual Reports Agriculture Ovamboland 1964, 1966 and 1968; OVE 10, f. 6/1/3, table 6.1.3; OVA 56, f. 6/20/3/2-7 (I), State Veterinarian to Director Agriculture, Ondangwa, 7 June 1971; OVA 6, f. 2/8/2-7 (ii), Annual Report Veterinary Service Owambo 1975/1976.

[28] NAN, OVA 56, f. 6/20/3/2-7 (I), State Veterinarian to Director Agriculture, Ondangwa, 7 June 1971; OVE 10 f. 6/1/3, table 6.1.3; OVA 6, f. 2/8/2-7 (ii), Annual Report Veterinary Service 1975/1976.

[29] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Reports Ovamboland 1955/1956 and 1956/1957; WAT 1, f. ww3 (I), "Equines, goats, pigs, and poultry in Northern Native Territories, 30 June 1959"; AHE (BAC) 1/352 f. (14) N8/21/4, Annual Reports Agriculture Ovamboland 1964, 1966 and 1968.

[30] NAN, OVA 56, f. 6/20/3/2-7 (I), Veterinarian to Director Agriculture, Ondangwa, 7 June 1971 and OVA 6, f. 2/8/2-7 (ii), Annual Report Veterinary Service Owambo 1975/1976.

Livestock Consumption, Sale, and Loss

While colonial experts and officials ascribed the "explosive" increase in cattle numbers to Ovamboland cattle owners' view of cattle as a cultural rather than an economic asset, colonial sources simultaneously indicated that the annual livestock take-off due to consumption, disease, and drought was significant.[32] Between 1966 and 1975, approximately 20-30% of the total herd was slaughtered annually, and the overall ten-year trend for this percentage increased from the 20th percentiles in the late 1960s to the 30th percentiles in the early 1970s. For every five head of cattle that Ovambo households "disposed of," roughly one head was consumed by the household and four were sold, whereas the ratio for goats was approximately 4:5 (see Table 6.2).[33]

Table 6.2 Average Estimated Livestock Consumption and Sales per Household

	Consumption	*Sale*
Heads of cattle	0.4	1.8
Goats	5.5	2.9
Pigs	4.0	5.5
Sheep	0.05	0.005

In 1956, fourteen "native" butcheries operated in the Oukwanyama district alone.[34] Livestock and livestock meat was widely traded, even across the Angolan border. Households that slaughtered cattle consumed part of the meat and sold or dried the remainder. In 1942 (a year of severe drought) a live ox cost eight Pound Sterling (16 Rand) while in 1954 official prices in the Union of South Africa for a good quality head of Ovambo cattle varied from two to seven Pound (4-14 Rand).

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[31] In 1971, 33,189 head of cattle less were vaccinated than in May of 1970. The fluctuations may in part be the result of owners' withholding of cattle from the vaccination centers. On the survey, see NAN, AGR 47, Meeting on Foot and Mouth Outbreak in Ovamboland, 29 January 1967.

[32] NAN, AHE (BAC) 1/352 f. (14) N8/21/4, Annual Reports Agriculture Oukwanyama 1964 and 1968; OVA 49 f. L6/8/4/1 (I), Meeting of the Sub-Committee on Village Planning, 2 September 1970; OVA 9 f. 6/9/1 (I), Statistics 1967, appendix to Director-in-Chief Economic Affairs to Director Agriculture, Ondangwa, 25 March 1969 and Director Agriculture to Director-General Department of Cooperation Pretoria, [Ondangwa], 5 May 1981; OVA 61, Monthly Reports Agricultural Officer: Andreus Ndeitwa, August 1976; OVA 6, f. 2/8/1, Annual Report Agriculture Owambo, 1979/1980. On the "backwardness" of Ovambo cattle management, see AHE (BAC) 1/346 f. (15) N8/19/4/4 (I), Chief Bantu Commissioner SWA to Principal Agricultural College Arabie, Transvaal, Windhoek, 13 July 1965.

[33] NAN, OVA 9 f. 6/9/1 (I), Director Agriculture to Department of Cooperation Pretoria, [Ondangwa], 5 May 1981; OVA 26, f. 4/4/1-7, "Owambo Livestock Practices," appendix to Secretary Department of Agriculture to Secretary Department of Bantu Administration, Ondangwa, 10 March 1977. These figures are estimates.

[34] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland, 1955/1956.

Cattle and beef were readily exchanged for millet and sorghum. In the mid-1950s, cattle hindquarters sold for five gallons of millet or sorghum.[35]

Cattle and goat hides were also sold. During drought years in the 1940s and 1950s, cattle owners from Ovamboland annually exported up to 5-10,000 tanned cattle hides to Portuguese traders across the border at a price of about one Pound Sterling (two Rand) apiece. Although formally prohibited, the export of (cattle) hides and skins to southern Angola continued until at least the early 1970s.[36]

In 1993, when asked if they sold cattle, less than 20% of OMITI survey participants answered affirmatively and 82% responded negatively. The majority of the latter (87%) explained that they did not own enough cattle to be able to sell any. Of a sample of the 35 respondents who did sell cattle, almost half reported selling the animals to traders from Oshakati and other towns and a similar number sold them to neighbors. A sample of 41 households identified the source of slaughter oxen required for a large feast as being their own cattle (56%), cattle from neighbors (24%), or cattle from traders from Oshakati and other towns (17%).[37] Pigs were primarily kept for household consumption (mentioned by 74% of the respondents) and for sale (emphasized by 33%).[38]

Livestock losses caused by disease and drought were high. During the severe 1941 drought, officials estimated losses due to drought and disease at 30% for cattle and 20% for goats. In 1945/1946, 12,500 head of cattle (5% of the total herd) and 5,000 small stock perished due to disease alone and in 1979/1980, 40,000 cattle (10%

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[35] NAN, NAO 98 f. 42/11 (ii), ANC to NCO, Oshikango, 11 June 1947 and Statement Mululu Kalongela, Ondangwa, 12 May 1948; NAO 64 f. 19/1 (i), Minutes of Ukwanyama Tribal Meeting [12 July 1954]; AGR 897 f. [13?]8/2/1(I), Statement Elizabeth Ikau, 27 November 1961; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland, 1955/1956. For other examples of the exchangeability of cattle and beef and grains, see, for example, NAN, NAO 98 f. 42/11 (ii), ANC to NCO, Oshikango, 11 Jume 1947 and Statement Mululu Kalongela, Ondangwa, 12 May 1948; A450, 23 D4 (1924) and Vol. 24 D19.

[36] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland, 1955/1956 and 1956/1957; NAO 27 f. 23/2, NCO to Sec. SWA, Ondangwa, 15 November 1941; NAO 103 f. 62/2, Censii of Agriculture Ovamboland, 1945/1946 and 1949/1950; NAO 70 f. 30/2, Statement Nehala Nangoro, Oshikango, 23 December 1948; NAO 64 f. 19/1 (i), Minutes of Ukwanyama Tribal Meeting [12 July 1954]; BAC 122 f. HN 7/8/2/1 Famine Relief Schemes (I), Chief Bantu Commissioner to Minister for Bantu Administration and Development, Windhoek, 26 June 1959; BAC 44 f. 1/15/4/17, Minutes of meetings at Ombalantu , 15 June 1960 and at Onkolonkathi tribal area, 16 June 1960; OVA 50, f. 6/10/5-7, Minutes Ukuanyama Tribal Government Meeting, 7 December 1971.

[37] OMITI survey 1993, 2.1.35-37 and 2.1.38.

[38] OMITI survey, 2.4.2.0-1, 2.4.3. See also OVA 6, f. 2/8/1, Department of Agriculture Owambo, Annual Report 1979/1980.

of the total herd) and 20,000 goats reportedly succumbed to a combination of disease and drought.[39]

With annual consumption levels as high as 20-30% combined with years that were characterized by disease- and drought-induced losses of up to 20-30% of the animal population, it seems remarkable that there was any livestock left at all. As is the case with the statistics for the actual number of livestock, however, these figures are estimates. The consumption, sale, and loss numbers may also overlap because the meat of livestock that had perished was often consumed and the hides were either used or sold. In addition, drought or disease-weakened livestock were routinely slaughtered.[40]

Still, the figures demonstrate that at the very least, some colonial officials had the impression that cattle and cattle products (meat and hides) were important consumption and trade goods, and this impression is borne out by oral testimonies of a lively trade in cattle and cattle products. In other words, cattle were commercialized at least within a regional parallel market, despite having been de-commercialized at the level of the formal colonial and international markets after the imposition of colonial rule in 1915.[41] It seems therefore that reports of overgrazing and an explosive increase in cattle numbers were overdrawn.

Grazing Pressure and Overstocking

Calculations of grazing pressure in the 1970s concluded that western Ovamboland (and the Mangetti areas in the far southeast of Ovamboland, just north of the Tsumeb district) could support one Cattle Unit (CU, i.e. one head of cattle) per 12 hectares. Central and eastern Ovamboland only had a carrying capacity of one CU

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[39] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Reports Ovamboland, 1955/1956 and 1956/1957; NAO 103 f. 62/2, Census of Agriculture Ovamboland, 1945/1946, and NCO to Secretary SWA, Windhoek, 8 March 1946; BOS f. "Oshikango," Agricultural Officer Ovamboland to Native Commissioners Ondangwa and Oshikango, [Ondangwa], 17 August 1956; OVA 6, f. 2/8/1, Annual Report Agriculture Owambo, 1979/1980; A450 vol. 7 f. 2/18, Annual Report Ovamboland 1941.

[40] On diets and the consumption of dead cattle, see NAN, NAO 60, f. 12/1 (i), Quarterly Reports Ovamboland, January-March 1948, January-June 1949, January-March 1951, January-March 1954; NAO 38 f. 26/14, Public Health Commission, Evidence by Hahn, "Ordinary and Everyday Diet of a Young Ovambo," and "Suggested Diet for Ovambos," Grootfontein, 19 September 1945; NAO 69 f. 25/6, ANC, "Dietary: Oukwanyama, Ovamboland," and K. Schettler, "Bantu Rural Diet: Ondonga Tribe," appendices NCO to CNC, Ondangwa, 4 October 1948; NAO 59 f. 9/17 (i), Kaibi Mundjele to NCO, Ombalantu, 2 May 1950; NAO 37 f. 26/8 (ii) Annual Health Report Ovamboland 1937; NAO 20 f. 11/1 (xiii), Monthly Reports Ovamboland, March-April 1940; NAO 62 f. 12/5, Agricultural Report Ovamboland 1953.

per 16 hectares. Actual grazing pressure in central Ovamboland, however, was thought to be as high as one CU per 3.5 to 5 hectares. In 1974, the carrying capacity of Ovamboland as a whole was set at 463,941 CU, but the total livestock population was 564,135 CU. In 1977, based on a 1975 count, it was calculated that Ovamboland's 5,567,400 hectares supported 660,704 CUs, or a stocking rate of one CU per 8.14 hectares.[42] As a result, desertification was thought to be imminent: "[t]he soil destruction …in the densely populated parts of Ovamboland is shocking and if this degradation is not halted soon, it can not be prevented that large parts of the area [Ovamboland] will be transformed in a unhospitable desert."[43] During the early 1970s, colonial extension workers consequently urged livestock owners to take action against overstocking and overgrazing.[44]

The assessment of severe overstocking and the conclusions derived from that analysis, however, are problematic at best. The concept of carrying capacity itself is controversial.[45] Moreover, presumptions about the grazing impact for South Africa and South West Africa were based on trials with Afrikaner and exotic cattle. Sanga cattle, despite its lower mass, were not differentiated from heavier cattle breeds, such as Simmentaler or Afrikaner. Yet, an overall 10 to 20% lower mass for Sanga cattle correspondingly should result in a lower CU. Of the 560,000 CU in the previously

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[41] In western Kenya similar local cattle markets operated under the colonial radar screen, see D.W. Cohen and E.S. Atieno Odhiambo, Siaya: A Historical Anthropology of an African Landscape (London: James Currey, 1989), pp. 76-81.

[42] NAN, OVA 26 f. 4/4/1-7, Sec. Agriculture to Sec. Bantu Administration Pretoria, Ondangwa, 10 March 1977.

[43] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956; OVA 57 f. 7/2-7, Dr. H.A. Lueckhoff, "Report on a visit to South West Africa, November 3-15, 1969," appendix Regional Forester to Director-in-Chief Bantu Administration Pretoria, Grootfontein, 3 April 1970; OVA 56, f. 6/20/4/2-7 (I), Sec. Bantu Administration to Director Agriculture Ondangwa, Pretoria, 11 June 1971; OVA 46, f. 6/8/1/1-7 (ii), Director Agriculture to Secretary Bantu Affairs Pretoria, Ondangwa, 17 November 1971; OVA 45, f. 6/8/1-7 (ii), Secretary Department of Agriculture to Foreign Affairs Pretoria, Ondangwa, 16 January 1974. One head of cattle or 6 head of smallstock counted as 1 CU. See also OVA 26 f. 4/4/1-7, Sec. Agriculture to Sec. Bantu Administration Pretoria, Ondangwa, 10 March 1977.

[44] See, for example, NAN, OVA 61, Monthly Reports Agricultural Officer Moses Nadjebo (Oukwanyama), Reports 1971.

[45] On the controversy surrounding the carrying capacity concept, see, for example, S. Sanford, Management of Pastoral Development in the Third World (Chichester, [West Sussex]: Wiley, 1983), pp. 104-105; P.D. Little, "Rethinking Interdisciplinary Paradigms and the Political Ecology of Pastoralism in East Africa," and W.A. Munro, "Ecological 'Crisis' and Resource Management Policy in Zimbabwe's Communal Lands," Bassett and Crummey, African Savannas, pp. 161-177 (especially 163-164) and pp. 178-204 (especially p. 195), respectively. In Ovamboland ideal carrying capacity estimates varied: for example, although in the early 1970s the acceptable carrying capacity for Ovamboland was set at 1 CU per 12-16 ha, a mid-1980s assessment set it at 1 CU per 8-10 ha, see Proposed Agricultural Strategy for SWA/Namibia, August 1986.

mentioned report, 488,000 consisted of cattle and 72,000 of other stock.[46] Based on a Sanga adjusted 0.8 CU, the actual CU aggregate is 468,000, which equals the area's presumed carrying capacity and thus as such does not support the conclusion that overgrazing by cattle was a major cause of environmental degradation before the mid-1970s.

Colonial Barriers: Conservation and Fences

In the 1950s, 1960s, and 1970s, vaccinations and fences became the main tools to contain Ovamboland's presumed livestock problem, thereby conserving its environment and protecting livestock in the white settler farming areas to the south of Ovamboland, in Angola and in the neighboring "Native Territories" of Kaokoland and Okavango, as well as Etosha Park's wildlife. Considerations of scientific management thus legitimized and institutionalized the confinement of Ovamboland's cattle to a smaller space, inhibiting its mobility and perpetuating its de-commercialization in any markets outside of the reserve.

In 1963, the Oukwanyama district contained a single cattle inspection kraal. In 1974, Ovamboland as a whole boasted 500 cattle inspection kraals and over one hundred smallstock dip tanks. The cattle inspection kraals greatly facilitated vaccination programs; in 1968, for example, 306,637 cattle were vaccinated against lungsickness.[47]

In addition, the colonial administration erected fences along the Angolan border, the western Kaokoland border, and along the "Red Line" to the south of Ovamboland in the 1960s and 1970s in order to contain diseases and to prevent the re-

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[46] NAN, OVA 45, f. 6/8/1-7 (ii), Secretary Department of Agriculture to Department of Foreign Affairs Pretoria, Ondangwa, 16 January 1974; OVA 26, f. 4/4/1-7, H. Hamburger, C.W.B. Amstrong, and J. Swanepoel, "Adaptability and Reproductive Efficiency: The Value of Indigenous Sanga Cattle in the National States of South Africa and Namibia," RSA, Department of Co-operation [1979?]; OVA 55, f. 6/20/1 (I), le Roux, "A Progress Report on Indigenous Cattle in SWA," 20 June [1980?]; BOS f. "Oshikango," Agricultural Officer Ovamboland to Native Commissioners Ondangwa and Oshikango, [Ondangwa], 17 August 1956. A 1972 report acceded that the CU standard was based on a head of cattle of 800 lbs. , see AGR 541 f. 68/8/A(I), Director [Nature Conservation?] SWA to Sec. Agriculture, Technical Service Pretoria, n.p., 16 October 1972.

[47] NAN, AHE (BAC) 1/352 f. (14) N8/21/4, Annual Report Agriculture for Ovamboland 1964 and 1968 and for Oukwanyama 1964 and 1966; AHE (BAC) 1/352 f. (66) N8/21/3 (I), Quarterly Agricultural Report January-March 1965; AHE 1/351 f. (14) N8/21/2, Report of Activities Agriculture Ovamboland, July-September 1966; AHE 1/351 f. (14) N8/21/2, Monthly Reports Agriculture Ovamboland, December 1966 and January -February 1967; OVA 36, f. 5/4/4/3/1-7 (I), Manager SWA Bantu Investment Corporation to Director Agriculture, Ondangwa, 16 May and 19 June 1972; OVA 36, f. 5/4/4/3/1-7 (I), lists of Mangas in Ondonga and in Oukwanyama on 31 December 1971; OVA 45, f.

infection of vaccinated animals by unvaccinated livestock and wild animals. Most of the Etosha Park boundary with Ovamboland proper was fenced between 1971 and 1974. Although the fences proved to be far from "cattle-proof" or "game-proof," they seriously hampered seasonal animal movements.[48] The impact of colonial fencing on livestock management in Ovamboland was dramatic because it cut herdsmen and herds off from some of the most important dry season forages and the fencing changed the transhumance system and access to cattle and cattle products. As long as grazing and water were abundant in the oshilongo inhabited zone during the rainy season, cattle were kept close to the homesteads of the owners. When water and grazing became scarce in the dry season, cattle were trekked to cattle posts in the wilderness to conserve precious water supplies in the villages. The locations of cattle posts were determined by the availability of dry season water. The herdsmen usually re-dug old waterholes upon their arrival or they dug new ones.[49]

Colonial Fences and Cattle Transhumance Patterns

Transhumance treks became longer during the 1930s, 1940s, and 1950s, for two reasons. First, Portuguese officials harassed herders engaged in cross-border transhumance to the cattle posts along the Kunene and Kavango Rivers and in Oshimolo. Second, the oshilongo village landscapes encroached on the ofuka-wilderness areas that formerly had been sites for cattle posts. As a consequence, cattle remained away from the villages for an increasing period of the year and critical cattle products (manure, dairy products and meat) were less readily available. By the mid-

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6/8/1-7 (ii), Secretary Department of Agriculture to Department of Foreign Affairs Pretoria, Ondangwa, 16 January 1974. See also Table 6.1.

[48] NAN, AGR 125 f. 6/5 (ii) Director Agriculture to Director Veterinary Services Pretoria, [Ondangwa], 27 August 1959; BOS, "District Record Book Oshikango," 1965; AGR 897, f. 138/2/1 (I), Director of Agriculture to Cattle Inspector Oshikango, [Ondangwa], 8 November 1961 and to Secretary SWA, [Ondangwa], 13 January 1961; BAC 40 f. HN 1/15/3/1, Director Agriculture to Chief Bantu Affairs Commissioner , Windhoek, 15 March 1963; AGR 95, f. 6/2/1/4/18, Veterinary Inspector to Department of Agriculture Windhoek, Omafo, 15 May 1963; AHE (BAC) 332 f. (14)N8/5/4, State Veterinarian to Director Agriculture, Ondangwa, 23 September 1966; AGR 298, f. 45/1, Memo Director Veterinary Services to Secretary LTD, 19 May 1968 and Director Agriculture to Administrator, 1 November 1968; OVA 56, f. 6/20/3/2-7 (I), Chief Bantu Commissioner SWA to Chief Director Ovamboland, [Windhoek], 18 December 1968, appendices I-II.

[49] NAN, NAO 18-20 f. 11/1 (v-xiv), Monthly Reports Ovamboland, February and May 1925, December 1926, January, June-July and September 1927, April and December 1932, August 1936, August 1937, January-February 1939, March-July 1941. See also NAO 20 f. 11/1, NCO to CNC, Ondangwa 19 April 1941; NAO 59 f. 9/17 (i-ii), ANC to NCO, Oshikango, 24 September 1949; ANC to Oukwanyama Headmen, Oshikango, 29 November 1950; NCO to Chief Kambonde, Ondangwa, 29 November 1950; NCO to Ombalantu Headmen, Ondangwa, 9 May 1950; and NAO 60, f. 12/1 (I), Quarterly Report Ovamboland, October-December 1949.

1950s and 1960s, a household's cattle often was kept away at the cattle posts during the entire dry season.[50] In August 1966, livestock that was kept in the oshilongo villages reportedly was losing "condition;" livestock in the less densely inhabited areas (e.g. in or close to the ofuka), however, remained in good "condition."[51] Herding the cattle back to the villages after the rainy season began was a top priority. In early 1967, for example, temporary veterinary cordons to contain an outbreak of cattle diseases proved impossible to maintain because owners insisted on bringing their cattle back to their homesteads.[52]

According to the results of the 1993 OMITI survey, 82% of 148 respondents customarily brought their cattle back to their homes during the rainy season. Of the 132 respondents who were asked the follow-up question of when they had last brought their animals back from the cattle post to their homes, 62% said that they had done so in 1993, and 22%, 8%, and 3%, indicated that they last had brought their cattle back in 1992, 1991, and 1990 respectively.[53] When asked why they kept their cattle at the cattle posts on a more permanent basis, 34 respondents indicated that the lack of grazing at the villages was a significant factor, while 13 respondents stressed water as a principal or additional factor. Five respondents mentioned the lack of herdsmen as a constraint.[54]

Relatives, usually the sons of the cattle owners, but also cousins and brothers, were the main source of herdsmen at the cattle posts during the early 1990s. Forty-two percent of the 88 respondents who identified the relationship to their herdsmen relied on relatives, while 17% of cattle owners personally went to the cattle posts. Seventeen percent of respondents relied on professional herdsmen who were not relatives.[55] Cattle herding was a common male youth experience: 86% of 273 respondents stated that they themselves (or the absent head of the surveyed

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[50] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Officer Ovamboland, Agricultural Report Ovamboland (1 September 1955 – 31 August 1956; BAC 132 f. HN 8/18/3/1/1 Trust Farming Projects (1960-1962), Agriculture Officer to Bantu Commissioner, Grootfontein, 1 February 1962, Monthly Report for January 1962; Kreike, Re-Creating Eden, ch. 8.
[51] NAN, AHE 1/351 f. (14) N8/21/2, Report of Activities Agriculture Ovamboland, July-September 1966 and monthly report August 1966.
[52] NAN, AGR 47, Director Agriculture to Director Animal Research Institute Pirbright, England, n.p., 23 February 1967.
[53] OMITI survey, 2.1.16-17.
[54] OMITI survey, 2.1.18. Respondents often indicated more than one category.
[55] OMITI survey, 2.1.20. Of the 117 household sample, 29 herdsmen were identified by name but not by their relationship to the individual being surveyed.

household) had herded cattle during their youth.[56] Ninety percent of 270 respondents stated that it was more difficult to find grazing for cattle during the early 1990s than it had been during their youth.[57] Water shortages due to poor rainfall were mentioned as a problem by 39% of 204 respondents, but this is not surprising in the context of a drought year. Other identified challenges to raising cattle were all related to a perceived decrease of available grazing and forages in and around the villages and in old cattle post areas because land was being fenced or transformed into farmland, and because formerly uninhabited cattle post areas were being settled from the 1940s onwards.[58] Of a survey sample of 149 households, 28% of the respondents admitted to having fenced off grazing at the cattle post; 29% of 161 respondents confirmed that others had fenced off grazing near the cattle posts.[59] The grazing shortages, however, are in and of themselves not a clear indication that grazing quality had declined (for example, as a result of overstocking and overgrazing). Rather, the shortages reveal the expansion of oshilongo environments of villages of farms and fields at the expense of ofuka, which is where cattle posts were located.

Differentiating Livestock Ownership and Management

Individual livestock owners, livestock holders, and herdsmen made the decisions about when and where to herd. Livestock was individual property but lending and herding arrangements often resulted in individual livestock being subject to consultative decisions involving various individuals, for example the actual owner of a head of cattle and the herdsman who took the cattle to a cattle post.[60]

Not all households owned cattle. While Shisheko Shishulika from Uukwambi owned 15 cattle and 14 goats in 1915, in 1917, a refugee from Uukwaluthi in Ombalantu owned 12 goats and no cattle. Seven hundred households surveyed in the Oukwanyama district of Ovamboland in 1938 owned on average seven to eight head of cattle and the same number of goats, but 25% of the households owned no cattle at

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[56] OMITI survey, 2.1.21.
[57] OMITI survey, 2.1.24.
[58] OMITI survey, 2.1.25. Of the 208 respondents, 38 specifically included population growth as a factor, 42 mentioned the increase of the number of farms, while 13 respondents mentioned increased fencing. Many respondents also mentioned that the grazing and forage "space" had decreased in size. Only six respondents referred to an increase in livestock numbers as a factor.
[59] OMITI survey, 2.1.33.
[60] A 1970 committee concluded that livestock ownership was individual and private, without any restriction on its sale, NAN, OVA 49 f. L6/8/4/1 (I), Meeting of the Sub-Committee on Village Planning, 2 September 1970.

all. In 1943, the combined ownership of three related households in Ondonga was 30 head of cattle, one donkey, and 88 goats. When Shikongo Amunkete from Ondonga died in 1946, he owned six head of cattle and a donkey. A 1950 Kwanyama household headed by an ex-serviceman, a person whose wages meant that he was wealthier than average, owned 10 head of cattle and a large herd of goats. During the early 1950s, Ipinge Shingulila from Okakwa in Ongandjera owned 19 cattle (including at least one ox, a bull calf and a heifer calf), a donkey and "some goats."[61] Of a group of ten people who kept cattle on the Angolan side of the border in 1972, three owned one head of cattle each, two had three to four head, one had eight head, one had 11, one had 12 and one owned 31 head of cattle. In February 1975, of four farmers in eastern Ovamboland who were identified as wealthy, one owned 149 head of cattle, a second had 45, a third had 122, and the fourth had 112. [62] Notables typically owned even larger herds. In the early 1930s, a senior headman of the Oukwanyama district had 700 head of cattle while King Iipumbu of Uukwambi owned at least 380 head of cattle and 40 horses.[63] Women also owned cattle and other livestock in Ovamboland throughout the 20th century. A woman from Ondonga district in 1942 owned five cows and one calf. A late 1960s list of 71 cattle owners in four Uukwambi district villages included 18 women (for locations see map 7).[64]

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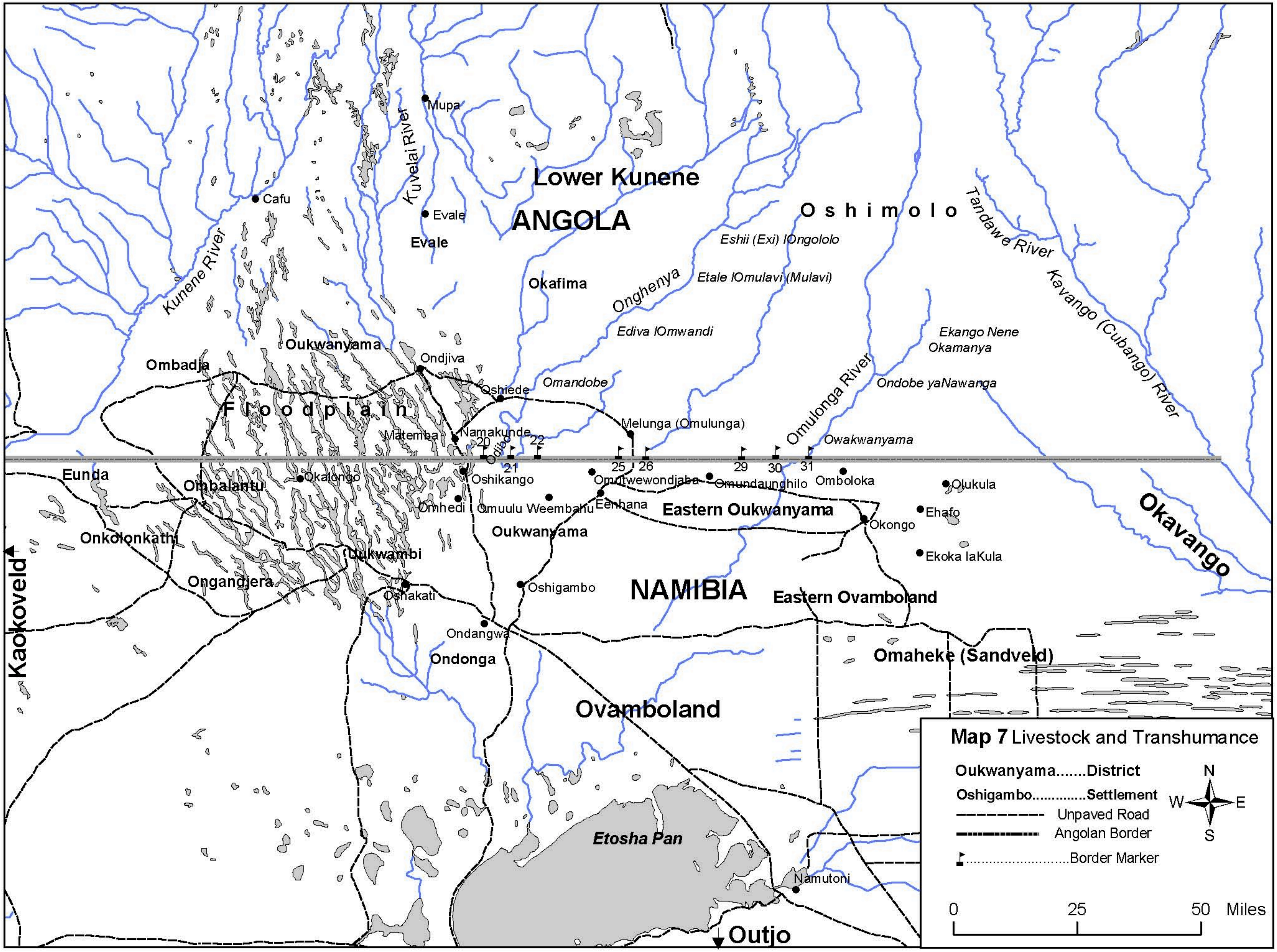
[61] NAN, RCO 4 f. 3/1916/2, RCO to [King] Ipumbu, Ondangwa, 11 December 1915; RCO 3 f. 2/1916/6, Statement Shigundu, Ondonga [Ondangwa], 11 February 1917; NAO 24 f. 15/2(iv), Ukuanyama Census 1938; NAO 90 f. 36/1 (i), NCO to ANC, Ondangwa, 15 May 1948; ANC to NCO, Oshikango, 24 June 1948; NCO to Chief Kambonde, Ondangwa, 30 June 1948; Statement Johannes Disena, Oshikango, 24 June 1948; NAO 55 f. 5/4 (iii?), Kaimbi Mundjele to Master Nakale [NCO Eedes], Ombalantu, 25 October 1949; NAO 72 f. 33/8 (i), National Secretary National Headquarters to ANC, Johannesburg, 5 December 1949 and NCO to National Secretary, Governor-General's National War Fund, Ondangwa, 12 January 1950; NAO 100 f. 42/11 (iv), Statement Namtenya Namtana, Ondangwa, 4 April 1952 and Chief Ushona Shimi (Ongandjera) to NCO, 12 March 1952.

[62] NAN, OVA 61, Monthly Reports Agricultural Officer: Moses Nandjebo [Ohangwena] (Oukwanyma), February 1975; OVA 55 f. 6/20/2/3-7, [Statement] signed Salmon Utoni, Dr. van Heerden and W. Ita, February [1972?].

[63] NAN, NAO 10 f. 5/7, O/C Oshikango to NCO, Oshikango, 31 August 1932 and NAO 9 f. 5/2, NCO to Sec. SWA, Ondangwa, 17 July 1933.

[64] NAN, NAO 93 f. 42/2 (ii), NCO to Magistrate Otjiwarongo, 30 October 1948; OVA 56, f. 6/20/(1)7, Agriculture to Tribal Secretary Uukwambi, 21 February 1969. For examples, see NAO 47 f. 46/1/1, Request for Leave Somon Akuramanana, n.p., [1943?]; OVA 56, f. 6/20/3/2-7 (I), unknown (translated from oshiNdonga by E. Amazila), to Director [Agriculture] Ondonga, 11 December 1968.



Map 7 Livestock and Transhumance
Oukwanyama.......District
Oshigambo.............Settlement
Unpaved Road
Angolan Border
Border Marker
N
S
E
W
0
25
50
Miles
Lower Kunene
ANGOLA
Oshimolo
Mupa
Kuvelai River
Cafu
Evale
Evale
Kunene River
Okafima
Onghenya
Eshii (Exi) !Ongololo
Etale !Omulavi (Mulavi)
Ediva !Omwandi
Tandawe River
Kavango (Cubango) River
Ekango Nene
Okamanya
Ondobe yaNawanga
Omulonga River
Owakwanyama
Oukwanyama
Ombadja
Ondjiva
Oshiede
Omandobe
Floodplain
Matemba
Namakunde
Odibo
Melunga (Omulunga)
20
21
22
25
26
29
30
31
Eunda
Ombalantu
Okalongo
Oshikango
Omutwewondjaba
Omundaunghilo
Omboloka
Olukula
Omhedi
Omuulu Weembahu
Eenhana
Eastern Oukwanyama
Ehafo
Okongo
Oukwanyama
Okavango
Onkolonkathi
Uukwambi
Ekoka laKula
Ongandjera
Oshakati
Oshigambo
NAMIBIA
Eastern Ovamboland
Kaokoveld
Ondangwa
Ondonga
Omaheke (Sandveld)
Ovamboland
Etosha Pan
Namutoni
Outjo

As did men, women purchased and inherited cattle or received cattle as compensation in tribal court cases. In 1952, for example, two Ondonga women received one head of cattle each as “compensation” in a murder case.[65] Increasingly, however, cattle were reconfigured as an exclusive male resource.[66] Although women contested male control over cattle, by the 1950s, women nevertheless may have had, for example, a more difficult time in reclaiming the cattle that had been lent out by deceased relatives, as evidenced by a series of disputes involving the Native Commissioner of Ovamboland.[67] By 1967 – at least in cases brought before the Tribal Council from the Oukwanyama district – the sisters of a deceased cattle owner were excluded from inheriting cattle from their brother, although the deceased’s mother continued to be eligible to inherit cattle. If the deceased owned six head of cattle, his mother received two head of cattle and the remainder was divided amongst the other members of the family (i.e. the deceased’s matrilineal clan members). If the cattle herd was small but included cows, even future calves could be promised to different clan members. The clan could also allow the children of the deceased to keep a head of cattle. If the animal reproduced, the children could divide the animals amongst themselves.[68]

A small sample of Uukwambi villagers in 1969 provides another illustration of the distribution of cattle, although it is unclear whether the samples represented all the villages’ cattle (see Table 6.3).

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[65] NAN, NAO 99 f. 42/11 (iii), Chief Kambonde to NCO, Okaroko (Ondonga), 17 September 1952 and Statement Helena Shilongo, Onethindi.

[66] Kreike, Re-creating Eden, chapter 8.

[67] NAN, NAO 100 f. 42/11 (iv-v), Statements Julia Ita, Ondangwa, 2 November 1953 and Namtenya Namtana, Ondangwa, 4 April 1952 and Chief Ushona Shimi (Ongandjera) to NCO, 12 March 1952; Tribal Secretary to NCO, Uukualuuthi, 4 December 1953; Statement Kanona Elina Shigueda, Ondangwa, 8 December 1953; NAO 98 f. 42/11 (i), Shetuatha Mbashu to NCO, Ukualuthi, 15 January 1949, and Statement Kokondo Amndjela, Ondangwa, 9 February 1949; Statement Mululu Kalongela (Oukwanyama), Ondangwa, 12 May 1948. For additional cases involving the Ondonga and Uukwambi districts and the Uukwaluthi and Ongandjera districts respectively, see NAO 98 f. 42/11 (I), Kambonde to Festus Hango, 30 October 1947 and Shetuatha Mbashu and Ushona Shimi, Uukwaluthi and Ongandjera to NCO, 14 September 1949. See also NAO 98 f. 42/11 (I), Chief Kambonde to RCO (received Ondangwa, 28 May 1948) and NAO 9 f. 5/1, Bourquin Memo “Re. Headman Filemon Shipena of Elope (Ondonga),” 22 January 1942.

[68] NAN, BOS, G. Kautwima to Omutonateli Wowilonga, Ohangewena, 1 March 1967.

Table 6.3 Cattleholdings in Four Uukwambi Villages in 1969[69]

Village	*Unnamed*	*Oshalati*	*Okantaya*	*Okamule*	*Total*
Total cattle	257	429	686	327	1,699
Nr. owners	16	16	26	15	71
Average nr. of cattle	16	27	26	22	24
Minimum herd size	4	13	3	8	3
Maximum herd size	41	62	90	44	90
Owner(s) 1-10 head	1	0	3	4	8
Owner(s) 11-20 head	11	6	9	3	29
Owner(s) 21-30 head	3	4	4	4	15
Owner(s) 31-40 head	0	5	6	3	14
Owner(s) over 40 head	1	1	4	1	7

A 1955/1956 report estimated that the average Ovambo household owned 9 Cattle Units of livestock (a head of cattle or donkey counted as 1 CU, a goat or sheep as 0.2 CU). The report estimated that up to 30% of all cattle (in Uukwaluthi district up to 75%) were owned by the kings and senior headmen.[70] In 1974, the average cattle holdings per owner in Ovamboland as a whole varied between 13 in Uukwambi to 36 in Uukwaluthi. The maximum number of animals per owner varied from 59 in Uukwambi to 194 in Ondangwa B (this is probably southeastern Ondonga); the minimum number of cattle varied from 2 in Uukwambi to 7 in Onkolonkathi (see Table 6.4).

Table 6.4 Cattle Distribution per Owner Differentiated by Traditional Districts, 1974[71]

District	*Total cattle*	*Average per owner*	*Maximum per owner*	*Minimum per owner*
Uukwambi	81,472	13	59	2
Ongandjera	52,000	22	152	4
Ondangwa A	74,773	19	123	4
Ondangwa B	73,933	31	194	4
Oukwanyama	74,703	21	69	2
Okalongo*	37,747	24	140	2
Ombalantu	37,364	17	115	5
Uukwaluthi	35,558	36	136	6
Onkolonkathi	30,318	35	99	7

* Okalongo previously had been included in the district of Oukwanyama

The extent to which the above information pertains to actual cattle ownership is uncertain because of cattle lending arrangements. Cattle lending was widespread throughout Ovamboland, cutting across district (and “ethnic”) borders as well as

[69] NAN, OVA 56 f. 6/20/(1-7), Department of Agriculture to Tribal Secretary Uukwambi, 21 February 1969. Numbers are rounded off the whole numbers.
[70] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956.
[71] NAN, OVA 55, f. 6/20/3/1-7, Memo “Cattlenumbers” State Veterinarian’s Office to Secretary Agriculture, Ondangwa, 26 October 1974.

spanning the Angolan-Namibian border. One owner might entrust cattle to different "clients;" Ipinge Shingula from the district of Ongandjera, for example, kept seven of his 19 head of cattle at his own household and distributed the remainder amongst three different residents of Uukwambi district.[72] In 1993, over 50% of OMITI survey respondents stated that they herded cattle for relatives, friends or others. In 14 detailed examples, the number of cattle herded for others varied from 2 to 40 head and included bulls, oxen, cows, and calves. Thirteen out of 17 respondents who stated that they kept cattle for others had included the lent cattle in the numbers they had provided for themselves. Of a sample of 36, 14 respondents stated that relatives, friends or others herded cattle for them. Thirty percent kept goats for relatives and 20% stated that relatives, friends, and others kept some of their goats.[73] Two out of 21 respondents mentioned that newborn male calves became the property of the caretaker as a reward. Individuals who took care of cattle that were not their own, including herdsmen, were fully responsible for any cattle that was lost.[74]

Only the livestock owner could decide to sell an animal or to slaughter it. Otherwise, the caretaker had almost full use of the animals and their products (e.g., milk and manure) and services (e.g., draught and plowing). Households or individuals that received cattle under a lending arrangement had unrestricted and exclusive use of the manure the cattle produced for as long as the cattle was in their physical care. In 1993, nineteen out of a sample of 21 households stressed that anyone who took care of other people's cattle could use the manure for their own fields.[75] In addition, 15 of 21 respondents specified that they could freely use the dairy products of any cattle in their care. A Sanga cow could produce approximately 1.5-2 gallons (six to eight liters) of milk per day (a calf, however, required a minimum of one gallon [4 liters] a day). During the rainy season, when grazing was abundant, cows were milked twice daily. From July/August-November, very few people consumed milk because the milk

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[72] NAN, NAO 104, "From Petrus Nnjendja, 16 August 1933"; Statement Noyoma Shivora, 11 August 1932, and Statement Festus Hango, Jakob Uguangu, and Junso Jakob, Oshikango and Uukwambi, 5 March 1933; NAO 98 f. 42/11(I), Ntinda Shivute to NCO, Oshendje, October 1947; [King] Kambonde to NCO, Okaroko, 30 October 1947; NCO to Festus Hango, Ondangwa, 4 November 1947; NAO 100 f. 42/11 (iv), Statement Namtenya Nmatana, Ondangwa, 4 April 1952 and Chief Ushona Shimi (Ongandjera) to NCO, 12 March 1952.

[73] OMITI survey, 2.1.4-9 and 2.2.2-3; NAN, BAC 45 f. HN 1/15/4/21, Minutes Tribal Meetings Oukwanyama, 9 May-29 May 1958.

[74] OMITI survey, 2.1.4-9 and 2.2.2-3; NAN, BAC 45 f. HN 1/15/4/21, Minutes Tribal Meetings Oukwanyama, 9 May-29 May 1958.

[75] OMITI survey, 2.1.4-9. See also BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956.

production just sufficed to sustain the calves, which lactated up to an age of 12 to 18 months.[76] The ability to use oxen to plow their fields was emphasized in 1993 by 12 of 21 households that were herding other people's animals.[77]

Small Stock Management

Whereas herdsmen led the cattle to the cattleposts in the ofuka-wilderness during the dry season, goats, other small stock, and donkeys and horses were kept near the villages, where they consequently largely impacted on the village environments. During the rainy season, boys (sometimes as young as four to six years of age), girls, or women herded goats and calves to keep them from damaging crops.[78] Respondents to the OMITI survey in 1993 stated that during the rainy season, the large majority of small stock was herded (only 14% of households with goats did not herd them), and that the herding was principally performed by children (in 49% of the cases). During the dry season, the large majority of households allowed goats (90%), sheep (81%) and pigs (43% of 133 pig-raising households) to roam freely.[79] Because goats and their herdsboys/girls traveled over greater distances to find water and grazing during the dry season(up to 6 miles or 10 km and beyond), their environmental impact stretched further beyond the villages, although it remained confined to the oshilongo environment (see Table 6.5). This meant that by the 1960s,

[76] NAN, BOS f. "Oshikango," Agricultural Officer Ovamboland to Native Commissioners Ondangwa and Oshikango, 17 August 1956 and BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956.
[77] OMITI survey, 2.1.4-9. See also BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956.
[78] Paulus Nadenga, interview by author, Oshomukwiyu, 28 April 1993; NAN, NAO 18-20 f. 11/1 (i-iii, v, x), Monthly Reports Ovamboland, February and September 1927, November 1928, June-August and November-December 1929, May-June and November-December 1930, September-October 1932, October-December 1937, and July-August 1938; NAO 60 f. 12/1 (I), Quarterly Report Ovamboland October-December 1952; NAO 90 f. 36/1 (ii), Statement Haipinge Makanda, Ondangwa, 22 April 1950; NAO 13 . 6/2/5 (i), NCO to Secretary SWA, 12 December 1934 and NCO to Secretary SWA, Ondangwa, 18 January 1935 and Alho (FMS) to NCO, Olukonda, 15 January 1935, and f. 6/3/1, Statement Lucas Shilunga, 17 September 1935; NAO 45 f. 45/1, Statement Andreas ya Zacharias, Onayena, 18 January 1940; NAO 10 f. 5/7, Minutes of a Special Meeting, 19 June 1931; A450, 9 f. 2/33, Tobias, October 1938; NAO 45 f. [45/1], Statement Matteus Angula, 14 September 1939; NAO 91 f. 36/3 (ii), Chief Kambonde to NCO, Okaroko, 14 June 1953 and f. 36/1 (iii), Statement Thomas Kupila, 5 May 1954; NAO 92 f. 36/3 (iii), Council Headmen Ombalantu to NCO, 9 October 1954; NAO 46 f. 45/1/13, Statement Nangombe Nute, Appendix to NCO to Attorny-General, Ondangwa, 4 June 1941; A450 vol. 12, SWA Commission, Minutes of Evidence vol. 12, Ukauluthi, 13 August 1935, evidence Hahn, p. 654; BAC 45 f. HN 1/15/4/21, Minutes Tribal Meetings Oukwanyama, 8-22 November 1957; WAT 146 f. 81/22(vii), Water Affairs to Director Windhoek, Ondangwa, 19 October 1961; MacDonald Diary, pp. 2, 9; Kreike, "Recreating Eden," ch. 8.
[79] OMITI survey, 2.2.4-5, 2.2.6.0-1, 2.2.20-1, 2.4.2.0-1, 2.4.3.

when villages in the floodplain were abutting, goats affected virtually the entire local environment.

Table 6.5 Distances from Farm to Grazing and Water for Goats[80]

Location	*Rainy season grazing (N=237)*	*Dry season grazing (N=216)*	*Rainy season water (N=245)*	*Dry season water (N=248)*
At farm*	84*	56*	88*	28*
0-1 km	156	98	162	99
2-5 km	39	73	22	100
6-10 km	3	29	2	29
Over 10 km	2	5	2	5

*Most of the "at farm" category is included in the 0-1 km category

Livestock and Deforestation

In the 1970s and 1980s, foresters and other experts perceived the relationship between livestock and "forest" in Africa in negative terms: livestock caused deforestation.[81] Foresters in South West Africa were no exception: the regional forester responsible for Ovamboland stressed in 1973 that goats killed all the young trees and reported in 1976 "[that] [l]arge parts of Owambo [Ovamboland] are already without foddertrees – the cattle and goats eat all the young trees."[82] Foresters feared that livestock browsing on trees would result in deforestation and soil degradation.[83] Yet, evidence of livestock-caused environmental degradation is hard to pinpoint. Casual observations about a lack of tree regeneration such as those made by the regional forester in 1970 are problematic because tree regeneration is often difficult to identify. Many indigenous trees in southern Africa have a suffrutex habit: the seedling dies back above ground, but its root system continues to develop. At any given time, for example, the large majority of a population of Transvaal teak (omuuva) may be in the suffrutex stage, which can last for seven to ten years. In the case of a sample of 14

[80] OMITI survey, 2.2.5.0-1, 2.2.6.0-1.
[81] Le Houérou, The Grazing Land Ecosystems of the African Sahel, pp. 90-128; H. Gillet, "Observations on the Causes of Devastation of Ligenous Plants in the Sahel and their Resistance to Destruction," Le Houérou, Browse in Africa, pp. 127-129; Westoby, Introduction to World Forestry, pp. 172-173.
[82] NAN, OVA 57, f. 7/2-7, Report on visit to SWA, 3-15 November 1969, appendix to Dr. H.A. Lueckhoff to Chief Director Department of Bantu Affairs, Ondangwa, 3 April 1970 and OVA 57, f. 7/4/1-7, P.J. Le Roux, "Planning Indigenous Forests," appendix to Regional Forestry Officer to Sec. Forestry, Grootfontein, 26 November 1973 and ibid, "Inventory: Indigenous Forests," to Sec. Agriculture, Ondangwa, 5 November 1976.
[83] NAN, OVA 57 f. 7/4/3-7, Supply Inventory: Indigenous Forests Ovamboland, Le Roux to Sec. Agriculture, Ondangwa, 5 November 1976.

Transvaal teak specimens taken from Ovamboland in 1969 the suffrutex stage had lasted from three to 23 years (the average was 9 years).[84]

Moreover, two indicators of degradation caused by overgrazing that are widely used elsewhere nevertheless are infrequently employed in the case of Ovamboland. For example, while bush encroachment has not been identified as an issue in Ovamboland, it is cited as a major problem in the livestock ranching areas to the south as well as in the former "Native Reserves" in Namibia and South Africa. In addition, veterinary officials identified poisonous plants as being a problem in Ovamboland. The mere presence of such plants, however, is an unreliable proxy for overgrazing because even if the plants truly were nasty invaders, herdsmen could prevent livestock from eating them and the animals apparently learn to evade them. Thus an increase in the incidence of plant poisoning is a poor indicator of vegetation degradation since it may result from a decline in the quality of herd management as opposed to being a consequence of overgrazing per se.[85]

Livestock and Woody Vegetation Browsing

In much of Africa, as elsewhere in dry environments, livestock and wildlife are critically dependent on woody vegetation. Scientists working on tropical Africa, however, have only relatively recently begun to examine the importance of woody vegetation as browse and the topic is still underresearched.[86] Livestock raising in Ovamboland's extreme semi-arid environment created a heavy dependence on woody vegetation. During Ovamboland's long dry season, nutrient deficiencies were a major problem and woody vegetation foraging held the key to livestock survival not only during the dry season but also during droughts. After the rains ceased, the grasses in much of Ovamboland declined in palatability and nutrient content, conditions that in

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[84] G.D. Piearce, "Natural Regeneration of Indigenous Trees: The Key to Successful Management," Piearce and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, p. 115. For Ovamboland, see NAN, OVA 57 f. 7/2-7, Lueckhoff, "Report on a visit to South West Africa, November 3-15, 1969," appendix Regional Forester to Director-in-Chief Department of Bantu Administration and Development Pretoria, Grootfontein, 3 April 1970.

[85] NAN, NAO 59 f. 9/17 (i), Dr. M. Zschokke, "Survey of Cattle Diseases in Ovamboland: October 1948," 5 November 1948 and OVA 6 f. 2/8/2-7(ii), Annual Report Veterinary Service Owambo 1975/1976.

[86] See Le Houérou, Browse in Africa, p. 3 and the contributions by B.H. Walker, "A Review of Browse and its Role in Livestock Production in Southern Africa," p. 12; C.M. McKell, Multiple Use of Fodder Trees and Shrubs – A World Wide Perspective," pp. 141-149; G.E. Wickens, "The Uses of the Baobab (Andansonia digitata L.) in Africa," pp. 151-154; and H.N. Le Houérou, "The Role of Browse in the Management of Natural Grazing Lands," pp. 329-338. See also M.B. Adjei and J.P. Muir, "Current Developments from Tropical Forage Research in Africa," Sotomayor-Ríos and Pitman, Tropical Forest

southern Africa usually define "sour" pastures.[87] In referring to the end of the rainy season and drought periods, colonial reports often simply noted that grazing had become "bad" or "poor" (in terms of nutrition), and the reports noted a rapid decline in the condition of the livestock and a sharp increase in the incidence of cattle diseases. Deficiencies in phosphate, natrium, copper, and protein in dry season forages were pronounced and, phosphate deficiency, for example, was directly linked to a variety of cattle diseases, including the highly prevalent botulism. Chemical analysis of 33 grazing samples from Ovamboland collected at the end of the rainy season in April 1969 revealed phosphate shortages in all samples. The authors of the report considered a reasonable grazing phosphate content to be 50-60 parts per million (ppm) but the samples that were drawn from the sandy soils of Ovamboland's "indigenous forest" contained only 20 ppm. Liver analysis of a small number of cattle from Ovamboland also indicated a significant copper deficiency.[88] Commenting on heavy livestock losses in 1941 following a series of drought years, the author of the annual report for Ovamboland pointed out that while goats somehow always found food, "[a]s for large stock it is hard to understand on what the Ovambo beast subsists at the present time."[89]

The answer is trees and bush. Typically, late in the rainy season and during the dry season, "the bush," "bush" or "bush country" were referred to as the major source of livestock food in general and in particular for cattle, although the word "grazing" continued to be used in reports where "browsing" would have been more accurate.[90] In July 1939, for example, the Assistant Native Commissioner wrote:

Plants, pp. 331-355, especially 351 and Frost, "The Ecology of Miombo Woodlands," Campbell, The Miombo in Transition, pp. 11-57, especially pp. 36-38

[87] NAN, NAO 18 f. 11/1 (I), Monthly Reports Ovamboland, February-March 1928; NAO 101 f. 43/3, Agricultural Survey of Ovamboland, Windhoek, 26 October 1947; NAO 62 f. 12/5, Agricultural Report Ovamboland, Omafu 30 November 1953.

[88] NAN, AHE (BAC) 1/352 f. (14) N8/21/4, Annual Report Agriculture Ovamboland, 1968; OVA 40 f. 6/5/2, Deputy Head Veterinary Services to Director-in-Chief Ovamboland, Windhoek, 29 August 1969 and appendix "Chemical composition of grazing samples in Ovamboland," 23 April 1969 and f. 6/5/1-7, Ovambo Government, Report "Verhoging van die Beesvleis produksie in Ovambo…," 5 August 1971; OVA 56, f. 6/20/4/2-7 (I), Secretary Bantu Administration and Development to Director Agriculture Ondangwa, Pretoria, 11 June 1971; OVA 46, f. 6/8/1/1-7 (ii), Department of Agriculture to Secretary Bantu Administration Pretoria, Ondangwa, 17 November 1971; OVA 57 f. 7/4/3-7, Forest Inventory Indigenous Forests Ovamboland, Le Roux to Sec. Agriculture, Ondangwa, 5 November 1976; OVA 6, f. 2/8/2-7 (ii), Annual Report Veterinary Services Ovamboland, 1978/1979.

[89] NAN, A450 vol. 7 f. 2/18, Annual Report Ovamboland 1941.

[90] NAN, NAO 17 f. 10/3 (i), NCO to Clarke, Ondangwa, 17 July 1933; NAO 23 f. 13/5, NCO to O/C Oshikango, Ondangwa, 15 July 1939 and O/C Oshikango to Wessels, [Oshikango] 17 July 1939; NAO 18-20 f. 11/1 (iii, ix, xi), Monthly Reports Ovamboland, November-December 1930, September-October 1936, September 1938; NAO 60-61, f. 12/1 (i-ii), Quarterly Reports, Ovamboland April-

> [i]n the Eastern Ondonga-Ukuanyama bush [eastern Ovamboland] the grazing on the whole is good, and once away from the Omusati [omufyaati or mopane] belt there is an abundance of Efufe [ofufe or Baphia massaiensis] and Ompanda [omupanda or Lonchocarpus capassa and/or L. nelsii] bush, the foliage of which is greatly sought after by both cattle and horses and which is a real stand-by during years of drought.[91]

Early in 1960, most of Ovamboland (except the northeast) suffered from a severe drought. No (fresh) grass was available; the only green vegetation consisted of trees and bush "on which the livestock largely lived."[92] In the West African Sahel, many trees and shrubs develop new leaves several weeks before the onset of the rainy season; the leaves are the only green vegetation available to the livestock and wildlife that otherwise survive on dry grass that has little nutritional value.[93] In dry areas of the West African Sahel, woody vegetation browse contributed from 5% of livestock intake in the rainy season and early in the dry season to 15-25% during the peak of the dry season. Dry grass continued to provide most of the energy. Although such browsers as goats, eland, impala, kudu, and elephant can sustain themselves on a diet that consists exclusively of woody vegetation, cattle cannot; an exclusive browse diet does not meet cattle's energy requirements (see Table 6.6).[94]

Table 6.6 Feed Value of Dried Grass and Browse during the Dry Season[95]

	Net. Energy Kcal/Kg Dry Matter (DM)	*Digestible Protein g/Kg DM*	*Phosphorous g/KG DM*	*Calcium g/Kg DM*	*Carotene mg/kg DM*
Dry Grass/ Straw	600-800	0.1	0.1	1.5-3.0	0.1
Browse	400-700	56-300	1.5-2.5	2.5-20.0	50-800
Maintenance Needs per Head of Cattle	700	50	1.3	2.5	1.5

Moreover, seasonal variation in the nutritional value of browse is considerable, as indicated by the South African research on mopane (see Table 6.7).

September 1948, April-December 1949, October-December 1953; NAO 41 f. 34/2, Famine Relief Report Ovamboland, October 1930. Mopane bush and other trees/bushes that cattle and goats feed on become green before most grasses, Personal observations, 1991-1993.
[91] NAN, NAO 9 f.5/1/1, O/C NAO to NCO, Ondangwa, 26 July 1939.
[92] NAN, BAC 123 f. HN7/8/2/1, Chief Bantu Commissioner SWA to Sec. Bantu Administration, Windhoek, 8 February 1960.
[93] Le Houérou, The Grazing Land Ecosystems of the African Sahel, pp. 49-50, 82.
[94] H.N. Le Houérou, "The Role of Browse in the Management of Natural Grazing Lands," Le Houérou, Browse in Africa, pp. 329-338.
[95] Le Houérou, "The Role of Browse," Le Houérou, Browse in Africa, p. 330, Table 1.

Table 6.7 Chemical Composition of Mopane Leaves from the Northern Transvaal[96]

	% Crude Protein	*% Crude Fiber*	*% Calcium*	*% Phosphorous*
January	13.7	28.1	1.51	0.19
May	11.4	25.6	2.28	0.20
Maximum	16.6	28.1	3.23	0.23
Minimum	8.4	21.9	1.15	0.12

After unsuccessful early 1960s trials with exotic Atriplex munularia fodder bush at Okatana, a forester in the late 1960s recommended trials with local fodder trees, including jackalberry (omwandi), apple leaf (omupanda), sheperd's tree (omunghudi or Boscia albitrunca), Phyllogeiton dicolor, camel thorn (omwoonde or Acacia erioloba) and mopane (omufyaati).[97] A 1976 report recommended that cobalwood (omushii or Guibourtea coleosperma) and apple leaf (omupanda) should not be cut down for commercial purposes because they were fodder trees, and because the latter's timber volume was small.[98]

Late 1960s and 1970s trials with indigenous cattle and forages revealed that the bush and tree leaves in Ovamboland remained nutritious much longer and that they contained much higher concentrations of such essential minerals as, for example, phosphate (P) and copper (Cu). Rhodesian teak (omupapa), wild seringa (omutundungu), and Transvaal teak (omuuva) were especially prevalent on the sandy soils of eastern Ovamboland, while leadwood (omukuku or Combretum imberbe) was abundant on Ovamboland's calcrete soils (see Table 6.8).

[96] B.H. Walker, "A Review of Browse and its Role in Livestock Production in Southern Africa," Le Houérou, Browse in Africa, pp. 16, table 9. The crude protein, P, and CA values for mopane are in the same approximate range as those of Leucaena leucocephala and Acacia albida/Faidherbia albida, although Leucaena is higher in crude protein and mopane higher in CA, see R.C. Gutteridge and H.M. Shelton (eds.), Forage Tree Legumes in Tropical Agriculture (Wallingford, UK: CAB International, 1994), pp. 180, table 4.1.1. and 182, table 4.1.2.

[97] NAN, BAC 131 f. HN 8/17/4, Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957; BAC 132 f. HN 8/18/3/1/1 Trust Farming Projects (1960-1962), Agriculture Officer to Bantu Commissioner, Grootfontein, 30 July 1961 Report on Work on Okatana Irrigation Scheme, 30 July-11 September 1961; Chief Bantu Commissioner to Bantu Commissioner Grootfontein, Windhoek, 3 August 1961; Agriculture Officer Grootfontein to Bantu Commissioner, Grootfontein, 31 July 1962 and Chief Bantu Commissioner to Bantu Commissioner Ondangwa, [Windhoek], 4 September 1962; OVA 57 f. 7/2-7, Dr. H.A. Lueckhoff, "Report on a visit to South West Africa, November 3-15, 1969," appendix Regional Forester to Director-in-Chief Department of Bantu Administration and Development Pretoria, Grootfontein, 3 April 1970. During drought conditions in 1959-1960, grass was scarce in most of Ovamboland by early February; only bush and trees were green and they formed the main diet for livestock, BAC 123 f. HN 7/8/2/1 Emergency Assistance Ovamboland vol. 3, Chief Bantu Affairs Commissioner SWA to Secretary Department Bantu Affairs, Windhoek, 8 February 1960.

[98] NAN, OVA 60 f. 7/4/3-7, Report on Assessment of Indigenous Forests Ovambo, 19 July 1976. and OVA 57 f. 7/4/3-7, Inventory Indigenous Forests Owambo, Le Roux to Sec. Agriculture, Ondangwa [5 November 1976].

Table 6.8 Mineral Contents of Tree Leaves (Parts Per Million)[99]

Tree species	*Fe*	*Mn*	*Zn*	*Cu*	*Al*	*Na*	*Ca*	*Mg*	*K*	*N*	*P*
Baikiaea plurijuga	2310	4562	250	46	136	144	7300	2300	5500	14400	850
Burkea africana	3425	955	189	74	144	80	4100	2200	1300	11300	270
Pterocarpus angolensis	64	545	21	6.8	22	29	7800	2800	8400	32000	1300
Combretum imberbe	74	38	25	6.0	50	61	29000	2800	12300	18200	1000

A 1979 report on indigenous cattle in southern Africa emphasized that

> Sanga cattle are also browsers…they make use of foliage in their diets and therefore withstand droughts in bushveld better than any grazers since they often obtain sustenance from green leaves of a number of tree species or fallen leaves picked up beneath the tree.[100]

The 1975/1976 progress report of the Ovamboland cattle project noted that green mopane bush land supplied forage late in the dry season and early in the rainy season that was superior to forage contained in the dry oshana grassland in the flood channels early in the dry season.[101] The less nutritious "oshana pastures" consisted of grasses and herbs with little or no tree or bush vegetation. Significantly, the "mopane pastures" were mainly covered with (mopane) bush rather than grass.

Late 1960s trials at Ogongo involving a plot of mopane pasture showed mopane as by far the dominant tree and bush. In the selected circle quadrants of the total of 1,297 bushes and trees, 84% consisted of mopane, more than half in the form of bush. The weight of dry vegetative matter on the mopane pasture plot was found to be 1,160 kg/ha. while a trial plot of combretum pasture only contained half that amount. Although researchers found the tree and bush cover of the combretum pasture to be high and the relative grass cover to be low, they nevertheless concluded that it could sustain one Cattle Unit (CU) per 10 hectare.[102] Additional 1970s research

[99] The first three trees grew in sandy soils in the forests of the Okavango and Ovambo regions; the last one grows on calcrete soils and was added for comparison. See OVA 57 f. 7/4/3-7, Le Roux to Sec. Agriculture, Ondangwa, 5 November 1976, "Forest Inventory: Indigenous Forests Owambo," Table 5.
[100] NAN, OVA 26, f. 4/4/1-7, H. Hamburger, C.W.B. Amstrong, and J. Swanepoel, "Adaptability and Reproductive Efficiency: The Value of Indigenous Sanga Cattle in the National States of South Africa and Namibia," RSA, Department of Co-operation and Development [1979?].
[101] NAN, OVA 56, f. 6/20/3/2, F.J. van der Merwe (Veterinary Studies, University of Stellenbosch), Progress Report 1975/1976: "Research into the Observed Low Meat Production Potential of the Indigenous Cattletype in Owamboland and its Causes."
[102] NAN, OVA 44 f. L6/8/1/1, D.P. Opperman, Grazing Official, and C.L. Prinsloo, Botanical Survey and Physical Planning Orongo Trial Area, Appendix to D. Opperman to Director Agriculture, Windhoek, 28 July 1969. A 1979 report also noted the importance of mopane as a dry season source of fodder, OVA 26, f. 4/4/1-7, "Owambo Livestock Practices," appendix to Secretary Department of Agriculture and Forestry to Secretary Department of Bantu Administration and Development, Pretoria, Ondangwa, 10 March 1977.

on oshana pastures concluded that the pastures were abundant in central Ovamboland, that they received large amounts of floodwater in addition to local rainfall, and that the pasture was "sweet."[103]

Respondents to the 1993 OMITI survey underscored the importance of tree fodder for cattle. They identified (Kalahari) apple leaf (omupanda), real fan palm (omulunga), mopane, sand camwood (ofufe or Baphia massaiensis), silver cluster leaf (omwoolo), marula (omwoongo or Sclerocarya birrea) birdplum (omuve or Berchemia discolor), okapoloti, and fig (various Ficus spp.) as the most important fodder trees. They listed buffalo thorn (omukekete or Ziziphus mucronata), baobab (omukwa or Adansonia digitata), coffee neat's foot (omutwanghuta/ omutanghuta or Bauhinia petersiana and/or B. macrantha), Transvaal teak (omuuva), jackalberry (omwandi), and camel thorn (omwoonde) as minor fodder trees. The same tree resources were important for goats, although palm, apple leaf, and sand camwood were relatively more important for goats than cattle. Most tree fruit was a relatively unimportant source of fodder for cattle, but the fruit of the camel thorn and to a lesser extent fig, was important for goats; even the fruit of the palm tree, although it was of far less importance, was mentioned by 10% of respondents.[104] The importance that OMITI survey respondents attributed to the young leaves of apple leaf (omupanda), palm, sand camwood (ofufe), mopane, silver cluster leaf (omwoolo), marula (omwoongo), birdplum (omuve), fig, okapoloti, and to a lesser extent to shoots of sand camwood, okapoloti, apple leaf, mopane, palm, fig, silver cluster leaf, marula, camel thorn, and birdplum is testament to the crucial role of browse to livestock early in the rainy season and probably just before the onset of the rains.[105]

Despite the clear dependence of Ovamboland's livestock on woody vegetation in both the oshilongo and the ofuka-wilderness, fears that livestock browsing would automatically lead to deforestation were not shared universally. Ovamboland's director of agriculture, for example, disputed concerns expressed by the Secretary for Bantu Administration in Pretoria in 1972 that overgrazing threatened the homeland's palm trees. Although the director could not confirm whether palm trees were diminishing in number, he emphasized that it was his impression that palm trees

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[103] NAN, OVA 43 f. 6/5/4. J.G.V. Joubert, "Final Report: Research on the Productive Potential and Best Use of Oshana Pasture Veld in Owambo," Appendix to Secretary Department of Plural Relations to Secretary Agriculture and Forestry, Ovambo Government, Pretoria, 5 June 1979.
[104] OMITI survey 2.1.26(cattle) and 2.2.7 (goats).
[105] OMITI survey, 2.1.26. For the English names of the trees, see appendix 1.

suffered little or no damage from livestock browsing and that palm tree recruitment was clearly occurring.[106] Indeed, ambiguity about the impact of livestock on woody vegetation in general is marked: some studies stress the positive impact of light to moderate livestock grazing in terms of increased productivity.[107]

In both Ovamboland and the southern African region in general, mopane emerges as a significant browse species. In terms of its dominant presence, usefulness, tenacity, and symbolism, and its ambiguous invasive properties, mopane is in fact very much the oak of Africa (or the oak is the mopane of the West). [108] Like oak in temperate and subtropical Europe and North America, mopane is an important source of browse in tropical southern Africa.[109] Its browse utility in Ovamboland emerges clearly: colonial experts identified it as an important livestock fodder plant; trials at Ogongo Agricultural College highlighted the fodder potential of mopane forage; and respondents to the OMITI survey identified it as a critical browse species. [110] Again, like oak, mopane leaves are high in tannins. Research indicates that young mopane leaves may be so high in tannins that they are avoided by most ungulates: when they are dry, however, cattle and wild ungulates eat them readily.[111]

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[106] NAN, OVA 49 f. 6/10/2-7(I), Director Agriculture Owambo to Sec. Bantu Administration, Ondangwa, 25 February 1972; State Forester to Director Agriculture, Ondangwa, 21 February 1972; Sec. Bantu Administration to Director Agriculture, Pretoria, 9 February 1972.

[107] D.M. Swift, M.B. Conghenour, and M. Atsedu, "Arid and Semi-Arid Ecosystems," T.R. McClanahan and T.P. Young, eds, East African Ecosystems and their Conservation (New York and Oxford: Oxford University Press, 1996), pp. 243-272, especially pp. 261-269 and W.D. Pitman, "Contrasts in Current Developments with Tropical Forest Research in Asia and the Americas," Sotomayor-Ríos and Pitman, Tropical Forest Plants, pp. 357-370, especially p. 361. See also J. Piot, "Management and Utilization Methods for Ligneous Forages: Natural Stands and Artificial Plantations," Le Houérou, Browse in Africa, pp. 339-349, who stresses that seeds ingested by cattle that pass through the digestive system undamaged are more likely to germinate (p. 342). McKell asserts that livestock moves on before the vegetation has disappeared, C.M. McKell, "Multiple Use of Fodder Trees and Shrubs – A World Wide Perspective," Le Houérou, Browse in Africa, pp. 141-149, especially 141.

[108] For mopane's importance in Zimbabwe, see P.T. Mushove and J.T. Makoni, "Coppicing Ability of Colophospermum mopane," Piearce and Gumbo, The Ecology and Management, pp. 226-230.

[109] Walker, "A Review of Browse," Le Houérou, Browse in Africa, pp. 12-14, 16-17, Tables 8-9 and p. 22. The crude protein, P, and Ca. values for mopane are in the same range as those of Leucaena leucocephala and Acacia albida/Faidherbia albida, see Gutteridge and Shelton, Forage Tree Legumes, pp. 180, 182, Tables 4.1.1., 4.1.2.

[110] OVA 56, f. 6/20/3/2, F.J. van der Merwe, Progress Report 1975/1976: "Research into the Observed Low Meat Production Potential of the Indigenous Cattletype in Owamboland and its Causes." OVA 44 f. L6/8/1/1, D.P. Opperman, Grazing Official, and C.L. Prinsloo, Botanical Survey and Physical Planning Orongo Trial Area, Appendix to D. Opperman to Director Agriculture, Windhoek, 28 July 1969. A 1979 report also noted the importance of mopane as a dry season source of fodder, OVA 26, f. 4/4/1-7, "Owambo Livestock Practices," appendix to Secretary Department of Agriculture and Forestry to Secretary Department of Bantu Administration and Development, Pretoria, Ondangwa, 10 March 1977. OMITI survey 2.1.26 and 2.2.7.

[111] Walker, "A Review of Browse," Le Houérou, Browse in Africa, p. 10.

Conclusion

The declinist, neo-Malthusian inspired “overstocking” narrative that is based on the premise that livestock mismanagement is a primary cause of environmental decline, i.e., erosion, deforestation, and desertification seems highly problematic. Domestic animals were both a cause and an effect of environmental change in 20th century Ovamboland. They effected environmental change because refugees and migrants from the early 20th century Ovambo polities brought animals with them as they settled the wilderness areas of the floodplain and beyond the floodplain, they competed with wildlife for precious water and forage resources.

The more decisive agency was mediated through human management of the region’s animal populations. Cattle owners and herdsmen made the decisions about where to take which cattle. They also managed livestock numbers (through take-off for slaughter, for example). Moreover, despite the prevalence of the “pre-colonial cattle complex” paradigm, cattle was a major export in the immediate pre-colonial era. Colonial measures dramatically reversed the commercialization of Ovamboland’s indigenous cattle because colonial officials sought to contain domestic animals, and to conserve wild animals. The available evidence does not support colonial officials’ thesis that a severe decline in grazing quality and deforestation resulted from an increase in livestock numbers, even though livestock were critically dependent on woody tree vegetation during the dry season. While an overall decline of ofuka-wilderness did lead to a decline of readily available dry season cattle post areas, the loss did not result from overstocking or overgrazing. Rather, it was caused by the transformation of ofuka into oshilongo landscapes of villages and farms, and by colonial attempts to correct what officials and experts (erroneously) perceived to be local mismanagement of Ovamboland’s animal resources.

CHAPTER 7
DEFORESTATION

Deforestation in Ovamboland was real. As people fled south across the colonial border from the northern floodplain or fanned out from the heartlands of the occupied southern floodplain polities, they cut woody vegetation to construct new homesteads and to clear new fields. For example, the Native Commissioner for Ovamboland wrote in 1931:

> [T]he Ovambos, who are agriculturalists, when they established themselves in the first instance, cut away into the bush and cleared spaces to make room for their fields. The timber and scrub thus cut away is firstly used to build their pallisaded kraal and secondly to enclose the borders of their lands, etc.[1]

Wood for constructing the original homestead was not only sourced from the area which became the farm plot, but also from beyond it. Thus, in spatial terms, the deforestation footprint extended beyond the confines of each particular farm. Moreover, the nature and extent of "deforestation" differed. On the farm plot proper, the objective was to clear off the woody vegetation in order to build a homestead and livestock kraals and to lay out the crop fields. The household destroyed the majority of the trees and the bush on the farm plot without much concern for regeneration, employing fire as a major tool. Only selected trees and bushes from the original vegetation were spared. Outside of the farm plot, however, where the wood was sourced, occupants coppiced trees and bush or lopped off poles and branches with the aim of allowing re-growth. This chapter first describes the different views that local inhabitants and colonial officials held of the environmental transformation that occurred as a result of the expansion of farmland in the floodplain. Next, it outlines the related environmental, social, and political factors that led to forest and bush clearing on the higher ground in the floodplain.

"The hoe determines the borders of the field"

In 1860s northern floodplain Oukwanyama, the local headman had the prerogative to grant permission for land to be cleared in the uninhabited ofuka-wilderness to build a farm and to make fields. Clearing a new plot enabled a household to lay out larger fields; the size was limited only by labor capacity, as is captured in

[1] NAN, SWAA 3, f. A1/2 (I), NCO to SEC. SWA, Ondangwa, 20 April 1931.

the saying: "the hoe determines the borders of the field."[2] Tree stumps were left in the crop fields.[3] The homestead, fields, and livestock kraals were demarcated with a thorn bush fence. In the early 1880s, the fenced farm of an Ombadja king enclosed the homestead, the cattle kraal, and fields that were so expansive that the area resembled a plantation.[4] Fields were commonly located around the homesteads, except in Ondonga, where the homesteads were constructed on the edge of the crop fields.[5] In some areas, farmers situated their homesteads around pans.[6] In 1917, in the "tribal areas," i.e. the oshilongo-inhabited areas of the southern floodplain, fields of neighboring farms were located closely together, separated by tracks. Ondangwa was "surrounded by fields and kraals" and during the 1917 military expedition against the rebellious Kwanyama King Mandume, the South African forces were stationed in the uninhabited flats southwest of Ondonga in order to prevent crop destruction and the infringement of "native rights".[7] Late 19th century visitors were impressed by the layout, size, and productivity of the floodplain crop fields: grain surpluses were stored in huge baskets and food was readily offered for sale, and in abundant quantities.[8] Millet and sorghum were the floodplain staples, with beans, pumpkins, and bambara nuts as secondary crops. During the dry season, stored grains were often the only food available.[9]

Shifting Cultivation?

In correspondence to his superior in Windhoek in 1941, Ovamboland's Native Commissioner described what he perceived to be wasteful shifting cultivation:

> [t]he system of shifting cultivation is also responsible for the destruction of timber, mostly mopane which is very plentiful. Ovambos on the whole make

[2] Wülfhorst, Shiwesa, pp. 7-8 and Wülfhorst, Moses, Eine Erstlingsfrucht aus den Ovambo (Wuppertal-Barmen: Missionshaus Verlag, n.d.), pp. 14-15.
[3] Wülfhorst, Moses, pp. 7-22, 36-37.
[4] NAO 104 C.L. Anderson to Hahn, diary Jordan.
[5] AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892 and RMG 2518 [?] C/h 52, Speiker, Visitationsbericht, Namakunde 13-18 July 1906; Möller, Journey, pp. 110-111, 126; NAN, NAO 104 Anderson to Hahn, Jordan diary and A233, J. Chapman, 1903-1916, 1876[?] [pp.61-62], and A450 Vol. 6 f. 2/2, Intelligence Report no. 10, Namakunde 3/1/1917.
[6] Lau, Carl Hugo Hahn Tagebücher, vol. iv, 22 and 23 July 1857, pp. 1040-1045.
[7] NAN, RCO 10, f. 15/1916/1, RCO and Hahn, Preliminary memo re[garding] Ovamboland and Chief Mandume, [1916] and RCO to staff officer Union forces SWA, Ondonga, 3 December 1916.
[8] Lau, Carl Hugo Hahn Tagebücher, 22-23, 27 July 1857; AVEM, RMG 2599 C/i 19, Beersmann, Omburo, 6 January 1892; NAN, A233, J. Chapman, 1903-1916, 1876[?] [pp.61-62] and NAO 104 Anderson to Hahn, Jordan diary; Möller, Journey, p. 110.
[9] Lau, Carl Hugo Hahn Tagebücher, 22-23, and 27 July 1857; NAN, A233, J.Chapman, 1903-1916, 1876[?] [pp.61-62] and NAO 104 Anderson to Hahn, Jordan diary; Lima, A Campanha, pp. 155, 159; AVEM, RMG 2518 [?] C/h 52, Speiker, Visitationsbericht, Namakunde 13-18 July 1906 and RMG 2599 CNDIH, Avulsos, Caixa 3703, Processo Missão de Estudos no Sul de Angola, 1914-15, Relatorio do Mes de Outubro [1914].

> good use of manure, but the quantity available is not sufficient and the regular clearing of new fields is unavoidable.[10]

As a first-hand observer of the extent of the destruction wrought on woody vegetation in what had been uninhabited bushlands in the late 1910s and 1920s, the Native Commissioner's use of the image of shifting cultivation is probably not surprising. Officials and missionaries in the 1920s and 1930s especially witnessed intense deforestation as thousands upon thousands of pioneer settlers streamed into the ofuka of Ovamboland. The specter must have been appeared similar to the massive forest clearing that threatens the forests of, for example, the Amazon and Indonesia today. In Ovamboland's ofuka, settlers not only cut down large amounts of poles to construct huts, palisades, kraals, and fences, but also decimated the vegetation on their prospective farm plots. Still, the Native Commissioner for Ovamboland observed "unless of course permanent clearings are made for new kraals or fields, the Ovambos usually see that the trees is [sic] not destroyed." Fire was the settlers' preferred tool when clearing land for farms and fields. A concerned agricultural expert commented in 1924:

> Natives are very destructive of the natural bush & their method of clearing ground is not economical. The usual method is to put a fire around a tree until it falls, no effort being made to remove the stump…. The destruction of the bush, without any effort to replant in suitable places will mean at an early date the extension of the desert & it is a problem requiring immediate & careful attention.[11]

The delimitation of the Angolan-Namibian boundary in 1927 spurred a new wave of refugee movements into the middle floodplain wilderness: "[n]ew kraals are seen everywhere and many natives are busy felling trees and clearing places for further settlement."[12] A few years later, the Native Commissioner commented on the

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[10] NAN, SWAA 3 f. Administration, Forestry: Indigenous Forests Ovambo A1/2 (I), NCO to CNC, Ondangwa, 2 June 1941. See also NAO 62 f. 12/5, Agricultural Report Ovamboland 1953 and NCO to CNC, Ondangwa, 11 March 1954.

[11] NAN, NAO 26 f. 21, Report Ovamboland Cotton Prospects appendix to Alec Crosby to Bishop of Damaraland [Mss.], St. Mary's Mission, 11 January 1924. See also O/C NA Oshikango to NCO, Oshikango, 20 June 1938; NAO 10 f. 5/7/1, Assistant NC to NCO, 31 October 1940, and Hahn's handwritten notes on the letter "Also in regard to indiscriminate burning of Mopane trees in Ukuambi and Ukuanyama lands"; SWAA 3 f. Administration, Forestry: Indigenous Forests Ovambo A1/2 (I), NCO to CNC, Ondangwa, 2 June 1941; BAC 131 f. HN 8/17/4 (1955-1963), Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957.

[12] NAN, NAO 18 f. 11/1 (I), Monthly Reports Ovamboland, June & July 1927. See also KAB 1 (iii), W. Volkmann, "Report on the Agricultural and Political Conditions at The Angola Boundary," 30 October 1928.

expansion of settlement in a new Oukwanyama district in the middle floodplain: "many patches have been denuded of trees and cultivated." Yet the Native Commissioner played down his subaltern's assessment that "the destruction in ukuanyama [Oukwanyama district] of forest trees has been carried on at an alarming rate during the last ten years."[13] In 1957, the agricultural officer for Ovamboland wrote: "[i]n many cases densely grown parts are consciously cut and burned to make room for fields, because those areas are much more fertile as [sic] the parts without trees…or those [parts] that are only covered by…inferior bushes."[14]

The Native Commissioner of Ovamboland engaged the chiefs and headmen to urge settlers not to burn the large trees on their farm plots, and he recommended severe punishment for the "unnecessary destruction or mutilation of trees." Moreover, trees that had to be removed were to be felled for use as timber, and the stumps were to be dug out for use as firewood. To facilitate felling rather than burning trees, in 1938, the administration entrusted the senior headmen of the Oukwanyama district of Ovamboland with large axes and saws.[15]

At the same time, however, the administration urged Ovamboland's inhabitants to prepare larger fields so that food reserves could be built up to prevent a repeat of the late 1920s/early 1930s "Famine of the Dams," when it had been necessary to provide food aid. The 1933 annual report for Ovamboland noted with satisfaction that the recommendation had been heeded in the southwestern districts of Uukwambi and Ombalantu. In Ondonga, however, frustrated officials continued to pressure the king and his senior headmen to induce the district's inhabitants to cultivate larger fields throughout the 1930s. Small fields were partially a legacy of the insecurity caused by the violence and displacement that plagued the region in the 1910s and early 1920s. Moreover, in Uukwambi and Ongandjera, "[i]n former years the rank and file were afraid to do this [make larger fields] for no sooner had one cultivated a nice big patch than a stronger tribesman would, by bribing the chief or headman, deprive him of it."[16] Indeed, clearing land in a wilderness area required a

[13] NAN, SWAA 3, f. A1/2 (I), NCO to SEC. SWA, Ondangwa, 20 April 1931.
[14] NAN, BAC 131 f. HN 8/17/4 (1955-1963), Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango ,[Ondangwa?] 28 January 1957.
[15] NAN, SWAA Native Affairs Vol. 456 f. A50/92 F, NCO to Senior Veterinary Surgeon, Windhoek, Odongua [Ondangwa] April 24, 1932; NAO 19 f. 11/1 (v-vi), Monthly Reports Ovamboland, November 1932 and June 1933; NAO 20 f. 11/1 (xiii), Monthly Reports Ovamboland, October & November and December 1940 and O/C NA Oshikango to NCO, Oshikango, 20 June 1938.
[16] NAN, NAO 19 f. 11/1 (v-vi), Monthly Reports Ovamboland, November 1932 and June 1933; A450, vol. 12 f. 3/21/5, SWA Commission: Minutes of Evidence (1935), vol. 9, Session at Otjikango

major effort in terms of time and labor and established farms were often highly valued.[17] As Holongo Amshelelonanda from the Ondonga district stated in 1952 "[I] did not go in the unoccupied bush to make my kraal there because I am now old and find it very difficulty [sic] to cut the bushes and poles in order to make a new kraal for myself. My big sons who can help me are in the south [i.e., south of Ovamboland]."[18]

Farm Size and Forest Clearing

Information about farm size is scarce. The field of an 1880s Ombadja king measured perhaps 1,000 meters across, and may have been as large as 10 ha.[19] In the case of a late 1930s Uukwaluthi farm, the distance from the homestead to the fence around the fields was 60-70 yards, suggesting a farm size of roughly 0.5 ha.[20] A mission agricultural expert in 1924 estimated that the total cultivated land of Ovamboland amounted to 64,000 acres (25,920 ha).[21] The 1945/1946 agricultural census estimated the surface of the planted area in early 1946 at 31,000 morgen (26,557 ha.); all but 1,000 morgen was under cultivation for millet.[22] In 1950, the Native Commissioner of Ovamboland estimated that Ovamboland's 27,606 households cultivated one ha each, a figure that was used in the agricultural census for 1949-1950.[23] The agricultural report for 1955/1956 estimated the average farm plot at 2 morgen (1.7 ha) which, given the estimated 40,000 households, led the report's compiler to conclude that 80,000 morgen (68,534 ha) were under cultivation.[24]

Assuming that the average farm size was between 0.5 and 2 ha, the approximately 18,000 households counted in the 1933 census meant that between 9,000 to 36,000 hectare had been cleared of woody vegetation at some point to make room for the homesteads, kraals, and crop fields. But, since much of the wood for the

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[Oshikango], 9 August 1935, 518-520; A450, vol. 7 f. 2/18, Annual Report Ovamboland 1926. On small fields and general insecurity, see A450, vol. 9 f. 2/39, Hahn, "Rough Notes on Tribal Customs in Ovamboland," p. 59 and vol. 10 f. 2/40, "Political and Tribal Affairs," p. 3 [Mss]. See also Kanime Hamyela, interview by author, Omutwewondjaba, 15 June 1993. Kanime Hamyela and her family only a very small field in the Ondonga village where they had sought refuge.

[17] Wülfhorst, Moses, p. 14-15.

[18] NAN, NAO 100 f. 42/11 (iv), Chief Kambonde to NCO, 8 August 1952 and Statement Holongo Amshelelonanda at Ondangwa, 4 July 1952.

[19] NAO 104 C.L. Anderson to Hahn, diary Jordan.

[20] NAO 46, f. 45/1/2, statement Kenatuka Keivanga, 9 March 1939, Rex vs Chiwetha Hiyanga, Chief Warden Windhoek Gaol to NCO, Windhoek, 23 November 1942.

[21] NAN, NAO 26 f. 21, Report Ovamboland Cotton Prospects appendix to Alec Crosby to Bishop of Damaraland, St. Mary's Mission, 11 January 1924.

[22] NAN, NAO 103 f. 62/2, Census of Agriculture Ovamboland 1945/1946. A morgen is 2.116 acres.

[23] NAN, NAO 103 f. 62/2, NCO, Ondangwa, 21 October 1950 and Census of Agriculture Ovamboland 1949/1950. A morgen is 2.116 acres and an acre is 0,405 ha.

actual construction of the farms had been sourced elsewhere, the creation of 18,000 farms theoretically would have led to the deforestation of the 9,000-36,000 ha of farm plots, plus the 9-18,000 ha of mopane bush land required for construction materials, for a grand total of approximately 18-54,000 ha of bush land or "forest" that had been severely affected. Deforestation was most dramatic in Ovamboland's Oukwanyama district, which was located directly south of the Angolan border, where the approximately 6,000 new farms that were established consumed between 3-6,000 ha of mopane bush land and resulted in the further clearing of 3,000-12,000 ha of farm plots. Deforestation thus affected 6,000-18,000 ha in a 17-year period, for an average of 353-1,059 ha affected per year. Moreover, most of this dramatic deforestation took place in a relatively small area in the middle floodplain. In the second half of the 1920s, the impact was especially concentrated in the area directly west, south and east of Oshikango along the border, i.e. right under the nose of the Assistant Native Commissioner of Ovamboland who was based there.

The deforestation also appeared to be especially dramatic because it was concentrated in the landscape niches that carried the richer woody vegetation cover. The new farms were located on the low ridges in between the watercourses. These ridges were covered by trees and bush vegetation, with farm plots cleared on the lower slopes and construction wood sourced from the upper slopes. The water courses themselves, which only had a sparse woody vegetation cover, could not be used for habitation or cultivation because they flooded.[25] Many of the farm plots owned by a village's early settlers sloped gently towards the seasonal watercourses, and the plots were located on the edge of the water course. On the uphill side, the farm plot bordered the omufitu bush or forest patches on top of the ridges. Many farm plots seem to have extended

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[24] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956.

[25] NAN, NAO 104 Anderson to Hahn, diary Jordan and A233, J. Chapman, 1903-1916, 1876[?], pp. 61-62; Kreike, Recreating Eden, ch. 2; Lima, A Campanha, pp. 132-14; AVEM, RMG 2518 [?] C/h 52, Speiker, Visitationsbericht, Namakunde 13-18 July 1906; AGCSSp, Duparquet, carnet #6, 1878, 1881, information from Carlston; Petrus Shanika Hipetwa, interview by author, Oshiteyatemo, 17 June 1993. NAN, KAB 1 (iii), W. Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions at The Angola Boundary." See also NAN, AHE (BAC) 1/346 f. (15)N8/19/4/4(I), Report of the SWA Planning Committee for Agricultural Training Centers, appendix to Chief Bantu Affairs Commissioner SWA to Bantu Affairs Commissioners Ondangwa, Runtu, and Oshikango, [Windhoek], 8 April 1965. This situation is also borne out by regular reports of flooded fields and destroyed crops. For example, in March-April 1925, fields in the districts of Oukwanyama and Uukwambi were destroyed by floodwater in the watercourses and even a number of homesteads in Oukwanyama were flooded, NAN, NAO 18 f. 11/1 (I), Monthly Reports Ovamboland, March and April 1925. See also NAO 19 f. 11/1 (vii), Monthly Reports Ovamboland, February and June and July 1934, January and February 1937; and NAO 21, f. 11/1 (xvii), Quarterly Report Ovamboland, January-March 1944. Similar conditions

into the edges of the omufitu and fenced omufitu vegetation may have been used as part of a farm's bush fallow (ekove), which served as reserve cropland and the lavatory as well as a source of wood and livestock fodder.[26] Having an expansive bush fallow, however, may have been discouraged given the colonial administration's urgings to make larger fields even as arable land grew scarcer. For example, when Nuthano Shanijengana, who was old and frail, left a part of her large farm in Omakango in early 1950s Ondonga under fallow, the village headmen used it as an excuse to take half of her land away.[27]

In densely settled areas, the fields of different households often adjoined because the best farm plots were located on the edge of the water courses. This was the case not only in early 1900s Ombadja, Oukwanyama, and Ondonga, but in other districts as well. In late 1930s Uukwaluthi, two neighboring homesteads were only 50-60 meters apart. In another example from Ongandjera in about 1941, neighboring homesteads were in view of one another.[28] In general, during the late 1920s, in the northwestern districts of Ovamboland, the population density was much lower and a report noted "[k]raals are much more scattered and distributed over wider areas."[29]

Homesteads were located within the confines of the farm plot on the edge or in the middle of the fields. The farm plots were clearly demarcated with a fence that enclosed the homestead, fields, fallow, and the livestock kraals. The construction of the fences consumed a considerable amount of bush in the middle floodplain, in the westernmost parts of the southern floodplain and east of the floodplain.[30] Frequent

prevailed in 1950, NAO 60, f. 12/1 (I), Quarterly Report Ovamboland, January-March 1950 and April-June 1950.

[26] Nahango Hailonga, interview with author, Onamahoka, 4 February 1993 and NAN, NAO 36, f. 26/8 (ii), Annual Health Report 1937. A German missionary commented in the early 1890s that in Oukwanyama, anything that was not a crop field was covered with bush, possibly referring to both fallow on farmlands and bush land in between individual farms, AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892.

[27] NAN, NAO 100 f. 42/11 (v), Chief Kambonde to NCO, Okaloko, 21 January 1954 and NCO to Chief Kambonde, [Ondangwa], 19 January 1954. See also NAO 19 f. 11/1 (vi), Monthly Report Ovamboland, June 1933 and A450, 7, f. 2/18, Annual Report Ovamboland 1937.

[28] NAN, NAO 46, f. 45/1/2, statement Kenatuka Keivanga, 9 March 1939, Rex vs Chiwetha Hiyanga, Chief Warden Windhoek Gaol to NCO, Windhoek, 23 November 1942 and f. 45/1/15, statement Shikua Iyambo, appendix to NCO to Attorney-General, Ondangwa, 9 September 1941. For Oukwanyama, see, for example, AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892.

[29] NAN, NAO 18 f. 11/1 (I), Monthly Report Ovamboland, September 1926.

[30] NAN, A450, 7, f. 2/18, Annual Report Ovamboland 1937; NAO 36, f. 26/8 (ii), Annual Health Report 1937; NAO 46, f. 45/1/1-2, Rex vs. Ninda, Statement ANC, 9 March 1939, statement Kenatuka Keivanga, 9 March 1939, Rex vs Chiwetha Hiyanga, Chief Warden Windhoek Gaol to NCO, Windhoek, 23 November 1942; NAO 45 f.[45/1], statement Mattheus Angula, [Ondangwa], 14 September 1939; NAO 17 f. 10/3 (ii), NCO to Secretary SWA, Ondangwa, 26 August 1940; A450, vol. 23, D6, Land Tenure; NAO 65 f. 21/14, Annual Health Report Ovamboland 1952; OVA 49 L6/8/4/1

complaints that livestock had damaged crops in Ondonga – and to a lesser extent in Ongandjera - make clear that such fencing was less common in the southern floodplain districts and that farmers had to rely on herdsmen and herdboys to keep livestock from entering their crop fields. A manuscript about Ovamboland Customs from the mid-1920s, which probably was based on information obtained from a missionary in Ondonga, emphasized: "[i]n the rain season the cattle must be strictly shepered [sic: herded], for the cornfields are without any fence."[31] In 1993, only one of every six sampled households lacked any form of a farm fence. Half of the fenced farm plots contained wire fences, reducing the use of branches of bush.[32] Fencing materials, however, had to be replaced at a high rate: of a sample of 236 OMITI survey respondents, half emphasized that fencing materials had to be replaced every year; 17% mentioned that replacement fencing was required every 2-5 years, and 11% mentioned the need to replace fences every 6-10 years. Only 7% of respondents stated that their fences lasted over 10 years.[33] Respondents mentioned camel thorn (omwoonde) and sicklebush (also omunghete/ongete or Dichrostachys cinerea) most frequently as sources of fencing materials (19% each), followed by lowveld cluster leaf (omuhama/omunghama), buffalo thorn (omukekete), leadwood (omukuku), omutyuula (various Acacia spp.) and real fan palm (omulunga), all in the range of 9-10%.[34]

More People and More Land Clearing, 1950s-1990s

As the population of Ovamboland grew from 107,000 in 1933 to 126,000 in 1938, then to 197,000 in 1951, and 618,000 in 1991, the amount of land that was cleared for fields commensurately increased. Of a sample of 25 households that had been compensated for the loss of their land in 1967, eight of the household plots were

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(I), Meeting Subcommittee Townplanning, 2 September 1970. For an example of a fenced farm in Onkolonkathi, see NAO 46, f. 45/1/10, statement Shiwetha Amawha, Ondangwa, 3 February 1941. Thornbush was common in the northwest, see, for example, NAO 18 f. 11/1 (I), Monthly Report Ovamboland, September 1925 and A450, vol. 23, D6, Land Tenure [Eunda].

[31] NAN, A450, vol. 9, file 2/35, Anonymous, "Ovamboland Customs (1926)"; RCO 10, f. 15/1916/1, RCO to MacKenzie, Ondonga, 9 February 1917; NAO 18 f. 11/1 (I), Monthly Report Ovamboland, August 1926; NAO 9, f. 5/1, blue note with heading "Chief Martin," n.d. but inserted between letters dated 6 April and 26 August 1929; NAO 9, f. 5/1, Bjorklund to NCO, Onajena, 10 June 1934; NAO 100, f. 42/11 (iv), subfile 42/11/384, NCO to Chief Kambonde, Ondangwa, 8 December 1952 and Chief Kambonde to NCO, Okaroko, 15 December 1952; NAO 91, f. 36/3 (ii), Kambonde to NCO, Okaroko, 14 January 1953; NAO 46, f. 45/1/15, statement Shikua Iyambo, appendix NCO to Attorney-General, Ondangwa, 9 September 1941.

[32] OMITI 4.3.6.

[33] OMITI 4.3.10.

0.5 ha or smaller; nine plots were between 0.5 ha to one ha; six plots were between 1 to 2 ha; and two plots were two ha or larger.[35] Based on a small survey sample, a 1991 report estimated the average farm size to range from two to five ha, with farms in eastern Ovamboland being larger on average than in the actual floodplain.[36] Thus, with 90,918 rural "traditional" homesteads having been counted in 1991, an estimated 181,836 to 454,590 ha of the total area of Ovamboland's 4,200,000 ha, i.e. from 4.3 to 10.8 percent, had been transformed into farm plots, compared to 9,000-36,000 ha or 0.21-0.86 percent in 1933. The colonial administration estimated aggregate farmlands in Ovamboland to be 27,606 ha in 1950, 71,961 ha in 1957, 59,968 ha in 1958, 88,400 ha in 1966, 94,000 ha in 1968, and 150,000 ha in 1978/1979. The figures for 1957 and upwards all seem to have been estimates of the actual surface area that was being cultivated, rather than the total available farm area. [37]

Some of the agricultural reports provided estimates of fallow. For example, of the 71,961 ha of fields available in 1957, 2,878 ha were not cultivated because of the late rains; the fields had been cultivated in the previous year. In the 1978/1979 season, 40,000 ha out of a total of 190,000 ha of "plowland" were not cultivated, despite having been cultivated during the previous rainy season.[38] Data on individual districts is rare, but in 1964, the Oukwanyama district's estimated 83,000 inhabitants had 36,837 ha under cultivation, compared to 3,344-13,378 ha in 1933, when the population was 34,000 inhabitants. In 1915, when the area consisted almost entirely of wilderness, it contained at most 600 households with 300-1,200 ha of farmlands. For comparison, the total surface of the Oukwanyama district in 1964 was estimated at 565,408 ha. Thus,

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[34] OMITI 4.3.3, 4.3.9, and 4.3.12.

[35] NAN, OVA 53 f. 6/18/2-7 (iii), Sec. SWA to Sec. Agriculture Owambo, Windhoek, 24 June 1974, Appendices A-C.

[36] NEPRU [Namibian Economic Policy Research Unit], "Land related Issues in the Communal Areas, 1: Owambo" (Windhoek: Paper for the National Land Conference, 1991). The author's personal observations bear out the impression that especially in the far east, in villages such as, for example, Ehafo, Oshikuni, and Big and Little Olukula, farm plots were considerably larger than in the floodplain. The plots were usually fenced with wire or branches and there were very few trees in the fields, 19 February 1993.

[37] Figures provided in morgen are given in hectares. See NAN, NAO 103 f. 62/2, Census of Agriculture Ovamboland 1949/1950; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957 and Quarterly Report Agriculture Ovamboland for the Quarter ending 30 June 1958; AHE (BAC) 1/352 f. (14) N8/21/4, Annual Reports Agriculture Ovamboland, 1966 and 1968; OVA 6 f. 2/8/1, Annual Report Agriculture Ovamboland 1978/1980.

[38] See NAN, NAO 103 f. 62/2, Census of Agriculture Ovamboland 1949/1950; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957 and Quarterly Report Agriculture Ovamboland for the Quarter ending 30 June 1958; AHE (BAC) 1/352 f. (14) N8/21/4, Annual Reports Agriculture Ovamboland, 1966 and 1968; OVA 6 f. 2/8/1, Annual Report Agriculture Ovamboland 1978/1980.

in 1915, 0.05-0.2 percent of the total land surface consisted of farmlands. The estimated figure for 1933 would be 0.6-2.4 percent, and 6.5 percent for 1964.[39]

In any given season, people cleared more or less of the plot depending on the rains and the available labor. Every year, crop residue and bush and other vegetation was cleared from the area that was intended for cultivation before the onset of the rains, and the plot would be planted after the first good rains had fallen.[40] The vegetation that was removed, including crop residue and small bushes, was collected in heaps in the field, where it was left to dry and subsequently burned. At times, the smoke of "thousands" of fields being burned inhibited the navigation of airplanes over Ovamboland.[41] The nutrient-rich ashes were spread over the fields.[42]

Plows and Deforestation

The rapid dissemination of the animal-drawn plow after the 1940s – the large majority of farmers used plows by the early 1990s - contributed to arable land scarcity because it facilitated and required the cultivation of larger fields per household at the expense of farm and village bush and forest lands. In addition, trees and tree remnants (trunks, roots) on fields hindered plowing and more than previously, trees may have come to be regarded as an obstacle to crop cultivation. The plow enabled larger fields to be prepared but, in combination with an increase in male absenteeism due to migrant labor, the use of the plow increased the weeding bottleneck because weeding continued to be done by hand. Weed competition decreased yields per hectare and in turn forced households to increase the area under plow cultivation at the expense of bush and grazing land.[43]

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[39] NAN, AHE (BAC) 1/352 f. (14) N8/21/4, Annual Report Agriculture Oukwanyama for 1964.

[40] For example, in September of 1925, 1926, and 1932, people reportedly were clearing their fields in anticipation of the rains, and in December 1924 and 1927 after the rains had commenced they were cultivating and planting crops, NAN, NAO 18-19 f. 11/1, Monthly Reports Ovamboland, December 1924, September 1925, September 1926, October and December 1927, September & October 1932; NAO 89 f. 35/22, NCO to Ikasha Kiyala, Ondangwa, 28 October 1948.

[41] Kalolina Naholo, interview by author, Ohamwaala, 26-27 January 1993 and NAN, A450, 12, f. 3/21/5, SWA Commission: Minutes of Evidence, Otjikango, 9 August 1935, Gawthorne (CEM), p. 568. See also A450, 7, f. 2/18, Annual Report Ovamboland 1937 and NAO 64 f. 19/1 (i), Telegram NCO to Commandant Fourie, Ondangwa, 25 September 1953.

[42] Kalolina Naholo, interview with author, Ohamwaala, 26 and 27 January 1993.

[43] Lea Paulus, interview with author, Onandjaba, 17 June 1993; NAN, NAO 62 f. 12/5, Agricultural Report Ovamboland, 30 November 1953; BAC 132 f. HN 8/18/3/1/1, Agricultural Officer Ovamboland to NCO, Ondangwa, 1 March 1957; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland, 1956/1957; WWA 637, f. ww. 31/3/1 (ii), report appended Erasmus to Director Water Affairs, Otjiwarongo, 13 May 1970; OMITI A5.2.2. Richards emphasized that weeding was as much a bottleneck as plowing, see Richards, Indigenous Agricultural Revolution, p. 136.

In 1946, Ovamboland contained an estimated one hundred plows. Four years later, the total number of plows reportedly had not increased. At the end of 1952, however, the number of plows had increased tenfold, to 1,073. Oukwanyama district accounted for over half of the plows and Ombalantu and Uukwambi each had approximately one fifth of the implements while only 39 were in use in Ondonga district.[44] According to a new agricultural officer, one reason for the upsurge in the use of plows by the early-1950s was that a way had been found to use the implement to make raised cultivation beds. He noted that only in some parts of eastern Oukwanyama had plowing resulted in the discontinuation of raised cultivation beds.[45] A later agricultural report similarly noted that the plow saved a lot of labor when it was used to make raised cultivation beds, but added that bed cultivation could be replaced by better methods.[46] Throughout the 1950s, most farmers in Ovamboland continued to rely on the hoe and raised cultivation beds. Moreover, hoes remained an essential tool for weeding.[47] Yet, by 1957, the plow was used on 20 percent of all fields according to the agricultural officer who identified a niche for the implement:

> [I]n Ovambo[land] the natives only use the plow on higher lands that do not flood so easily in years with exceptionally heavy rainfall. On such fields, the results to date have been quite satisfactory. It can be expected that plowed fields may do very badly if another very good rainy season is experienced. The reason that the Ovambos increasingly make use of the plow, however, is that it requires much less labor and time to cultivate a field with a plow than to raise cultivation beds in the same field. Because the plow is also much faster every plow owner can take care of a bigger plot… Therefore although plowed land produces less per field, the total production is higher because the farm plot can be increased.[48]

Despite evidence that plowing could cause soil salinization, the administration continued to promote the use of the plow, for example by renting out tractors and encouraging farmers to purchase them. In 1976, renting a tractor with a driver cost 10 Rand per hour. In 1980, an estimated 100 tractors were in private hands and 20,000 ha

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[44] NAN, NAO 103 f. 62/2, Censii of Agriculture Ovamboland 1945/1946 and 1949/1950; NAO 103 f. 62/2, Assistant NCO to NCO, Oshikango, 30 December 1952, Chief Kambonde to NCO, Okaroko, 18 December 1953, Council of Headmen Ombalantu to NCO, 25 July 1952, Council of Headman Ukuambi to NCO, Ukuambi, 16 July 1952, Chief Ushona Shimi to NCO, Okakua, 7 July 1952, and Ikasha Nkandi and Ashimbanga Mupole to NCO, Onkolonkathi, 26 June 1952.
[45] NAN, NAO 62 f. 12/5, Agricultural Report Ovamboland 1953.
[46] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956.
[47] NAN, NAO 62 f. 12/5, Agricultural Report Ovamboland 1953 and BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957.

were cultivated with plows. In the early 1990s, the large majority of households surveyed relied on plow cultivation.[49]

After the 1940s, male absenteeism in Ovamboland increased as more and more men signed up for repeated and longer labor contracts in South West Africa and South Africa, leading to a severe shortage of agricultural labor. The labor crunch especially affected eastern Ovamboland, where settlers were in short supply. The labor saving properties of plow cultivation consequently were very attractive; moreover, age labor income made plows more affordable. The plow thus appears to have been most readily embraced in eastern Oukwanyama during the 1940s and 1950s, and from there its use was disseminated back into the floodplain.[50]

The introduction of plow agriculture also had social repercussions that affected the gender division of labor, female control over land and crops, and agricultural productivity. In 1993, only 37% of a small sample of 54 women had a field of their own, although 59% emphasized that they had had their own field before they had married.[51] The loss of access to the proceeds from their own field meant that women, who had increasingly become the mainstay of agricultural labor because of male absenteeism due to migrant labor, had less incentive to invest additional labor in cultivation, for example, to do the extra weeding that plowing required.As a result, to some extent, even adult female labor may have been disinvested from crop cultivation

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[48] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957.
[49] NAN, OVA 50 f. 6/10/4-7 (I), Sec. Agriculture to Sec. Bantu Administration, Ondangwa, 2 April 1976 and J. Amutenya to Sec. Agriculture, Ombalantu, 30 August 1975 and 13 October 1976; OVA 6 f. 2/8/1 Annual Report Agriculture Ovamboland 1979/1980; WWA 637, f. 31/3/1 (ii), report appended Erasmus to Director Water Affairs, Otjiwarongo, 13 May 1970; OMITI A5.2.2. The Secretary for Agriculture for Ovamboland informed the Secretary for Bantu Administration in Pretoria in 1976 that he had been warned that tractor plowing could cause the saline subsoil to be mixed in with the thin topsoil of Ovamboland, OVA 50 f. 6/10/4-7 (I), Sec. Agriculture to Sec. Bantu Administration, Ondangwa, 2 April 1976. On the danger of salinization, see, for example, OVA 47 f. 6/8/3/1-7, Venn, Loxton & Associates, Mahanene Research Station Visit by Research Committee, 23-24 February 1976 (which reported a marked effect of salinity with deep tillage); WWA 644 f. 31/3/2/3 (iv), A. Trevor, ACE Planning, 11 July 1972; WWA 640 f. 31/3/2/1 (I), Report Ovamboland Pipelines, October 1977; OVA 49 f. L6/8/4/1 (I), Meeting Subcommittee Townplanning, 2 September 1970; OVA 93 f. 6/5/4, Sec. Agriculture, 13 September 1979.
[50] See Kreike, "Recreating Eden," chapters 5 and 7.
[51] Kreike, "Recreating Eden," ch. 6; OMITI A0.11 and 12 (N=54). In the early 1950s, Christian Hashitende divorced his wife but allowed her to continue to cultivate her field for the remainder of the agricultural season. He remarried and gave his new wife a field, NAN NAO 100 f. 42/11 (iv), NCO to Chief Kambonde, 24 January 1953, and Statement Christian Hashitenda of Oyovu (Ondonga), made at Ondangwa, 24 January 1954. In the same era, Nikodemus Amtenya's refusal to allocate half of the farm to his wife, Ruusa Mandungu, led to the involvement of the Native Commissioner, NAO 100 f. 42/11 (vi), subfile 42/11/519, Ruusa Amtenya against Nikodemus Amtenya, Statements Ruusa Amtenya and Nikodemus Amtenya, Ondangwa, 17 September 1954.

from the 1950s onward.[52] Thus, in the social and environmental context of Ovamboland, the introduction of the plow had contradictory repercussions related to the intensification of crop cultivation. On the one hand, the use of the plow led to an intensification of agriculture, with the adoption of ox or donkey drawn plows. On the other hand, crop cultivation became more labor- and land-extensive.[53]

Plowing directly and indirectly affected the use and availability of woody resources. The impact was direct because trees and tree stumps hindered plowing and it became more common to burn tree stumps out, especially when tractors were used, which, by 1993, was the case for 34% of survey respondents.[54] Moreover, the plow meant that treelings were more easily plowed under and the root systems of existing trees were damaged. Still, that the plowshares cut the roots in some cases may actually have encouraged vegetative regeneration, as occurred, for example, with the marula tree (omwoongo), because new trees developed from the cut roots.[55]

Indirectly, plowing and the entire social and agricultural complex within which the use of the plow became imbedded affected the on-farm and off-farm availability of woody vegetation in the villages. Off-farm, the expansion of arable land as a result of an increasing number of farms per village or the expansion of individual farm plots diminished the total surface of the commons that was under woody vegetation. A diminishing village commons reduced the local availability of forest products and forage, and the scarcity of the latter in turn forced cattle owners and herdsmen to herd the cattle to the cattle posts earlier and for longer periods of time, reducing the availability of manure and other cattle products.

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[52] See, for example, Kreike, "Recreating Eden," ch. 5.

[53] Berry emphasizes that agricultural intensification is not a necessary result of, for example population pressure and also notes that it is not irreversible, Berry, No Condition is Permanent, pp. 181-196. Gray notes that despite population pressure, agricultural change in southwestern Burkina Faso in modern times has been marked by agricultural extensification, L.C. Gray, "Investing in Soil Quality: Farmer Responses to Land Scarcity in Southwestern Burkina Faso," Bassett and Crummey, African Savannas, p. 72-90.

[54] Lea Paulus, interview with author, Onandjaba, 17 June 1993. In 1924, an agricultural expert for the Anglican mission noted that tree stumps were not dug out when farmland was cleared and concluded that this would make plowing inefficient, NAO 26 f. 21, Report Ovamboland Cotton Prospects appendix to Alec Crosby to Bishop of Damaraland, St. Mary's Mission, 11 January 1924. In the early 1960s, trees were common in fields in the eastern side of the middle floodplain and the area directly to its east, BAC 131 f. HN 8/17/2, Deputy Secretary of Forestry,"Report of a visit by the Deputy Secretary of Forestry...17-29 April 1961," Pretoria, 10 May 1961. On the use of tractors, see OMITI A5.2.2. Tractor plowing greatly increased the possibility that tree trunks and roots would damage a plow blade, personal observations by author, 1991-1993.

[55] Interviews by author: Helemiah Hamutenya, Omuulu Weembaxu, 17 July 1993; Philippus Haidima, Odibo, 9 December 1992 and Pauline, Onenghali, 15 December 1992; Kreike, "Recreating Eden," ch. 6.

The agricultural report for 1955/1956 noted that the number of farm plots in all villages was increasing and explained "[i]t is not rare to see a native who cuts out hundreds of mopane trees in the mopane forests and then just leaves the trees to rot while he does not even plant manna [millet] on the clearing area." The compiler of the report feared that the consequences in the long term might be environmentally disastrous. He estimated that each new farm diminished a village's pastureland by two morgen and noted that leaving the trees to rot destroyed years' worth of potential firewood. Moreover, "[b]ecause the kraal and the field is kept clean there is no possibility that the area in the future will produce new trees that could be used as firewood….The presence of the new kraal also means that there is an additional consumer of firewood in the ward." Finally, he expressed concern that the remaining pasturages would be overgrazed, preventing tree regeneration and predicted that without trees, soil erosion would become a serious menace.[56]

Village Forest Reserves

Farms on the lower slopes of the ridges between the flood channels backed up (and often extended) into what in the middle and northern floodplain was known as omufitu bush land/forest, which covered the crest of the ridges. Settlers cleared farm plots on the lower slopes on both the western and eastern areas of the ridges. Before the 1950s, the omufitu forest on the crest of the ridges had been a "natural" boundary between neighboring villages.[57]

The village forests were a main source of wood for constructing new kraals and fences and for replacing poles, sticks, and thorn branches.[58] Early 20th century sources emphasize the often very dense bush vegetation on the low ridges between the

[56] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956. See also interviews by author: Joseph Kambangula, Omboloka, 25 February 1993; Nahango Hailonga, Onamahoka, 4 February 1993; Timotheus Nakale, Big Ekoka, 21 February 1993; and Moses Kakoto, Okongo, 17 February 1993.

[57] Helemiah Hamutenya, interview by author, Omuulu Weembaxu, 17 July 1993; NAN, NAO 46 f. 45/1/8, Testimony Hamnyela Nashipili, Grootfontein, 5 May 1941, Statements Hamnyela Nashipili, Dirk Jacobus Greyling, Martin Kapenda, Namkoloka Nashipili, Ondangwa, 12 February 1941.

[58] On omufitu as the source of replacement poles, see Moses Kakoto, interview by author, Okongo, 17 February 1993; Nahandjo Hailonga, interview by author, Onamahoka, 4 February 1993; Franscina Herman, interview with author, Odibo, 12 December 1992; Julius Abraham, interview by author, Olupito, 16 and 18 June 1993; NAO 46 f. 45/1/8, Testimony Hamnyela Nashipili, Grootfontein, 5 May 1941, Statements Hamnyela Nashipili, Dirk Jacobus Greyling, Martin Kapenda, Namkoloka Nashipili, Ondangwa, 12 February 1941.

watercourses.[59] Omufitu was the source especially of sickle bush (onghete), wild seringa (omutundungu), and omunghono (omuhongo[?], i.e. Spirostachys africana or tamboti) followed by mopane (omufyaati) and "omuve" (probably not omuve or Berchemia discolor but omuuva, i.e. Transvaal teak [Pterocarpus angolensis]).[60] Dense stands of mopane bush occurred on locations on the ridges that were easily waterlogged. Thorn bush occurred as well but trees were relatively rare.[61]

The colonial government attempted to convert the omufitu forests and other bush and tree vegetation on the low ridges into formal village forest reserves in the 1940s and 1950s, with little or no success. A 1941 letter from the Native Commissioner of Ovamboland to his superior in Windhoek stated: "[i]t has always been the policy of this office to encourage the protection of indigenous trees and in every 'umkunda' (area) [village] a portion is, as far as possible, always kept as bush and forest reserve. The difficulty, however, is one of control."[62] In eastern Ovamboland, for example, enforcement proved entirely impossible.[63]

In 1940s Okatope in Oukwanyama, Pauline and her husband cleared a farm in a small omufitu forest.[64] Senior headman of the Oukwanyama district Gabriel Kautwima permitted farm plots to be cleared in Omhedi village's omufitu in the 1950s, when little other suitable land for settlement was left; omufitu soil, for example, was not conducive to cultivating grain unless large amounts of manure were applied.[65] Joshua Mutilifa was the first to settle in the omufitu forest of Omhedi, but many followed his example. As a result, by the early 1990s, forest forage had been depleted.[66] By the early 1990s, in some areas, such as, for example, the floodplain village Oshomukwiyu very little of the off-farm bush remained. Moreover, stumps of the previously abundant mopane were cut out, thereby preventing the regeneration of even that hardy plant. Kulaumoni Haifeke, who grew up in Oshomukwiyu, recalled

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[59] NAN, KAB 1 (iii), W. Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions at The Angola Boundary."

[60] Mateus Nangobe, interview by author, Omupanda, 24 May 1993; Malita Kalomo, interview by author, Omutwewondjaba, 15 July 1993; Pauline, interview by author, Onenghali, 15 December 1992; Julius Abraham, interview by author, Olupito, 16 and 18 June 1993.

[61] Petrus Shanika Hipetwa, interview by author, Oshiteyatemo, 17 June 1993.

[62] In 1938, the administration planned to distribute bush knives to the senior headmen of Oukwanyama to demarcate a protected forest in each village, O/C NA Oshikango to NCO, Oshikango, 20 June 1938Book 2 section 35; SWAA 3 f. Administration, Forestry: Indigenous Forests Ovambo A1/2 (I), NCO to CNC, Ondangwa, 2 June 1941.

[63] NAO 44 f. 37/1 ANC to NCO, Oshikango, 24 March 1942.

[64] Pauline, interview by author, Onenghali, 15 December 1992.

[65] Joshua Mutilifa, interview by author, 8 March 1993 and Nahandjo Hailonga, interview by author, Onamahoka, 4 February 1993.

that the area had once resembled ofuka, and explained that people had cut all the trees and bushes in "no-man's land" (i.e. in the village "commons"): "You can't prevent it because they are not on your farm. People cut them in places which are not owned." Asked whether rules had prevented such behavior in the past, she responded: "There was no such rule to prevent people to cut down trees outside anybody's land. [There were] Only rules to prevent [other] people from cutting trees in your ekove [fallow]."[67]

On-farm arable land was expanded at the expense of the bush fallow. When Nahango Hailonga and her husband separated in the 1940s, her husband and their sons cleared a farm plot for her in his ekove. Even in the expanses of eastern Ovamboland, where villages typically were isolated from one another by large stretches of bush and forestland, fields encroached on farm fallow. In the 1950s, Joseph Kambangula extended his fields into the ekove fallow maintained by his late father. In the 1960s, upon purchasing an existing farm, Moses Kakoto cleared and plowed the fallow that the previous owner had used as a source of forage. The woody vegetation in the ekove bush fallow supplied critical resources; shrinking ekove fallow diminished the availability of on-farm construction and firewood, and forage.[68]

With shrinking on- and off-farm bush lands in the villages as a result of increased settlement density, it became more and more difficult to sustain livestock near the villages. The director of agriculture predicted that "as the country is developed through the provision of water in the outlying areas, the practice will further drain the stock population away from the cultivated area making manure less readily available."[69]

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[66] Joshua Mutilifa, interview by author, 8 March 1993.
[67] Kulaumoni Haifeke, interview by author, Oshomukwiyu, 11 May 1993.
[68] Interviews by author: Joseph Kambangula, Omboloka, 25 February 1993; Nahango Hailonga, Onamahoka, 4 February 1993; Timotheus Nakale, Big Ekoka, 21 February 1993; Moses Kakoto, Okongo, 17 February 1993. In the 1957/1958 cropping season, almost all of the available on-farm land was cultivated, despite the drought conditions. This may have been a result of the expansion of arable land at the expense of the fallow, BAC 133 f. HN 8/21/4/1, Quarterly Report Agriculture Ovamboland, 30 June 1958.
[69] NAN, AGR 538 f. 68/7 (i), Director of Agriculture Windhoek, 26 October 1949, Agricultural Survey of Ovamboland with Reference to Agricultural and Stock Improvement in that Area.

Trees Preserved in Fields

Although land clearing destroyed substantial amounts of Ovamboland's woody vegetation, pioneer farmers typically spared selected fruit trees.[70] When Timotheus Nakale's father cleared a new farm plot at Onakalunga in the 1940s, he preserved a monkey orange (omuuni/omunhi or Strychnos cocculoides) tree for its fruit and a couple of sheperd's trees (omunghudi; in the interview he used onghudi) to provide his family with a shady place to rest while they were cultivating.[71] Surveyed and interviewed farmers expressed a clear awareness of the potential advantages and disadvantages of having on-farm trees. Trees, for example, were considered to be important windbreaks toprotect crops from wind damage. Moreover, trees in and around fields reduce water loss through evaporation and evapotranspiration. And, trees can buffer temperature extremes (frost occurs occasionally in eastern Ovamboland). While sixty percent of those surveyed in 1993 considered wind damage to be a more or less important threat to crops, 66% reported the actual damage caused by sand particles to be a relatively unimportant, a figure that may partly be a testimony to the protection offered by the agroforestry practices that were already in place.[72] Throughout north-central Namibia, but especially in far eastern Ovamboland (the eastern part of modern Ohangwena), strong winds carry sand and dust particles that have the potential to damage crops on impact, especially during the vulnerable flowering stage. Moreover, the particles could cover plants with a fine layer of dust that interferes with photosynthesis. The combination of the use of a large variety of (mainly) indigenous cultivars and local intercropping and agroforestry practices may help to explain why crop diseases are ranked relatively low amongst crop-related concerns that were identified by Ovambo households. Only 23% of survey respondents ranked disease as one of the most important threats to crop; 20% considered crop diseases to be a lesser threat; and 51% believed that disease was unimportant as a threat to crops.[73]

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[70] NAN, NAO 104 Anderson to Hahn, extract diary Jordan, pp. 519-539; A450, 9 f. 2/38, "Property Rights"; Julius Abraham, interview by author, Olupito, 16 and 18 June 1993; Timotheus Nakale, interview by author, Big Ekoka, 21 February 1993; Mateus Nangobe, interview by author, Omupanda, 24 May 1993; BAC 131 f. HN 8/17/4 (1955-1963), Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957. See also chapter 6.

[71] Timotheus Nakale, interview by author, Big Ekoka, 21 February 1993. See also NAN, BAC 131 f. HN 8/17/4 (1955-1963), Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957.

[72] Interviews by author: Timotheus Nakale, Ekoka laKula, 21 February 1993 and Joseph Kambangula, Omboloka, 25 February 1993; OMITI A5.2.3.

[73] OMITI A5.2.3.

Farmers were conscious of a strong link between particular trees and soils. The clayish omutunda soil, for example, supported mopane, tamboti (omuhongo) and red bushwillow (omunaluko or Combretum apiculatum) tree species and sandpaper raisin (omwushe/omushe or Grewia flavescens) bush, while the sandy ehenene or omahenene soil supported mopane bush. Omufitu soil supported birdplum (omuve) on the side of the watercourses, as well as wild seringa (omutundungu) and Transvaal teak (omuuva).[74] In addition, trees affected and changed soil composition; species such as sheperd'stree (omunghudi), (Kalahari) apple leaf (omupanda), African wattle (omupalala or Peltophorum africanum) and marula (omwoongo), for example, were considered to have beneficial effects on the soil. In 1993, amongst reasons given to explain the advantages of on-farm trees, 78% of respondents mentioned shade, ranked in frequency only after the importance of trees as sources of fruit and fodder, but before firewood. Sixty percent of respondents mentioned esthetic reasons, ranked after firewood. Forty-four percent of respondents claimed that on-farm trees were beneficial for crops; 42% of respondents mentioned that trees were beneficial for the soil; and 35% of respondents explained that trees reduced water loss.[75]

In explaining the disadvantages of on-farm trees, 77% of the respondents mentioned that trees inhibited plowing; 46% of respondents mentioned that trees drained the soil of nutrients; 44% of respondents emphasized that trees were bad for crops; 19% of respondents mentioned that trees used a lot of water; and 15% of respondents were displeased that trees shaded crops.[76] The high number of respondents who singled out the difficulties associated with on-farm trees underlines the actual and potential impact of plowing on woody vegetation. The apparent contradiction in the relationship between trees and crops/soils may be attributed to the fact that different trees were perceived to have different effects on crops and/or soils. For example, fig, mangetti (omunghete) and Transvaal teak (omuuva) trees were considered to render the soil useless for crop cultivation because of their "bad roots," as a farmer from eastern Ovamboland (Ohangwena region) put it.[77] Specific trees could also harbor birds that could be crop pests, and bird scaring and hunting were

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[74] Abisai Dula, interview by author, Oikokola, 25 June 1993. Ehenge in the Kwanyama dialect is the equivalent of Mahenene or henene in the Ndonga dialect.
[75] OMITI 4.4.26 (N=354).
[76] OMITI 4.4.27. For this question, N=144, i.e. half of the universe for 4.4.26, which suggests that half of the sample was of the opinion that on-farm trees had no disadvantages.
[77] Timotheus Nakale, interview by author, Ekoka laKula, 21 February 1993.

critical.[78] In 1993, 73% of surveyed households considered birds to be more or less important as a threat to their crops.[79]

Conclusion

The creation of farms and fields caused often dramatic deforestation. Much of the required construction materials were drawn from the woodlands on top of the low ridgesand the woody vegetation for farms and fields was cleared from the middle and lower slopes of the ridges. On-farm deforestation was more destructive than sourcing off-farm construction wood because a great deal of woody vegetation was burned, a method that limited regrowth. Colonial officials consequently considered the practice of burning to be an utter waste of timber.

The practice of subdividing farms and the rapid dissemination of plow technology after the 1940s also diminished on-farm bush fallow lands. The overall effect was an intensification of the process of deforestation, with a subsequent decline of available forest resources on farms and in villages. A decline in forage availability forced households to herd cattle to ever more distant cattleposts, denying households access to sources of nutrition and to the manure that was used to maintain agricultural productivity.

Agricultural productivity also suffered as a result of social changes. Increased land tenure insecurity for women, which was related to headmens' attempts to subdivide the farms of the weaker villagers, and the decline in the practice of dividing the farm land between the husband and the wife and allocating fields to junior members of the household (which in part was related to the increasing use of the plow) undermined control over and the access of women and children to land and crops. As a result, women disinvested from crop cultivation.

The above spatial and gender characteristics of environmental change in northcentral Namibia constituted double-edged swords. As women disinvested their labor from agriculture, they diverted some of it to nurturing fruit trees, a resource that was less heavily contested in the 1930s and 1940s than land or crops. Thus,

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[78] On birds as a pest and/or trees and birds, see interviews by author: Timotheus Nakale, Ekoka laKula, 21 February 1993 and Marcus Paulus, Olukula, 19 February 1993; NAN, NAO 19 f. 11/1 (iv), Monthly Reports Ovamboland September & October 1931; NAO 45 f.[45/1], statement Andreas Zacharias, Onayena, 18 January 1940; NAO 51 f. 3/13 Kaundjua Andunge to NCO, Ombalantu, 16 April 1950; NAO 91, f. 36/1 (iii), subfile 36/1/50, statement Titus Muatelai Kakonda, Ondangwa, 10 May 1954; OVA 47 f. 6/8/3/1-7, A.C. Venn to Sec. Agriculture Owambo, 12 March 1976; OVA 58 f. 7/7/1-7, Forester to Principal Ongwediva [Ondangwa?], 15 October 1979.

environmental change in Ovamboland was not only related to political and demographic change (e.g. violence and population displacement) but also to socio-environmental change, for example the consequences of migrant labor, including the introduction of the plow.

[79] OMITI A5.2.3.

CHAPTER 8
ARCHITECTS OF NATURE:
DAY-TO-DAY REFORESTATION

Humans are "architects of Nature" because they are environmental actors. In effect, humans frequently work with nature (which is at once an actor and a medium), rather than dominating nature or being dominated by nature. The "architects of nature" create, configure, maintain and remake "environmental infrastructure" in interaction with other local, regional, and global actors, factors, and processes (for example, climate change). Any change in how the architects maintain their environment has implications for the environmental infrastructure.

This chapter analyzes how and why the agents of and the spaces with the most destructive deforestation– farmers and their households, and farms and fields, respectively – were also the agents of and the places with the most dramatic reforestation. Paradoxically, as deforestation of the wilderness areas of Ovamboland progressed from the 1920s through the 1940s, a process of reforestation followed in its wake. In a matter of decades, majestic fruit trees towered over homesteads and cropfields in areas that previously had been ofuka-wilderness. This astonishing transformation is a direct result of the efforts of individual men and women to improve their local environment by deliberating landscaping their surroundings: the architects of Nature.

Although on-farm fruit trees figure prominently in colonial and postcolonial descriptions of Ovamboland's vegetation, colonial officials and experts and their postcolonial successors found it difficult to understand that the fruit trees constituted reforestation.[1] In Ovamboland, the "reforesting" species on farmlands were chiefly indigenous fruit trees that colonial officials and experts considered to be "wild" species and trees from the "wilderness." Actually, they were neither. Moreover, the actual day-to-day details of the reforestation process and the who, why, and what have received little explicit attention even in the literature related to the Inclinist paradigm.[2] The chapter discusses the dynamics of on-farm tree management at

[1] Fairhead and Leach, Misreading the African Landscape.
[2] Fairhead and Leach in Misreading the African Landscape document that forest islands in the West African savanna are associated with human settlements but provide little information of how, why, and by whom the sites were (re)forested. On the paucity of research on this topic, see J. Clarke, W. Cavendish, and C. Coote, "Rural Households and Miombo Woodlands: Use, Value, and Management" and B. Campbell and N. Byron," Miombo Woodlands and Rural Livelihoods: Options and Opportunities," Campbell, The Miombo in Transition, pp. 101-135 (especially 134) and pp. 101-135 (especially 223), respectively. Crummey and Winter-Nelson provide selected narratives to show who

especially the level of individual human actors and individual trees. People and trees are more than simply a product of genetics. As with individual humans, individual trees each have a personal history, and interactions results in unique characteristics.[3] Moreover, in Africa, individuals are responsible for most of the planted trees, and each tree is individually planted.[4] Tree propagation in Ovamboland displays a gendered pattern: women appear to have been more involved in on-farm fruit tree propagation and management.[5] People propagated trees in Ovamboland for diverse reasons: tree fruit, for example, was a source of food, forage, and alcohol. Alcoholic beverages constituted a source of income especially for women, and the beverages

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planted what kind of trees but provide no details, for example, about how they were planted or where, D. Crummey and A. Winter-Nelson, "Farmer Tree Planting in Wällo, Ethiopia," Bassett and Crummey, African Savannas, pp. 110-114. Kajembe provides lists of which trees were planted and stresses that most were planted to demarcate plots of land, but does not specify who did the planting, Kajembe, Indigenous Management Systems, pp. 99, 102-108.

[3] On the importance of focusing on individual trees as the object of research, see Tomlinson and Zimmermann, Tropical Trees as Living Systems, Editorial Preface, p. xv and D.H. Janzen, "Seeding Patterns of Tropical Trees," pp. 83-128. On trees having histories, see Huxley, Tropical Agroforestry, pp. 74, 174-197, 241-242. Kozlowski, Kramer, and Pallardy, in The Physiological Ecology of Woody Plants, pp. xvii, 56, 81, 234 note that woody vegetation should be seen as individuals and that because woody vegetation builds up and stores reserves over the years, their reserve levels at any given time are a reflection of their historical experience (i.e. droughts, pests, herbivore browsing, etc.). See also F. Hallé, R.A.A. Oldeman, P.B. Tomlinson, Tropical Trees and Forests: An Architectural Analysis (Berlin: Heidelberg and New York: Springer Verlag, 1978), pp. viii-ix. Adaptation to different ecological conditions may lead to great intra-species variation, for example in terms of the onset of flowering, see M. Grouzis and M. Sicot, "A Method for the Phenological Study of Browse Population in the Sahel: The Influence of Some Ecological Factors," Le Houérou, Browse in Africa, pp. 233-240. As a result, the palatability of browse to herbivores may greatly differ from plant to plant within a single species, see H.N. Le Houérou, "Browse in Northern Africa," in the same volume pp. 55-82, especially 61.

[4] Dejene found that farmers preferred to plant trees as individuals rather than through community projects, A. Dejene, Environment, Famine, and Politics in Ethiopia: A View from the Village (Boulder, Col.: Lynn Rienner, 1990), pp. 61-62. Crummey and Winter-Nelson highlight that tree planting was an individual undertaking, D. Crummey and A. Winter-Nelson, "Farmer Tree Planting in Wällo, Ethiopia," Bassett and Crummey, African Savannas, pp. 110-114. Although they provide little detail, Franzel et al. also emphasize the farmer as an individual, see S. Franzel, P. Cooper, G.L. Denning, and D. Eade, eds., Development and Agroforestry: Scaling up the Impacts of Research (Oxford: Oxfam, 2002), for example the chapter by G.L. Denning, "Realising the Potential of Agroforestry: Integrating Research and Development to Achieve Greater Impact," pp. 1-14. Tree ownership by the planter also underlines that trees should be regarded as individuals. Bonnéhin, for example, emphasized that the person who planted a tree remained its owner irrespective of the tree's location, L. Bonnéhin, "Domestication paysanne des arbres fruitiers forestiers: Cas de Caula edulis Baill. olacaceae, et de Tieghemella heckelii Pierre ex. A. Chev., sapotaceae, autour du Parc National de Tai, Côte d'Ivoire" (Wageningen Agricultural University: Ph.D. thesis, 2000), pp. 68-75.

[5] Nygren points out that forest clearing is often seen as a male activity, A. Nygren, "Development Discourses and Peasant-Forest Relations: Natural Resource Utilization as Social Process," Doornbos, South, and White, Forests: Nature, People, Power, p. 25. Bonnéhin noted that both women and men planted trees but that men more commonly did so, Bonnéhin, "Domestication paysanne des arbres fruitiers forestiers, pp. 68-75. The gender dimension is considered of critical importance in agroforestry: men and women tended different trees and women typically were not integrated into agroforestry projects, see A. Böhringer, "Facilitating the Wider Use of Agroforestry for Development in Southern Africa," and M.D. Faminow, K.K. Klein, and Project Operating Unit," On-Farm Testing

were also critical capital for creating and maintaining social networks, which in turn were essential for security and for gaining access to land, labor, and other services and resources.

Fruit Trees at the Turn of the 19th Century

The earliest Europeans travelers to the Ovambo floodplain were struck by the abundance of fruit trees. In the early 1890s, upon entering the southern floodplain from the south, the missionary Wulfhorst noted Ondonga's fertile fields, "here and there interspersed with groves of dark leafed trees or tall palm trees and through the leaves…large numbers of huts."[6] The "dark leafed trees" were most likely fig trees, which grew to gigantic dimensions, reaching a height of 80 feet. The baobab attained the same height and its trunk grew to up to 40 feet in circumference, but it was confined to the drier western half of the floodplain and the northern districts of Oukwanyama and adjacent Evale. Uukwaluthi in the southwestern floodplain boasted baobab and fig trees as well as palm trees.[7] Fig (omukwiyu), real fan palm (omulunga), birdplum (omuve/omuye) and marula (omwongo/omugongo) occurred throughout the northern and southern floodplain, including Ongandjera, but the latter two trees were not nearly as abundant elsewhere as in the northern floodplain. Huge jackalberry (omwandi), birdplum and marula dominated the northern floodplain landscape. Jackalberry lined the banks of the seasonal watercourses in the central and middle floodplain and the seasonal Etaka River in the southwest. During the 1880s and 1890s, missionaries waxed enthusiastic about the "wild" birdplum and marula trees and interviewees recalled that the trees had been abundant throughout pre-1915 Oukwanyama and Ombadja.[8]

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and Dissemination of Agroforestry among Slash and Burn Farmers in Nagaland, India," Franzel, et al., Development and Agroforestry, pp. 35-55 and 84-106 respectively.

[6] Wülfhorst, Aus den Anfangstagen, p. 4. See also, Lau, Carl Hugo Hahn Tagebücher, part iv, p. 1039; NAN, NAO 104, Anderson to Hahn, extract diary Jordan, Cape Quarterly Review vol II. 1882 pp. 519-539.

[7] Interviews by author: Johannes Shipunda, Omundaunghilo, 14 July 1993; Kulaumoni Haifeke, Oshomukwiyu , 11 May 1993; Elisabeth Ndemutela, Okongo, 16 February 1993; Helemiah Hamutenya, Omuulu Weembaxu, 17 July 1993; NAN, A233, J. Chapman, entries 1876 [pp. 61-62]; RCO 8 f. 9, Extract from RCO's Personal Diary, 10 March 1917 and RCO to Sec. SWA, Ondonga, 27 October 1918. See also the preceding footnote.

[8] AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892; AGCSSp 466-A-VII, Duparquet, Carnets de Notes-Voyages # 3, entries August-September 1879 and info. Mr. Leen, 29 April 1879; ibid Duparquet 1880 journal, July 10-11, 14, 1880. Interviews by author: Elisabeth Ndemutela, Okongo, 16 February 1993; Helemiah Hamutenya, Omuulu Weembaxu, 17 July 1993; Johannes Shipunda, Omudaunghilo, 14 July 1993 and Julius Abraham, Olupito, 16 June 1993. See also Möller, Journey, pp. 125-126 and NAN, A233, J. Chapman, entries 1876 [pp. 61-62] and 1896 [146-147]; RCO 10 f.

During the last decades of the nineteenth century, palm wine was a popular alcoholic beverage in the southern floodplain while in the northern floodplain, marula tree and raisin bush fruit was also made into wines. In Oukwanyama, when the marula fruit ripened during the months of February and March, men and women engaged in celebrations for weeks on end and marula wine flowed freely. Not even recent mission converts could resist participating and a despairing missionary wrote: "[u]nfortunately [marula] trees are too abundant and everyone has them on their fields."[9] Despite their distaste for marula wine, however, the missionaries witnessed that tree fruit in the early 1900s proved to be invaluable during the seasonal period of shortages early in the rainy season (before the main field crops ripened), and during famine years.[10]

Fruit trees were not "communally" owned. During the early 1900s, on-farm baobab trees in Omukwa in the far northern floodplain were the property of the farm owners. When the fruit was ripe, the owners shared some of it with other households.[11] The marula tree was subject to complicated and overlapping rights. A portion of the marula wine that was produced had to be brought to the king of Oukwanyama. The households that occupied the land where the trees grew consumed the remainder.[12] In 1916-1917, British-South African troops who entered the floodplain to quell Oukwanyama resistance received strict orders to "[s]pare all fruittrees viz : Palm, Wild Fig, Marula etc. and all trees in inhabited areas [of Ovamboland]" after the local colonial officials concluded that "[p]ractically all trees in such areas are wild fruit trees…and native owned."[13]

15/1916/1, RCO, Notes for O/C Military Detachment Ovamboland, Ondonga, October 1916; A464, Archives FMS, Martii Rautanen Collection HP xxviii.1, Diarey 1886-1888, Entry 15 November 1886 (the missionary Rautanen in the 1880s planted and transplanted fig saplings on his Ondangwa station).

[9] NAN, NAO 104, Anderson to Hahn, diary Jordan; Möller, Journey, pp. 125. AGCSSp Duparquet, 1879 journal, August 17, September 10, 12, 14, 21, 23; C. Estermann, Etnografia do Sudoeste de Angola: Vol. 1, Os Povos não-Bantos e o Grupo Étnico dos Ambós ([Lisbon]: Ministério do Ultramar, Junta de Investicações do Ultramar, 1960), p. 134; Wülfhorst, Anfangstagen, p. 28; and quarterly reports in AVEM RMG 2518 C/h 34, Ondjiva, 10 April 1911, 12 April 1912, 1 April 1913, and 30 June 1914; RMG 2517 C/h 33 folio 10, Omupanda, 1 April 1914; RMG 2515 C/h 31, Omatemba, 30 March 1916.

[10] AVEM, RMG 2599 C/i 19, Bernsmann, Omburo, 6 January 1892. On famines and fruit trees, see, for example, RMG 2518 C/h 34, Ondjiva, 1 April 1913; Helena Nailonga, interview by author, Big Ekoka, 23 February 1993; NAN, RCO 10 f. 15/1916/1, Major C.E. Fairlie, "Report of the Situation in the Ovakonyama Couthry," Namakunde, 25 March 1917.

[11] Johannes Shipunda, interview by author, Omundaunghilo, 14 July 1993.

[12] AVEM, quarterly reports RMG 2517 C/h 33, Omupanda, 1 April 1914 and RMG 2518 C/h 34, Ondjiva, 1 April 1913.

[13] NAN, RCO 10, f. 15/1916/1, "Notes for Officer Commanding Military Detachments Ovamboland, October 1916" and "Preliminary Memorandum for Expeditionary Force by Resident Commissioner C.N. Manning and Lt. Hahn [1916]."

Fruit Trees and People

Colonial officials continued to be struck by the abundance of fruit trees in the northern floodplain in the second half of the 1920s. The Neutral Zone, a disputed area that encompassed the southern districts of Oukwanyama and that was transferred to Portuguese sovereignty in 1927, was "exceptionally rich in wild fruits."[14] The inhabitants of the southern districts of Ombadja fled during the violent 1910s. In the late 1920s, the area was uninhabited; as an official noted "[m]uch of it was a perfect Paradise for natives abounding as it did in fruit trees and grazing."[15]

Monika Hidengwa was born in Ombuwa (in modern Angola), a location that lay outside of the oshilongo settled zone of Oukwanyama. Although trees and bush were plentiful, the area was devoid of birdplum, marula, and palm trees. During the 1920s, Monika Hidengwa moved with her family to Ombwabwa near Omulunga (also in Angola). The only fruit trees in this village were mangetti (omungete).[16] An official who traveled east of Omafo into what was then considered ofuka-wilderness noted a "singular absence of fruit trees which attract the natives in selecting settlement places."[17] Marula, birdplum, and palm trees began to appear after refugees from the north colonized the middle floodplain ofuka-wilderness, clearing land, constructing farms, fences, and water holes, and laying out fields. While these fruit trees were not entirely lacking in the middle floodplain before 1915, their occurrence was often associated with settlements that had been abandoned in the nineteenth century. For example, in the 1920s, when settlers from the northern floodplain arrived in Okalongo, they found real fan palm and jackalberry trees that were associated with the early nineteenth century kingdom of Haudanu: a cluster of palm trees at Onandjaba, was known as Omilunga yaHaudanu, or "the palm trees of Haudanu." The absence of contemporary settlement, however, meant that the region was considered to be ofuka-wilderness and most of the fruit trees in the area's villages were propagated after the settlers had established their farms and fields.[18]

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[14] NAN, A450 vol. 7 f. 2/18, Annual Report Ovamboland 1926.
[15] NAN, KAB 1 (vi), Draft Report Kunene Water Commission, Olusandja, July [1927], to Secretary SWA.
[16] Monika Hidengwa, interview by author, Eenhana Refugee Camp, 16 July 1993. Ombuwa was probably a cattle post where her family sought refuge during the 1915 war.
[17] NAN, KAB 1 (ii), Submission to Administrator, Secretary and Attorney-General of SWA, 1927.
[18] Interviews by author: Julius Abraham, Olupito, 15-16 June 1993; Mathias Walaula, Onandjaba, 15 June 1993; Kanime Hamyela, Omutwewondjaba, 15 June 1993; personal observations, 15 July 1993; NAN, KAB 1 (iii), Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions at The Angola Boundary."

Only the southernmost district of the pre-1915 Oukwanyama kingdom, which included such villages as, for example, Namakunde, stretched into the middle floodplain. In 1879, the missionary Duparquet had noted clusters of fruit trees and signs of previous settlement at pans in this area, although at the time it was entirely abandoned. In 1915, the area was regarded as ofuka wilderness.[19] Following the influx of refugees, the landscape changed dramatically. A 1928 description of the Angolan-South West African border between border markers 16 and 23 highlights the abundant signs of recent colonization: "[t]he first Ukuanyama werft [homestead] is at Point 16. The country becomes more open….The werfts are on the dune-like banks; the bush has been destroyed. Everywhere one sees the beautiful Onjandi [omwandi or jackalberry] trees or wild figs."[20]

Colonial officials were conscious of the extent to which fruit trees were locally valued. Native Commissioner Hahn stressed that fruit trees were "generally speaking" protected in all the "tribal areas" of Ovamboland, and that "[i]n fact certain species are very jealously guarded and many species have special names and there are definite laws in regard to their ownership."[21] Indeed, Petrus Mbubi in 1993 asserted that his parents had owned all of the 39 fruit trees that grew on their farm in Oikokola (Ondonga) during the 1920s.[22] Paulus Wanakashimba recalled that fruit trees were not owned by "the household" or by "the head of the household," but by the owners of the individual fields: "a palm tree belongs to the owner of the particular piece of land. If it is in a woman's piece of land then it is the wife's palm tree. All trees within a garden when they are taken care of - if in a woman's garden then [they] are her birdplum trees."[23] Hahn was baffled by what seemed to be contradictions in who owned which trees when different parties in a dispute confronted him with different versions of "traditional tenure." And he attempted to codify local resource tenure in the context of consolidating colonial rule. His main sources were missionaries, selected chiefs and headmen, and his Ovambo assistants and servants. One of his sources, probably a Finnish missionary stationed in Ondonga, noted that "[i]n some

[19] AGCSSp Duparquet, 1879 journal, August-September 1879; Malita Kalomo, interview by author, Omutwewondjaba, 15 July 1993.
[20] NAN, KAB 1 (iii), Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions." "Points" were boundary markers.
[21] NAN, NAO 44 f. 37/1, Officer Oshikango to NCO, Oshikango, 17 March 1931 and NCO to Secretary SWA, Ondangwa, 20 April 1931.
[22] Petrus Mbubi, interview by author, Onanime, 26 February 1993.
[23] Paulus Wanakashimba, interview by author, Odimbo, 10-11 February 1993. On the oshikokola-plot, see Kreike, "Recreating Eden," ch. 7.

districts the fruit trees in the field do not follow the ownership of field, but must be purchased separately."[24]

Not surprisingly, given his preferred sources, Hahn's codification of customary Ovambo law tended to favor claims by chiefs and headmen. His rough personal notes based on information he gathered during the 1920s attest to the enormous variation in tree tenure. In Ongandjera, "[the] [o]ccupier [of a farm] has not always got the right to all the fruit trees in area allotted him as in many areas fruit trees are reserved for chiefs (fruit for beer making) and occupiers understand this condition." In Onkolonkathi and Eunda in the southwestern edge of the floodplain "[f]ruit trees are general(ly) shared [in] particular marala [marula] tree by the headman who has right to collect fruit from certain trees reserved for himself. Owner of kraal may not use fruit from reserved trees unless he receives headmans permission." In Ombalantu, Hahn was persuaded that the headmen's control over land and trees had collapsed.[25] During the early 1930s, Hahn concluded that in South West African Oukwanyama:

> Omuongo (marula) trees and fruit belong to the chief [king] but the headman of the omukunda [village] owns the fruit which remains after the chief had his share collected; it is the duty of the headmen to collect it and to send it to the Chief. If a chief does not require the fruit from a particular area the headman owns it. Today, in the absence of a chief, the eight principal headmen exercise the rights of the chief in this respect; each in his own district…. The right of use of indigenous fruit trees other than omuongo ... depends upon the situation of such trees. If a tree stands in a cornfield the fruit belongs to the cornfield and the possessor or occupier for the time being becomes the owner of such fruit. If the tree is outside the cornfield or kraal its fruit is public property.[26]

Headmen's claims, however, were contested. For example, in 1939, a farmer from Uukwaluthi in the far west engaged the assistance of the Assistant Native Commissioner at Oshikango to foil the local headman's attempt to take control over his marula tree. In 1947, a farmer from Ondonga refused to give his headman a portion of the marula wine that he had harvested from his trees.[27] Native Commissioners Hahn and Eedes patterned themselves after Ovamboland's pre-colonial kings, and thus the headmens' superiors. Consequently, in a 1953 letter to

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[24] Kreike, "Recreating Eden." On the missionary, see NAN, A450, vol. 9, f. 2/35, "Ovambo Customs (1926)."
[25] NAN, A450, vol. 23, D6, Land Tenure.
[26] NAN, A450, vol. 9, file 2/38, "Property Rights."
[27] NAN, NAO 10 f. 5/6/1, Statement Hinikamba (Onkolonkathi) at Oshikango, 1 April 1939; NAO 98 f. 42/11 (ii), [King/Chief] Kambonde to NCO, Okaroko, 4 November 1947.

Petrus Kuferi, Hahn's successor, H.L.P. Eedes, wrote: "I notice that you are concerned about what you call YOUR marula trees [emphasis original]. The trees are not yours - they belong to the Government. You are really worried about them because they produce a form of liquor."[28]

A broad interpretation of the concept of the "moral economy" sheds light not only on the contested claims to fruit tree ownership but also on some of the contradictions.[29] Gifts of fruit and fruit products assured chiefly patronage and reciprocal access to fruit trees between neighboring households, permitting the residents of marginalized households (especially elderly single women) access to either "private" or "communal" fruit trees. For example, Shangeshapwako Hauladi's family lived in Onelombo (in modern Angola) until the late 1920s. Her family had no fruit trees on their farm but jackalberry and fig were abundant throughout the village and "anybody could come and gather the fruit from any tree." In 1920s Omundaunghilo in eastern Ovamboland, birdplum trees similarly abounded and every household had fruit trees. Children could go anywhere to pick the birdplum fruit. Paulus Nadenga's parents' neighbors gathered fruit from his parents' birdplum and marula trees; the neighbors in turn allowed his family to gather fruit from their marula tree, which bore fruit later in the season.[30]

In 1954, after Eedes retired, the Native Affairs Department of the Union of South Africa took control over the reserves of South West Africa and South African conservation policies were introduced in Ovamboland. Ovamboland was assigned an agricultural officer whose tasks included forest conservation. Although the agricultural officer in 1957 concluded that fruit trees were already being protected by the local population, he nevertheless recommended compiling a list of "valuable trees" that could not be cut down, and distributing the list to all the district and village headmen. In 1978, the new forester for Ovamboland, apparently unaware of these earlier attempts, compiled a separate list of protected trees that included all the principal indigenous fruit trees. He, too, acknowledged that most were already protected under "Owambo [Ovambo] tradition." Moreover, he stressed that while

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[28] NAN, NAO 63 f.17/1 (I), NCO to Petrus Kuferi, Ondangwa, 10 December 1953.
[29] On the concept of "moral economy," see J. Scott, The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia. (New Haven: Yale University Press, 1976).
[30] Interviews by author: Shangeshapwako Hauladi, Omundaunghilo, 14 July 1993; Paulus Nandenga, Oshomukwiyu, 28 April 1993; see also Helena Nailonga, Ekoka, 23 February 1993 and Mateus Nangobe, Omupanda, 24 May 1993.

most of the trees on his list were already protected in South West Africa, there was no formal legislation to that effect in the Ovambo Homeland.[31]

Colonial conservation regulations had an impact. Interviewees recalled that fully grown indigenous fruit trees could not be cut down without the permission of the village and the district headmen, even if they were located on a household's farmlands. Philippus Haidima mentioned that cutting down a marula tree could even get one arrested. Permission to cut down a fruit tree was granted only when, for example, the tree contained a hole that housed snakes. The restriction also applied to the species' non-fruit bearing male trees, which previously had enjoyed little protection. Cutting the branches of indigenous fruit trees was also restricted. [32]

The impact of settlement on vegetation cover was especially dramatic in the eastern half of the middle floodplain, where a new Oukwanyama had been carved out of the ofuka wilderness in less than 15 years. Because such fruit trees as, for example, the marula, were categorized both as wild and wilderness trees, they were also sometimes included on the list of deforestation victims. In 1931, the Assistant Native Commissioner for Oukwanyama, newly arrived at his post, was shocked by the "[m]any cases of wilful destruction of large, often fruit, trees….to quote the words of Mr. Hahn in one particular case, 'The area had altered so much, due to destruction of trees, that it was hard to believe it was the same area.'" He immediately issued a "tribal order" to re-establish "the old tribal law" "protecting all fruit trees, palm trees and trees, the trunk of which is thicker than the thigh of a man." Native Commissioner Hahn, however, surmised that tree clearing for new farms was unavoidable and emphasized that the chiefs and headmen generally protected such trees in the tribal districts.[33]

The colonial government also attempted to limit tapping palm juice from the trunks of adult trees (which could kill the tree) and championed "customary" preservation regulations to prevent fruit trees from being cut down in the inhabited

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[31] NAN, NAO 61 f. 12/1 (ii), Quarterly Reports, April-June and July-September 1954; BAC 133 f. HN 8/21/4/1, Agricultural Officer to CNC, Ondangwa, 19 November 1956 and to NCO, Ondangwa, 4 July 1956; BAC 131 f. HN 8/17/4, Agricultural Officer to Bantu Commissioners Ondangwa and Oshikango, [Ondangwa], 28 January 1957; OVJ 19 f. 23/20/2, Forester Owambo to Secretary, [Ondangwa], 18 August 1978. See also Erkkilä and Siiskonen, Forestry in Namibia, pp. 74-77.

[32] Interviews by author: Kaulikalelwa Oshitina Muhonghwo, Ondaanya, 2 February 1993; Philippus Haidima, Odibo, 9 December 1992; Joseph Nghudika, Onamahoka, 3 February 1993.

[33] NAN, NAO 44 f. 37/1, O/C Oshikango to NCO, Oshikango, 17 March 1931 and NCO to Sec. SWA, Ondangwa, 20 April 1931.

areas of the floodplain.[34] In 1916, the South Africans issued a proclamation in Ovamboland that included the stipulation that no palm trees could be damaged.[35] During the late 1920s and the early 1930s famine, however, desperate individuals tapped palm juice on such a scale that it contributed to the destruction of large numbers of palm trees and deforestation in the southern floodplain.[36] In the 1950s, fines for illegal palm juice tapping were draconian: in Ombalantu the fine was five head of cattle or 25 Pound, several times over the amount of bride wealth or the fee for a farm.[37] In 1972, the Director of Agriculture for Ovamboland sought to reassure the Secretary for Bantu Administration in Pretoria that his fears that palm trees were declining in number were groundless.[38]

The Fruit Tree Frontier

Despite noting that fruit trees occurred on farms and fields, that they were mostly absent from wilderness areas, and that they were contested as property, colonial officials do not seem to have been shaken in their belief that, for example, marula and birdplum were wilderness and wild trees. But marula and birdplum trees (and to a lesser extent palm trees) by and large only began to appear in the middle floodplain ofuka wilderness after the area was settled during the 1920s and 1930s. Moreover, although they did sometimes randomly occur, the phenomenon was confined to a highly specific and private space: farms and fields, where they were protected by palisades, fences and/or herdsmen from people, livestock and the elements.

Oral histories confirm that the introduction of marula and birdplum trees in the middle floodplain ofuka accompanied settlement. In the early 1930s Omupanda, marula trees were confined to only two of the eight existing farms, and one of the two was

[34] NAN, NAO 101 f. 43/7, NCO to CNC, Ondangwa, 17 April 1948; NAO 44 f. 37/1, NCO to CNC, Ondangwa, 2 June 1941; NAO 43 f. 35/1 (iv), NCO to CNC, Ondangwa, 26 August 1946 and telegram NCO to Secretary SWA, Ondangwa 26 August 1946; NAO 60-61 f. 12/1 (I-ii), Quarterly Reports October-December 1952 and April-June 1954; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957. On colonial forestry in Namibia, see Erkkilä and Siiskonen, Forestry in Namibia, pp. 65-80.
[35] NAN, RCO 4 f. 3/1916/7, “Proclamations by Chiefs, Notice: Orders to Headmen and People.”
[36] NAN, NAO 18-19 f. 11/1 (I-v), Monthly Reports, November-December 1928, January-February 1929, April 1930, March 1931, and July-August 1932.
[37] NAN, NAO 51 f. 3/13, Proceedings of an Enquiry held at Ombalantu on 15 June 1954 in the Allegation against Headman Hishitile Shiweda. See also NAO 71 f. 32/3, Chief Kambonde to NCO, Okaloko, 2 December 1953 and NCO to Kambonde, 4 December 1953.
[38] NAN, OVA 49 f. 6/10/2-7 (I), Sec. Bantu Administration to Director Agriculture, Pretoria, 9 February 1972; State Forester to Director Agriculture, Ondangwa, 21 February 1972; and Director Agriculture to Sec. Bantu Administration, Ondangwa, 25 February 1972.

located on the farm of the first person who had settled there in around 1900.[39] Although the Ombalantu district had a good number of marula trees and even some birdplums in the late 1960s, and Uukwambi district also acquired those trees by the early 1990s, many of the trees had been brought by settlers when they established new villages in the large wilderness areas between the former Ovambo polities. The seeds themselves may have originated from further north.[40]

Fruit trees were not only associated with human settlement; human action also caused their southward expansion, although the extent to which people intervened in "natural" processes varied. Kulaumoni Haifeke, the 1930-born daughter of the first pioneers to settle Oshomukwiyu, saw her village change from ofuka-wilderness into an oshilongo rich in full-grown marula, birdplum, and palm trees and concluded: "only God makes them grow."[41] The health officer of Ovamboland noted in 1933 that the pits were often consumed along with the fruit of the birdplum. He counted 26 birdplum pits in a single stool of a small child and surmised that this was the reason that birdplum seedlings could be observed everywhere around the homesteads.[42] Paulus Wanakashimba attributed the introduction of marula and birdplum trees in his village to the agency of the women who had collected the fruit in older villages further north; some of the pits that had been discarded after the fruit had been consumed had developed into seedlings. Paulus Nadenga, however, emphasized that careful human management facilitated the "natural" propagation of fruit trees: "[seedlings] only survived because during the dry season [they] lose their leaves and animals cannot eat them. During the rainy season, if they are located in the fields, people will till the soil and prevent the goats from entering."[43]

Indeed, although Paulus Wanakashimba's village had few marula trees when he was a young boy during the early 1920s, by the mid 1930s, both his and a neighboring village boasted many marula and birdplum trees. After clearing his own farm in 1947, he fenced new seedlings with thorn bush to protect them from livestock

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[39] Interviews by author: Mateus Nangobe, Omupanda, 24 May 1993; Paulus Wanakashimba, Odimbo, 10 and 11 February 1993; Paulus Nandenga, Oshomukwiyu, 28 April 1993; Kulaumoni Haifeke, Oshomukwiyu, 11 May 1993.
[40] On Uukwambi, Personal Communication with Joseph Hailwa, Regional Forester Ovamboland, 24 March 1992. On the occurrence of marula and birdplum in late 1960s Ombalantu, see NAN, OVA 57, f. 7/2/1-7, Lueckhoff, Report on Visit to SWA, 3-15 November 1969, Appendix to Regional Forester to Chief Director Bantu Administration, Grootfontein, 3 April 1970.
[41] Kulaumoni Haifeke, interview by author, Oshomukwiyu, 11 May 1993.
[42] Paulus Wanakashimba, interview by author, Odimbo, 10-11 February 1993; NAN, NAO 36 f. 26/8 (I), Annual Health Report Ovamboland 1933.
[43] Paulus Nandenga, interview by author, Oshomukwiyu, 28 April 1993.

and by the early 1990s, his farm contained birdplum, marula, and palm trees.[44] In a similar vein, Mathias Walaula stressed that in Onandjaba, fire was used to thin out the palm bushes because only a free standing palm bush could grow into a tree and Kanime Hamyela proudly recounted how he had shaped the dense bush into a fertile garden with stately trees: “[t]he plants are like grains. If you thin millet it will grow fast and properly. It is the same with the bushes – if you cut out some then the remaining will grow fast and healthy.”[45] In 1993, the large and shady marula tree on Julius Abraham’s Olupito farm produced enough fruit to brew a 30 liter (30 quarts) pot of marula wine that he used to entertain his friends and guests. His father – one of the pioneers to settle the Okalongo area – had discovered the tree when it was a mere bush hemmed in by huge trees. After felling the trees around the bush, his father kept the surroundings free from weed. In addition, one of the older villagers, Joseph Kashinghola, had watered his birdplum treelings and they had developed into impressive full-grown trees.[46]

The fruit tree frontier advanced beyond the Ovambo floodplain into eastern Ovamboland beginning in the 1930s. Although Omundaunghilo, east of the floodplain, was already a fully-fledged village with birdplum, marula and real fan palm trees by 1923, in most of the region, mature floodplain fruit trees appeared later because settlement only really took off during the early 1920s. For example, a 1934 report on settlement in the east stated: “[t]he usual fruit trees are, of course, not as plentiful as in the actual tribal area but natives are being encouraged to plant them whenever possible.”[47] Kalolina Naholo observed settlers in the east seeding marula, birdplum, and jackalberry. Marula could also be propagated by cutting off a green branch and planting it in moist soil.[48]

As the floodplain filled with farms, fields, and fruit trees during the 1950s-1990s, the fruit tree frontier advanced into the far eastern Ovamboland, towards the

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[44] Paulus Wanakashimba, interview by author, Odimbo, 10-11 February 1993.
[45] Interviews by author: Mathias Walaula, Onandjaba, 15 June 1993 and Paulus Wanakashimba, Odimbo, 10-11 February 1993; Kanime Hamyela,interview by author, Omutwewondjaba, 15 June 1993.
[46] Julius Abraham, interview by author, Olupito, 16 June 1993.
[47] NAN, A450 vol. 7, f. 2/18, Annual Report 1935.
[48] Interviews by author: Kalolina Naholo, Ohamwaala , 26-27 January 1993; Paulus Nandenga, Oshomukwiyu, 28 April 1993; Franscina Herman, Odibo, 12 December 1992; cf. Helemiah Hamutenya, Omuulu Weembaxu, 17 July 1993. On eastern Ovamboland, see Kreike, Recreating Eden, ch. 9.

border with Kavango.[49] In 1993, small birdplum trees could be found as far east as Olukula. Beyond Olukula, however, birdplum, marula, and palm trees, were rare.[50] Moses Kakoto settled in Okongo on an existing farm during the late 1960s. Although the birdplum trees on his farm had grown “naturally,” he had planted palm seeds from the floodplain in his first homestead.[51] Timotheus Nakale stressed that fruit trees were more numerous in fields in the west, i.e. the floodplain, because they grew “naturally;” in the east, however, people had had to plant the seeds. During the 1960s and 1980s, he had planted marula and birdplum seeds that he had brought from further west, and these grew into large trees. In 1992, when he moved his homestead to a new location, he successfully seeded more birdplum in addition to palm seeds; he had obtained the latter from Uukwambi. Some of the fruit trees, notably jackalberry, had not grown at all.[52]

Interviewees from the floodplain and from the most western part of eastern Ovamboland tended to stress that the fruit trees that appeared in their new villages and farms grew “naturally” or were “gifts of God,” even if the seedlings had been carefully nurtured. Interviewees from eastern Ovamboland, however, tended to emphasize human agency in fruit tree propagation. For example, Pauline commented that during her childhood: “[a]ll people took care of these trees….Young men of today don’t take care of plants (trees); they cut them down or plough them under….Because they were not abundant we took care of every birdplum, jackalberry, and fig [tree].”[53]

Women especially valued fruit trees because the food source could be consumed fresh, or it could be dried and stored. In addition, alcoholic beverages that were fermented or distilled from fruit were critical means to maintaining social security and patronage networks. Finally, the sale of alcoholic beverages, distilled

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[49] Tree propagation in the older villages continued. See, for example, Philippus Haidima, interview by author, Odibo, 9 December 1992.
[50] Werner Nghionanye, interview by author, Olukula laKula, 18 February 1993 and personal observations, 20 February 1993. In a survey of 35 crop fields in the west of eastern Ovamboland, Erkkilä found that marula, birdplum and palm tree occurred with the highest frequency (respectively 27%, 14%, and 10%) and that these trees only occurred near or on crop fields, see Erkkilä, “Living on the Land,” pp. 96-97.
[51] Interviews by author: Kalolina Naholo, Ohamwaala, 26 and 27 January 1993; Kaulikalelwa Oshitina Muhonghwo, Ondaanya, 2 February 1993; Moses Kakoto, Okongo, 17 February 1993.
[52] Timotheus Nakale, interview by author, Ekoka laKula, 21 February 1993.
[53] Interviews by author: Pauline, Onenghali, 15 December 1992; Alpheus Hamundja, Ohamwaala, 26 January 1993; Joseph Nghudika, Onamahoka, 3 February 1993; Nahandjo Hailonga, Onamahoka, 4 February 1993; Kaulikalelwa Oshitina Muhonghwo, Ondaanya, 2 February 1993.

liquors in particular, was the sole means by which women could earn cash.[54] Although the colonial administration indicated that home distilling was illegal, the late 1920s and early 1930s economic crisis caused a severe decline in the demand for migrant laborers from Ovamboland, and for many households, the sale of especially liquor distilled from birdplum fruit provided an alternative cash income.[55]

Ovamboland's Oukwanyama and northern Ondonga districts, as well as the Lower Kunene province of Angola were the principal production centers of liquor.[56] The importance of liquor distilling is underlined by the long and ultimately failed crusades that Native Commissioner Hahn and his successor Eedes waged against the practice from the 1930s to the 1950s. Although the colonial staff destroyed over 400 stills in Ovamboland in 1947, 1948, and 1949, 42% of the respondents to the 1993 OMITI survey reported that they sold homemade liquor. As an income generating enterprise, the commodity was topped only by the sale of Ovambo basketry.[57]

Although they were not important for distilling, exotic fruit trees also played a role in the expanding fruit tree frontier from the 1940s onwards. The 1940 annual report for Ovamboland noted that papaya cultivation was rising, especially in Oukwanyama. A 1945/1946 colonial report estimated that there were approximately 100 citrus trees in Ovamboland; this figure probably understates the spread of exotic fruit trees in Ovamboland's villages.[58] Fruit trees, including papaya, guava and lemons could sometimes be found in the 300 horticultural gardens that colonial officials had identified in Ovamboland. Vegetables, including tomatoes and onions, and tobacco were the main horticultural crops. The majority of such gardens were located in the Oukwanyama district, especially around Endola. Water scarcity was a serious constraint to the expansion of horticulture and horticulturists hand-irrigated

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[54] For details about the uses of various fruits, see NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957.
[55] NAN, NAO 18 f. 11/1 (I), Monthly Report December 1928. NAO 11, f. 6/1/1 (I), FMS to NAO, Olukonda, 12 November 1928 and NAO to FMS, Ondangwa 25 November 1928 and interviews by author: Mwulifundja Haiyaka, Omhedi, 8 March 1993; Franscina Herman, Odibo, 12 December 1992; and Philippus Haidima, Odibo, 9 December 1992.
[56] NAN, NAO 18 f. 11/1 (I), Monthly Report December 1928. NAO 11, f. 6/1/1 (I), FMS to NAO, Olukonda, 12 November 1928 and NAO to FMS, Ondangwa 25 November 1928 and interviews by author: Mwulifundja Haiyaka, Omhedi, 8 March 1993; Franscina Herman, Odibo, 12 December 1992; and Philippus Haidima, Odibo, 9 December 1992.
[57] NAN, A450, vol. 12 f. 3/21/5, SWA Commission, vol. 12, pp. 671-72; NAO 71 f. 32/3, NCO to ANC, Ondangwa, 12 May 1947; NCO, [Ondangwa], 29 August 1947; NCO to CNC, Ondangwa, 14 September 1947; ANC to NCO, Oshikango, 13 November 1947; NAO 71 f. 32/3, NCO to Chief Kambonde, Ondangwa, 28 December 1948 and to CNC, Ondangwa, 20 February 1949; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957; OMITI 7.2.
[58] NAN, NAO 103 f. 62/2, Census of Agriculture Ovamboland 1945/1946.

their crops.[59] The estimated 2,000 exotic fruit trees in Ovamboland in the mid-1950s were mostly thought to be located in the Oukwanyama district and "in general…are randomly planted next to the kraals." Of this total, 1,500 were papaya, 450 guava and the remainder citrus. Sometimes, such fruit trees were hand-watered. As with horticulture in general, however, water scarcity was a major constraint: "[f]ruit cultivation [occurs] on very small scale because water is scarce and at certain times in fact only for domestic use."[60]

In the mid-1970s, the head of agriculture concluded that mango seemed to thrive in Ovamboland and recommended trials. Subsequent trials at the Mahanene nursery in the late 1970s included mango as well as papaya and advocado and by the late 1970s, the Department of Agriculture marketed seedlings grown under irrigation (probably at Mahanene). In 1979/1980, the Department sold 200 papaya and 20-30 other treelings, including citrus plants.[61] In the early 1990s, the annual production of the Danish Aid from People to People (DAPP) tree nursery at Ombalantu, one of less than a handful of tree nurseries in Ovamboland, was 3,000 guava, 1,000 jacaranda, 100 Acacia, 2,500 Leucana, 800 Eucalyptus, and 100-200 others species. DAPP planted the trees depending upon demand and popularity. Prices varied: mango seedlings cost 7 Rand, guava and papaya sold for 3 Rand each, jacaranda sold for 2.5 Rand and the prices for the other species varied from 1-2 Rand.[62] DAPP income decreased in the dry season because "many people buy during rainfall where water is available and plants grow fast because they get enough water. During [the] dry season there is no [sic] enough water for watering trees."[63]

Indigenous and exotic trees alike thus were closely associated with human agency. They were located on-farm, where people, palisades, and fences protected

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[59] NAN, A450 vol. 7 f. 2/18, Annual Report Ovamboland 1940; BAC 133 f. HN 8/21/4/1, Agricultural Reports Ovamboland 1955/1956 and 1956/1957 and Quarterly Report Agriculture Ovamboland for the Quarter ending 30 June 1958.
[60] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956 and 1956/1957; Quarterly Report Agriculture Ovamboland for the Quarter ending 30 June 1958. See also AHE (BAC) 1/352 f. (14) N8/21/4, Annual Report for Agriculture Ovamboland 1968.
[61] NAN, OVA 50 f. 6/11/3 (I), Sec. Agriculture to Head Research Institute for Citrus and Subtropical Fruits Nelspruit, Ondangwa, 14 August 1974; OVA 6 f. 2/8/1, Annual Report Agriculture Owambo 1979/1980; Jerry Ileka (Agricultural Officer Mahanene Research Station), interview by author, Mahanene, 20 March 1992.
[62] Sheuyange Tufaneni (2nd year student, Agriculture, Ogongo Agricultural College, report of a field trip to the DAPP nursery, Ombalantu, n.d. [July 1993].
[63] Saara Nehale (2nd year student Agriculture at the Ogongo Agricultural College), report field trip to DAPP nursery, Ombalantu, n.d. [July 1993]. Three nurseries operated in Ovamboland in 1993: the government nursery at Ondangwa, the Rural Development Center at Ongwediva (since 1988), and DAPP, see Erkkilä and Siiskonen, Forestry in Namibia, pp. 135-136.

them. Respondents to the 1993 OMITI survey emphasized the intense management of fruit trees. According to the survey, marula and birdplum were by far the most frequently seeded local trees. Marula was also actively propagated by cuttings (18%). By far the most common management practice involved protecting seedlings: 39% and 48% of respondents reported that they protected marula and birdplum treelings respectively (see Table 8.1).

Table 8.1 Fruit Tree Management[64]

	Seeding (N=141)	*Cutting (N=120)*	*(Trans)planting treeling (N=105)*	*Protecting "natural" tree(ling)s (N=163)*	*Coppicing (N=62)*	*Pruning (N=166)*
marula	15%	18%	9%	39%	31%	20%
birdplum	15%	7%	9%	48%	13%	20%
palm	6%			9%	16%	19%
fig	4%	5%	3%	9%	5%	4%
jackalberry	0.7%			10%	5%	7%
baobab	1%		1%	2%		0.6%
manghetti				1%	2%	1%
monkey orange (omuuni)				4%		2%
papaya	40%	8%	19%	8%	5%	
citrus	3%		6%	1%	5%	
guava	8%		15%	0.6%		0.6%
mango	2%		2%			

Respondents to the 1993 OMITI survey ranked indigenous fruits as the most important trees in their villages. Birdplum and marula were mentioned by respectively 64% and 63%, of respondents, palm by 48%, jackalberry by 31%, fig by 16%, omuuni by 3%, and baobab by 2%.[65] When queried about the trees that they would wish to have on their farms that they did not already have, respondents mentioned a mixture of exotic and indigenous trees, principally fruit trees (see Table 8.2).[66]

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[64] OMITI 4.4.4, 4.4.8, 4.4.12, 4.4.17, 4.4.20, 4.4.22.
[65] OMITI 4.4.29 (N=353).
[66] OMITI 4.4.30 (N=319). The absence of the mangetti fruit tree is notable. It is possible that respondents and/or interviewers misunderstood omunkete/omughete (mangetti) for omukekete (buffalo thorn).

Table 8.2 Wished-for Woody Plants

Ranking	*Name*	*Frequency (in %)*
1	guava	40
2	citrus	29
3	birdplum	28
4	papaya	25
5	marula	22
6	jackalberry	17
7	eucalyptus	17
8	fig	15
9	mango	13
10	palm	9
11	apple	6
12	banana	5
13	omupapa	3
14	mopane	3
15	baobab	3
16	grapes	3
17	buffalo thorn	2
18	monkey orange	2
19	Bushman orange	1

By the early 1990s, jackalberry, marula, palm, and birdplum were all considered to have become more important than they had been in the past, while the importance of baobab, mangetti, and Bushman orange (omupwaka) had declined over time (see Table 8.3).[67]

Table 8.3 Changes in the Relative Importance of Trees

	Less important now	*More important now*	*No change*
jackalberry	1%	22%	78%
marula	3%	21%	76%
fig	4%	14%	81%
baobab	6%	8%	86%
palm	2%	17%	79%
mangetti	8%	8%	84%
Bushman orange	15%	7%	77%
birdplum	0%	20%	69%

[67] OMITI 4.4.43 (N=325). It may also be significant that jackalberry and marula were listed as "sacred trees" by a relatively high percentage of respondents. The sample was small (N=49), but jackalberry ranked first (mentioned by 20%) with marula in a shared 5th place (8%), and with baobab and birdplum mentioned as "sacred" by 4% each. Birdplum was not listed amongst the possible answers on the questionnaire; the respondents volunteered it.

Farms and Fields: Tree Nurseries

To colonial officials, the location of fruit trees in the landscape appeared random, an impression that reinforced their misperception that indigenous fruit trees were "wild" and "wilderness" trees. In his report for 1956-1957, the agricultural officer stated that the abundant indigenous "natural fruit tree species…grow without any care and succeed well in meeting the needs of the population….they really occur everywhere in the forested areas of the region."[68] The "forested areas" to which the agricultural officer referred were located in the oshilongo, however, and not in the ofuka-wilderness, and the fruit trees were located inside the villages, on farms and fields and not in the bush on the margins of the villages or between farms.

The actual homestead, consisting of living quarters, kitchens, and storage huts and surrounded by a palisade (omiti), was the perfect nursery for the active and passive propagation of fruit trees. Fruit was prepared and eaten within the palisaded homestead; pits and used water were discarded around the huts or on adjacent household middens. Under favorable conditions, pits sprouted and developed into treelings. According to the 1993 OMITI survey, 41% of the households surveyed had engaged in seeding trees, mostly since the mid-1950s; 90% had planted the seeds within the homestead; and all of the households had seeded the trees on-farm. Tree propagation in other forms also centered on the homestead. Cuttings were planted in the homestead by 86% of respondents; 89% of respondents reported (re)planting treelings in the homestead; and in all other cases, treelings were propagated on-farm. According to 54% of OMITI survey respondents, naturally occurring trees were protected within the homestead, and, according to 53% of respondents, within the farm fence. Although three percent of respondents mentioned protecting naturally occurring trees off-farm, in all cases, the trees were located just outside the farm fence. The omiti palisade offered saplings protection from livestock and from the seasonal ravages of the burning sun, merciless winds, and frost. The entire palisaded homestead generally was relocated within the farm every 3-5 years; by then, treelings

[68] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957. See also NAO 17 f. 10/3 (ii), ANC to NCO, Oshikango, 25 January 1942; BAC 123 f. HN 7/8/2/2, Famine Relief Schemes Oshikango vol. 2, Bantu Affairs Commissioner Oshikango to Chief Bantu Affairs Commissioner, Oshikango, 15 November 1961.

were much better prepared to face the elements and livestock. Full-grown fruit trees therefore often marked former locations of the omiti-enclosed homestead.[69]

Indeed, colonial officials' observations indirectly confirm that the most important fruit trees, for example, palm, marula, birdplum, fig, and baobab, were located in the inhabited parts of Ovamboland, as they were often explicitly described as being associated with habitation and homesteads. A manuscript written by the Native Commissioner during the 1920s or 1930s stated: "[i]n the inhabited areas are to be found various wild fruit trees…." In a 1942 letter, the Native Commissioner emphasized that "wild fruits" were part of the diet but that these sources of food were located near the homesteads and "[were], however, not available when working in the bush." In 1953, elephants damaged a large number of "home-trees [emphasis mine] especially…marura [marula] and palm trees –necessary trees which supply people with nutritive food." In 1957, the agricultural officer for Ovamboland wrote "[t]ree species that carry fruit such as Maroela [marula], Wildevy [fig], Jakkalvrug [jackalberry]…usually are not eradicated because of their economic and food value. The Makalanie palm is also protected because of its fruits." In 1961, the Deputy Secretary for Forestry of the Union of South Africa followed the border road from the Kavango region in the east to Oshikango in the west and noted that the landscape changed from a more or less closed forest from the Kavango region to 20-25 miles east of Oshikango, to a much more open landscape west of this point, with beautiful

[69] Interviews by author: Kaulikalelwa Oshitina Muhonghwo, Ondaanya, 2 February 1993; Moses Kakoto, Okongo, 17 February 1993; Timotheus Nakale, Ekoka laKula, 21 February 1993; Helemiah Hamutenya, Omuulu Weebaxu, 17 July 1993; Philippus Haidima, Odibo, 9 December 1992; Paulus Wanakashimba, Odimbo, 10-11 February 1993; OMITI 4.4.1-3, 4.4.7, 4.4.11, 4.4.16. In his overview of agroforestry projects in Africa, Kerkhof noted that few projects conducted initial surveys but stresses that in the cases where project staff did undertake research, they were surprised to learn that farmers commonly planted trees, Kerkhof, Agroforestry in Africa, pp. 52-60, 81, 115, 143-148, 168. Kessy noted that some trees had been domesticated on-farm in East Usambara. He surveyed 18 home gardens to identify "domesticated species" but provides no details concerning how and the extent to which these trees had been domesticated, Kessy, Conservation and Utilization of Natural Resources, pp. 88, 104-106. Kajembe observed that indigenous trees were disappearing from crop fields and that they were concentrated in home gardens or used to mark plot boundaries, see Kajembe, Indigenous Management Systems, pp. 99, 113. Bonnéhin stressed that the Tieghemella heckelii that began to be domesticated in the late 1960s was often found around the locations of old settlements or camps, Bonnéhin, "Domestication paysanne des arbres fruitiers forestiers, pp. 68-69. In his study area in the western part of eastern Ovamboland, Erkkilä observed that the fruit trees that were located in the center of the fields had the highest crown density and surmised that the center of the field indicated the oldest cultivated section. It is as probable, however, that the location marked the location of the original palisaded homestead. In addition, Erkkilä points to a farmer in the Omusati region (in the floodplain) who stressed that he had moved his homestead because marula trees had begun to grow in it and Erkkilä also identifies the fig tree as an introduced tree in Ondobe. See Erkkilä, "Living on the Land," pp. 92, 97-98.

marula, jackalberry, and fig trees scattered in the Ovambos' fields.[70] The 1963 Odendaal Commission reported: "Westwards towards the oshana region of Ovamboland [i.e. the Ovambo floodplain] the bush becomes sparser and the ana tree (Faidherbia albida), mopane and palm ... make their appearance. Marula and manketi [mangetti], as well as wild fig and other kinds of trees such as omwaandi [jackalberry] also occur here…. In the southern region of Ovamboland the palm belt merges into extensive grassy plains."[71] Another 1960s description reads, "[t]he first impression of Ovamboland is trees, trees, and more trees. Makalani palms, Mangetti, Maroella [marula] trees and the wild Fig tree and many others."[72] Despite the evidence that the bulk of the fruit trees occurred inside the villages, colonial officials did not revisit the overlapping assumptions that the fruit trees were "wild" - and that they were the sole relics of a previous "natural" forest cover.

The contestation concerning the ownership of fruit trees on private farms and the rights to their fruits that emerged during the early 1970s underscores the value of tree fruit and its products. A committee of the new Ovambo "homeland's" legislative council undertook to evaluate land tenure in Ovamboland, holding closed meetings with a limited number of select notables in all the "tribal areas." One of the objections raised against existing land tenure arrangements was that if a person "bought" a piece of land with fruit trees, the fruit would not belong to the buyer. The committee concluded that "people" demanded that "[f]ruit trees belong to the owner of the parcel of land and if a headman wanted, for example, marula drink, he should receive this as a percentage and indeed in a friendly way." [73] By 1993, it was rare that outsiders had rights to the fruits of a household's on-farm trees; when asked if they could change any rules regarding trees, just 6% of households answered that the owner of a farm should fully control the on-farm trees.[74]

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[70] NAN, A450 vol. 10, f. 2/40, "Tribal Affairs"; NAO 17 f. 10/3 (ii) ANC to NCO, Oshikango, 25 January 1942; NAO 67 f. 24/14, Tribal Secretary Uukwaluthi to NCO, Uukwaluuthi, 22 September 1953; BAC 131 f. HN 8/17/4), Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957 and BAC 131 f. HN 8/17/2, Deputy Secretary of Forestry,"Report of a visit by the Deputy Secretary of Forestry to South West Africa: 17-29 April 1961," Pretoria, 10 May 1961.

[71] Report of the Commission of Enquiry into SWA Affairs 1962-1963, 12 December 1963, p. 9.

[72] NAN, WAT 3 f. 17 (ii), S. Davis, Tour of Northern Territories – Some Random Observations, Comments, and Thoughts [approximately 1960]."

[73] NAN, OVJ 15, f. 12/1 "Minutes of the elected Committee on land ownership and use," Oshakati, 4 December 1970, appendix to Secretary of the Interior to Secretary Justice and Labor, Ondangwa, 9 November 1973 and "Kommentaar op konsepverslag van gekose komitee van die Owambo wetgevende raad … [1974?]."

[74] OMITI 4.1.9.

Yet, barely a decade earlier, the king and headman in the southern Ondonga area allegedly owned the fruit trees (including the marula), even if they were located on an individual's farm. Commenting on tree management practices, 18% of the 1993 OMITI respondents emphasized that in the past, especially in the case of (marula) fruit trees, outsiders (specifically headmen and kings) had had rights to fruit trees on a household's farm. Individuals who picked the fruits solely for their own use were punished with heavy fines. In contemporary Oukwanyama, where royal authority had been destroyed during the 1910s, the owner of a farm had full use rights for all of the fruit trees on the land except for the marula tree: part of the marula wine had to be presented to the village headman, who in turn gave a share of it to his district headman (or senior headman). For other fruit trees, however, the owner of the farm could even sub-allocate use rights to a third party.[75]

By the early 1990s, the fruit of on-farm trees was considered to be the property of the household: according to 79% of the respondents, the head of the household, and/or the members of the household (according to 67% of the respondents) could freely gather fruit from their on-farm fruit trees. Only 4% of respondents specified that fruit could be picked by the person who planted the tree in question; only 2% of respondents stated that everybody could gather the fruit of on-farm trees; and only 1% said that fruit from trees could be freely picked from a neighbour's farm.[76]

In sharp contrast, according to 84% of respondents, the fruit of any off-farm trees could be gathered freely by "everybody;" 6% stated that the permission of the "government" was required, and 6%, 4%, and 2% respectively emphasized that the headman, the head of the household, and the members of the household had to be consulted first. Four percent reported that nobody could gather such fruit freely.[77] Off-farm trees were sometimes fenced, an action that constituted a general right according to 51% of respondents, although 27% of respondents maintained that no one was allowed to fence them. Eleven percent of respondents thought that only the government could fence an off-farm tree; 9% was of the opinion that the headman had

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[75] NAN, BOS, N.A. to [Bantu Commissioner Ondangwa], Oranjemund, 27 March 1961 and Native Commissioner Oshikango to CNC, Oshikango, 24 June 1958 and 8 October 1961. Fruit trees and bundled rights, OMITI 4.1.8. Cf. OMITI 4.4.37 where 41% of a small sample (N=98) in their responses emphasized that in the past households did not enjoy exclusive rights to the (fruit) trees on their farm because of rights held by kings, headmen, church elders, and the individuals who had planted the trees involved.

[76] OMITI 4.1.2.0-1.

the right to do so; and 5% and 1% respectively stated that it was the privilege of the head of the household or the king.[78] In brief, over time, local understanding surrounding on-farm vs. off-farm fruit tree rights evolved clearly.

Conclusion

The most dramatic reforestation in Ovamboland was the result of tree propagation based on individual agency that moreover was focused on individual trees. In addition, fruit tree propagation was confined to the private, household space that ironically had also been the loci of the most destructive deforestation. While such indigenous fruit trees as marula abounded in the early twentieth century northern Ovambo floodplain oshilongo, they were rare in the middle floodplain ofuka and in the southern floodplain until they were introduced by refugees from the northern floodplain. The resulting process of reforestation in Ovamboland appears to sharply contradict studies that have argued that north central Namibia's twentieth century history is marked by dramatic deforestation.[79] The marula, birdplum, and palm trees that dot Ovamboland's fields are neither "wilderness" nor "wild" trees, and thus do not constitute the relic vegetation of an earlier extensive forest cover.[80] Rather, they were propagated both passively and actively through human agency (e.g. via seeds and cuttings), and they were as rare in the uninhabited ofuka in the 1890s as they were in the 1990s ofuka-wilderness.

Crop fields were not only forest tombs, but also tree nurseries, where the active and passive propagation of regional trees was increasingly accompanied by the planting of "exotic" trees. After the woody vegetation on the farms and fields had been cut and burned to erect homes, palisades, and fences, livestock and people were kept away from areas that functioned as sanctuaries for selected saplings. On-farm reforestation was first and foremost a process that took place at the intra-household,

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[77] OMITI 4.1.2.0-1.
[78] OMITI 4.1.6.1.
[79] On deforestation, see Erkkilä and Siiskonen, Forestry in Namibia; M. Seely and A. Marsh (eds.), Oshanas: Sustaining People, Environment, and Development in Central Ovambo ([Windhoek], 1992).
[80] For Ovamboland, see Seely and Marsh, Oshanas and R.J. Rodin, The Ethnobotany of the Kwanyama Ovambos ([Missouri]: Missouri Botanical Garden, 1985), p. 34. Cf. the seminal articles on the same fruit tree species in Zimbabwe by K.B. Wilson, "Trees in Fields in Southern Zimbabwe," Journal of Southern African Studies, vol. 15 (1989), no. 2, pp. 369-383 and B.M. Campbell, "The Use of Wild Fruits in Zimbabwe," Economic Botany, vol. 41 (1987), no. 3, pp. 375-385. Although they stressed that fruit trees were "wild" trees and that the fruit trees were spared when the original vegetation cover was cleared for settlement, both Wilson (p. 373) and Campbell (p. 383) noted, however, that some of the fruit trees had been planted.

farm, field, and tree level. This chapter (and the preceding chapter) demonstrate the importance of differentiating environmental change at the micro level, showing how households and individuals caused environmental change on a day-to-day basis. Only the micro-level of analysis allows for an assessment of the motivations behind human agency. For example, trees were overwhelmingly cut and propagated by individuals or by groups of individuals, processes that occur tree by tree. Moreover, the chapter highlights that the process of on-farm reforestation in Ovamboland had a very strong gender dimension. Women disinvested from crop cultivation as it became increasingly male "owned" (but commensurately dependent on female labor) and they reinvested in propagating and protecting especially fruit trees, which were not only a relatively uncontested source of household food, but also a potential source of extra-household income and a form of social security.

Thus the chapter reveals a most striking phenomenon: the very sites that suffered the most severe deforestation, that is, individual farms and fields, and their immediate surroundings, were also the loci of the most dramatic reforestation. In tandem with the preceding chapter, this chapter also illustrates that the motivation to cut down and to propagate trees may not primarily emerge from any specific environmental considerations regarding the role of trees or forests. In Ovamboland, for example, women played a major role in the propagation and management of the fruit trees but their actions were not motivated by strictly environmental concerns. Rather, because men heavily contested their control over land and crops, women diverted part of their attention to a less coveted resource: fruit trees.

CHAPTER 9
ORGANIC MACHINES:
COLONIAL SCIENCE, CULTURE, AND NATURE

A unilinear Nature-to-Culture model by definition and a-priori defines the outcome of the process of environmental change as Culture. In early 1970s Ovamboland, Culture seemed to dominate Nature. A hydraulic system that supplied water from the Kunene River throughout the year made urbanization possible, providing many villagers with clean water through a pipeline system, and supporting small-scale irrigated horticulture and tree nurseries. The tree nurseries supplied seedlings to large Eucalyptus plantations that were being managed according to scientific forestry, and which were intended to combat deforestation by making available an alternative supply of construction and fuelwood to Ovamboland's growing population.

Colonial officials and experts –inspired by a modernization zeal - regarded the hydraulic system and the forest plantations as scientific tools to liberate Ovamboland from the constraints of a semi-arid environment: wood and water would be in abundant supply despite deforestation and desertification. By the early 1990s, however, the Eucalyptus plantations were in disarray and they had in fact contributed nothing to satisfy local wood needs. Moreover, a severe drought during the early 1990s demonstrated that scientific hydraulic technology had failed to make Ovamboland immune to the vagrancies of a semi-arid climate. The large majority of Ovamboland's population had no access to the new water system and even some of those who were connected to the pipeline standpipes found them empty.

In fact, analysis informed by the declinist paradigm could argue that the colonial hydraulic infrastructure further undermined the local environment: the colonial dams, borehole, canal, and the pipeline system allowed for larger and more concentrated human and animal populations, thus further taxing Ovamboland's environment. An inclinist informed interpretation could highlight the resilience and the sustainability potential of indigenous water practices. The modernization, declinist, and inclinist narratives, however, describe environmental change as unilinear; the point of departure (unspoiled Nature), the outcome of the process (despoiled Nature), and the process of change itself are understood to operate in a closed bipolar universe where Culture gains as Nature loses.

Richard White's concept of the "organic machine" offers an alternative mode for analyzing the history of water resources and plantation forestry in 20th century Ovamboland. According to White, the modern Columbia River in the United States is an organic machine because humans have modified it in their attempts to control it (e.g. through dams and spillways), but without fully understanding the river system's past and present workings, and thus without establishing real domination.[1] Similarly in Ovamboland, colonial scientists constructed canals, causeways, and dams, and laid out plantations without fully understanding the region's environmental dynamics. Their efforts failed to conquer Nature, and floods and droughts continued to frustrate government development goals.

White underscores that the Columbia River is organism and artifact, both Nature and Culture: an ecosystem that is an organic machine. The concept emphasizes that nature and culture are closely interrelated, as opposed to being discrete opposites.[2] As applied to the history of environmental change in 20th century Ovamboland the concept bypasses not only the Nature-Culture dichotomy (by introducing a hermaphrodite), but, in addition, facilitates moving beyond a second, closely related dichotomy between (Western) science and technology and (non-Western or indigenous or traditional) knowledge and technology. The Nature-Culture and the Western Science-Non-Western Indigenous Knowledge dichotomies are closely related because Western Science is often equated with Culture and Indigenous Knowledge is often presumed to work within Nature. Colonial science and technology and indigenous knowledge and technology, however, interacted closely concerning water use and management in Ovamboland. Colonial water experts intentionally located dams and wells on the sites of pre-existing indigenous water harvesting systems and Ovamboland's elite in turn rapidly adopted and adapted well technology.

A second useful and related concept is that of a mosaic vegetation or mosaic environment. The concept highlights differentiation and diversity in the process and the outcome of human-nature interaction, in contrast to the Nature-Culture dichotomy, which imposes homogenization through the idea of a rolling frontier that changes everything (usually nature) in its path, leaving cultural landscape in its wake. The concept does not a priori privilege human or nature's agency over the other, and it offers a narrow passage between the rock of environmental/biological determinism

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[1] White, The Organic Machine.
[2] White, The Organic Machine, pp. 108-110.

and the hard place of cultural/human determinism.[3] Highlighting human-nature interdependence, perceiving environmental change as a differentiating process, and acknowledging both humans and nature as environmental actors (with social, political, economic, and cultural repercussions) permits the identification of more dynamic and open-ended impacts and outcomes.

This chapter analyzes the dynamics of environmental change by focusing on colonial scientific water and forestry projects. The chapter also assesses the extent to which colonial science interacted with local bodies of knowledge and technology.

Colonial Science and Environmental Planning

During the early 1940s, the Native Commissioner of Ovamboland concluded that the Ovambo floodplain area was overpopulated. He consequently postulated that serious environmental degradation including deforestation could only be prevented if the region east of the floodplain could be further opened up to accommodate the population increase.[4] The enormous stretches of land in eastern Ovamboland and south and southwest of the floodplain, however, could not effectively be used because of a lack of water. Indeed, a steady supply of water could not be maintained even for the small administrative staff at the Ovamboland colonial headquarters at Ondangwa, despite the use of modern dam and borehole technology. In 1947-1948, plans to move the administrative headquarters to another location were discussed, but the idea was abandoned.[5] Ironically, a rainy season with heavy local rains or heavy rains in the northern part of the Kuvelai watershed (which fed the semi-annual flood or efundja) often cut the Ondangwa headquarters off from the rest of Ovamboland and severed overland communications with the rest of South West Africa. The 1950 flood served as another harsh reminder of how vulnerable the South African colonial order was to the whims of Nature. During the 1949/50 rainy season, the watercourses were so full that communications between Ondangwa and Oshikango were cut off for months,

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[3] Bradshaw and Marquet, How Landscapes Change, especially the Introduction and chapters 1, 2, 5, and 18; Bassett and Crummey, African Savannas, pp. 43-45; Evans, Environmental Archaeology, p. 53. Merchant proposes the idea of a human-nature partnership instead of focusing on the question of whether people or nature is dominant, Merchant, Reinventing Eden, pp. 6, 217, and 223-226.
[4] NAN, A450, 10 f. 2/40 draft annual report Ovamboland for 1942 and [Mss: a page marked with number: 56].
[5] NAN, NAO 101 f. 43/1 [Secretary] SWA to Administrator SWA, [Windhoek], 2 February 1948 and NCO to Director Works, Windhoek, 22 November 1947.

long after the rains had stopped.[6] Another major flood in 1954 isolated Ovamboland for almost four months and severely hampered labor recruitment for the South West African and South African mines, industries, and farms.[7]

In 1950, the Department of Works and the Native Commissioner for Ovamboland proposed a scheme of combined road and water conservation projects to address water shortages during the dry season and flooding during the rainy season. A pilot project was initiated at Okapya, 9 miles north of Ondangwa, where the road crossed one of the major seasonal watercourses between Ondangwa and Oshikango. The project called for a dam to be constructed using soil excavated from the upstream side of the watercourse. The construction would permit water to be stored up to one meter (three feet) above the bed of the watercourse. The dam also functioned as a traffic lane above the rainy season flood level.[8] Water storage dams and boreholes were the main scientific technologies used to attempt to harness Ovamboland's "natural" and "wild" water resources through the 1960s.

A 1947 report on the geology and groundwater conditions concluded that boreholes that relied on deep fresh water aquifers could also bring relief to the eastern and western parts of Ovamboland. In the central areas, which constituted the heart of the densely settled floodplain, however, colonial experts judged boreholes to be inefficient because of highly saline aquifers. Instead, the Director of Works proposed an improved version of the excavation dams that had been introduced through food for work projects during the 1929-1931 Famine of the Dams. Significantly, the Director of Works, an engineer, concluded that excavation dams were the only useful addition colonial science had to offer to the indigenous water hole technology. The excavation dams, however, had two drawbacks. First, the dams could not be excavated too deeply for fear of contamination from subsurface saline water layers. Second, the dams were small, and they were rapidly polluted by people and animals. As an alternative, the Director of Works proposed excavation storage systems, which consisted of star-shaped systems of trenches excavated in such a way that they sloped slightly towards the center of the star. A concrete well with sand strainers was placed

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[6] NAN, WAT 144 f. ww 81/22 (i) Secretary [Department of Works?] to Administrator SWA, [Windhoek], 4 December 1950 [sic? 1951?] and Director of Works to CNC, Windhoek, 30 August 1950. Cf. NAO 60 f. 12/1 (I) Telegram NCO to Sec. SWA, Ondangwa, 17 February 1950.

[7] NAN, NAO 65 f. 21/14, Annual Health Report Ovamboland 1954.

[8] NAN, WAT 144 f. ww 81/22 (i) Secretary [Department of Works?] to Administrator SWA, [Windhoek], 4 December 1950 [sic? 1951?] and Director of Works to CNC, Windhoek, 30 August 1950.

in the center and the trenches were filled with loose sand. Part of the water would be soaked up by the sand, which served to reduce evaporation and to filter the water.[9]

Colonial Science and Colonial Practice

Between 1947 and 1953, however, little came of these plans. Engineers successfully drilled four boreholes in eastern Oukwanyama and equipped them with pumps and engines. They also drilled a number of boreholes at and near Oshigambo mission but the water was of questionable quality. Two boreholes constructed in Uukwaluthi district in western Ovamboland yielded water unfit for human consumption. The construction of a dam at the Ondangwa administrative offices was a failure. Only the pilot dam causeway north of Ondangwa on the Ondangwa-Oshikango road functioned, and, although the floodwaters destroyed the causeway by early 1953, 13 additional dam-causeways were envisaged between Ondangwa and Oshakati, and 66 from Ondangwa westward to Uukwaluthi and Tshandi. Pipes through the dam-causeways allowed surplus water to flow to the downstream side of the dam. Colonial experts proposed that water erosion could be reduced by temporarily protecting the sides of the dam-causeways with a frame of small poles and sticks until a thick grass cover had developed.[10]

Colonial Dams and Indigenous Knowledge

Colonial water reservoirs, known as "dams" in Namibia and South Africa, may not have substantially augmented the total water availability. Despite colonial claims to the contrary, typically, the reservoirs merely replaced existing "indigenous" water hole complexes (sing. etambi, pl. omatambi). While the dams may have "harvested" more water, water preservation and distribution were far less efficient than in the case of the "traditional" water holes, and water losses through evaporation were considerably higher.

Between 1953 and 1966, the colonial administration constructed more than 300 water storage dams in Ovamboland. The dams typically had a capacity of 20-30,000 m3. The administration often constructed the dams at the location of pre-existing indigenous water hole complexes or wells. A small number of the colonial

[9] NAN, NAO 101 f. 43/1, Director of Works, "Ovamboland: Geology and Groundwater Conditions," 5 November 1947.

dams were pump storage dams: the stored water fed wells located on the side of the reservoir. The colonial administration only constructed pump storage dams at selected sites that included its headquarters at Ondangwa and Oshakati, hospitals, for example at Odibo, and "tribal" capitals. The well shafts in the pump storage dams consisted of brick and the top was covered with a concrete slab to limit pollution. Water use was expected "to be small and only for the utmost priorities; and in their own interest the population has to assist in ensuring that water is not wasted."[11] Food for work programs during the 1953 and 1958-1961 droughts provided cheap labor for the construction of dams and other water projects.[12] From 1961 onwards, however, dam construction was less dependent on local labor. A bulldozer/tractor purchased with Tribal Trust Funds was an important tool for constructing dams. The bulldozer prepared the ground for all five dams constructed in 1962, as well as for one of the three dams completed in 1964, four of the 13 dams that were added in 1965, and the single dam that was constructed in 1966. Contractors constructed most of the other dams.[13] Some of the dams were intended to support the creation of planned towns.[14]

The new dams, however, proved less effective than had been anticipated. During the countrywide 1958-1959 drought, rainfall in most of Ovamboland was far below average and the flood (efundja) did not reach Ovamboland. A survey of 80 dams revealed that only 30% of the dams (mostly located in the eastern Ovamboland, where rainfall had been better) were full. Twenty-two percent of the dams were

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[10] NAN, NAO 101 f. 43/1, NCO to CNC, Ondangwa, 14 February 1953 and WAT 144 f. ww 81/22 (ii), "Report on the Details of Schemes," 29 January 1953.

[11] NAN, WAT 148 f. 81/22 (xiii), Director Water Affairs to Bantu Commissioner, Windhoek, 23 and 24 March 1966 and BOS, District Record Book Oshikango [typescript by N.A. Burmeister, Acting NC Oshikango, 1965], pp. 10-11; OVA 33 f. 5/3/1-7, Senior Magistrate Ondangwa to Superintendent Onandjokwe Lutheran Hospital, Ondangwa, 4 March 1970. For an example of a "dam" constructed purposefully at a site of a water hole complex [etambi] – in this case in Uukwaluthi, see OVA 33 f. 5/3/1/2/6-7, Agricultural Officer to Sec. Agriculture, Ondangwa [22 November 1974]. In the 1970s, an official requested the Tribal Council of Uukwaluthi to indicate sites with "water hole complexes" for the creation of dams, OVA 33 f. 5/3/1/2/6-7, Agricultural Officer to Sec. Agriculture, Ondangwa, 22 November 1974 [or 1977?]. On the typical size of the dams, see WAT 148 f. 81/22 (xii), Director Water Affairs to Chief Engineer Conservation Rhodesia, Windhoek, 16 July 1965. On pump storage dams, see WAT 147, f. 81/22/1 (ix), Register Dams in Bantu Areas, appendix no. 7 to Five Year Plan Water Affairs [1962 or 1963].

[12] NAN, BAC 122 f. HN 7/8/2/1 (I), Chief Bantu Commissioner to Minister Bantu Administration and Development, Windhoek, 26 June 1959 and 16 May 1959.

[13] NAN, BOS, District Record Book Oshikango, pp. 10-11. See also WAT 148 f. 81/22 (xii-xiii), Director Water Affairs to Chief Engineer Conservation Rhodesia, Windhoek, 16 July 1965; Progress Report Dams, Bridges, 28 February 1966 and Director Water Affairs to Bantu Commissioner Ondangwa, Windhoek, 24 March 1966.

[14] NAN, WAT 148 ww81/22 (xii), Adjunct Director Water Affairs to Director Works, [Windhoek], 11 June 1965 [?] and Sec. Bantu Administration to Chief Bantu Commissioner Windhoek, Pretoria, 2 February 1965.

empty, 29% were only ¼ full, 9.5% were half full and 9.5% were ¾ full. All of the dams that were less than ¾ full (i.e. 40% of the dams) were expected to run out of water within two to three months. Only 40% of the 80 dams, therefore, were expected to contain water during the height of the dry season. Under normal conditions, the rainy season generally did not bring relief to the water situation until October/November, at the earliest. In western Ovambo, however, people had deepened their "wells" (probably mostly water holes) as early as May, an activity that under more favorable circumstances typically took place in October/November.[15] Conditions were better in subsequent years, but were far from satisfactory. Surface water supplies following the rains in late 1959 quickly ran out by early 1960. The large dam at Okatana contained a mere two feet (0.6 meter) of water, and most storage dams (except those in eastern Ovamboland) only contained muddy water. During this time, people reportedly relied only on "traditional" water holes. The staff of the South West Africa Native Labour Association shop at Ombalantu hauled water all the way from the Kunene River and the Ondangwa government station.[16] In the 1961-1962 season, one of every five dams was completely dry (see Table 9.1).

Table 9.1 Water Stored in Dams during the Beginning of the Dry Season, 1958-1962[17]

	1958/59 (80 dams)	*1959/60 (96 dams)*	*1960/61 (97 dams)*	*1961/62 (122 dams)*
Dam full	30%	64%	61%	22.1%
¾ full	9.5%	3.2%	7.2%	22.1%
½ full	9.5%	8.3%	7.2%	15.5%
¼ full	29%	17.1%	10.15%	18.9%
empty	22%	7.4%	12.35%	21.4%
no data	-	-	2.1%	-

By 1968, Ovamboland had 257 storage dams and 45 other types of dams. Evaporation losses in the shallow excavation dams were high. A 1965 report ventured that evaporation in the dams was 2.4 meters (8 feet) per year. Observations at Mahanene research center in Ovamboland in the 1970s, resulted in evaporation figures between 2.9 and 3.2 meters (9-11 feet) per annum, with over 30% of the annual losses occurring during the months of October, November, and December. By

[15] NAN, BAC 122 f. HN 7/8/2/1 (I), Director Water Affairs Department to CNC, Windhoek, 13 May 1959.
[16] NAN, BAC 123 f. 7/8/2/1(iii), Chief Bantu Commissioner SWA to Sec. Bantu Affairs, Windhoek, 8 February 1960.
[17] NAN, WAT 146 f. 81/22 (viii), SWA Administration, Windhoek, 3 July 1962. The table presents data on all the dams and causeway-dams.

the mid-1960s, the use of floating slabs in the pump storage dams may have cut evaporation losses by half.[18] Another problem was the build up of silt (up to one to two feet a year), especially in the pump storage dams, although the clay build up also may have sealed the reservoirs off from saline water infiltration.[19]

Creating a Colonial Hydraulic Society

By the early 1960s, borehole exploration had only proved successful in the southwestern and northeastern margins of Ovamboland; elsewhere, the water proved to be too saline. In 1968, Ovamboland had a total of 65 working boreholes. Boreholes were costly, particularly given the high failure rate for discovering potable water. In 1968 alone, 49 drilling attempts had failed. Of the 54 boreholes that were successfully drilled, eight were inoperational due to a lack of equipment; five had too low a yield to make it worthwhile to install pumps; 14 yielded water unpotable to either human or animal; and in nine boreholes, the water quality was only suited for livestock consumption. In brief, only 18 operational boreholes yielded water potable for humans. Moreover, operating the boreholes that contained potable water required installing wind pumps, and in 1967, for example, a number of the boreholes in the far east of Ovamboland lacked adequate equipment and consequently did not function. Borehole yields varied from as little a nine gallons (36 liters) per hour to over 4,000 gallons (16,000 liters) per hour.[20] In 1974, a government geologist recommended halting borehole prospecting in Ongandjera in the southwestern side of the floodplain because the high salinity and fluoride levels made the water unsuitable for human consumption.[21] Boreholes continued to be constructed, however, and by 1980,

[18] NAN, WAT 148 f. 81/22 (xii), Director Water Affairs to Chief Engineer Conservation Rhodesia, Windhoek, 16 July 1965. The slabs consisted of a mixture of cement, sand, and plastic and measured 60x60x5 cm or 24x24x2 inches. See also OVA 48 f. L6/8/3/1-7 (ii), Venn, Loxton, Hunting & Associates, Periodic Progress Report Mahanene research Station, 15-16 June 1974; WAT 333 f. 23/8 (I), Director Water Affairs to National Institute Transport, 30 November 1978. In the late 1960s, evaporation losses at the Oshakati dams were 20 cm (8 inches) (probably on an annual basis) but at the hospital dam, which was likely a pumpstorage dam with floating slabs, evaporation was only 10 cm. (4 inches), WWA [WAT?] 640 f. 31/3/2/1, Water Use 12 October 1967 to February 1969.

[19] NAN, WWA [WAT?] 636 f. 31/3 (I), Damlogs 1970 and Report J.D. Peterssen, 23 July 1969.

[20] NAN, WWA [WAT?] 222 f. 20/8/1(ii), Bantu Commissioner to Chief Bantu Commissioner Windhoek, Oshikango, 15 August 1967 and Chief Bantu Commissioner to Director Water Affairs, Windhoek, 7 November 1966; WWA [WAT?] 223 f. 20/8/1(iii), Report Boreholes Western Ovamboland, 24 September 1970; WAT 66 f. 70/13/2(ii), Sec. SWA to Sec. Bantu Administration Pretoria, Windhoek, 21 June 1961; AHE (BAC) 1/352 f. (14)N8/21/4, Annual Report Agriculture Ovamboland 1968; OVA 33 f. 5/3/2, Adjunct Director Geological Survey to Director Water Affairs Windhoek, Windhoek, 29 January 1974.

[21] NAN, WWA [WAT?] 223 f. 20/8/1(iii), Report Boreholes Western Ovamboland, 24 September 1970; WAT 66 f. 70/13/2(ii), Sec. SWA to Sec. Bantu Administration Pretoria, Windhoek, 21 June

Ovamboland contained a total of 206 boreholes. Chiefs and headmen privately owned some of the boreholes.[22]

In the early 1960s, the colonial administration introduced a grand scheme to construct canals across the floodplain. The canals were to be oriented perpendicular to the north-south drainage and they initially were conceived to redirect the flood and rain waters to the envisaged administrative and core urban areas in Ovamboland and ultimately (in the 1970s), to import water from the Kunene River. The plan called for the canal to cover a distance of 70-80 miles from the Kunene River to close to Okatana, about 25 miles to the northwest of Ondangwa. A second canal served to guide water into the Etaka seasonal river that formed the southwestern edge of the floodplain. The administration initiated the project in 1959 and by early 1960 five miles of canal had been constructed near the large Okatana dam.[23] Water losses in the canal were expected to be as high as 21% of the total volume carried, partly through percolation, but mainly through evaporation (10-15%). By the end of 1965, the canal ran from east of Ombalantu to Oshakati Dam, which was then connected to Ondangwa through a pipeline. The Finnish Mission station and its hospital at Elim were connected to the main canal with a smaller canal. The Etaka canal was completed between Eunda and Ongandjera using part of the Etaka seasonal riverbed.[24] The canal required periodic cleaning to remove silt and plant growth.[25]

Colonial Water Technology and Environmental Change

It is difficult to measure unambiguously the impact of changes in Ovamboland's water infrastructure in terms of environmental improvement or degradation. Environmental change was dramatic. First, the entire pattern of the availability of water resources changed both seasonally and structurally. The canals

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1961; AHE (BAC) 1/352 f. (14)N8/21/4, Annual Report Agriculture Ovamboland 1968; OVA 33 f. 5/3/2, Adjunct Director Geological Survey to Director Water Affairs Windhoek, Windhoek, 29 January 1974.

[22] NAN, OVA 49 f. 6/9/1(I), Sec. Agriculture to Sec. Department Chief Minister, Ondangwa, 3 May 1980; OVA 33 f. 5/3/1-7, Ongandjera Tribal Authority to Sec. Agriculture, Okahao, 4 April 1978 and Sec. Agriculture to Magistrate Ondangwa, Ondanwa, 21 May 1979.

[23] NAN, BAC 122 f. HN 7/8/2/1 (I), Chief Bantu Commissioner to Minister Bantu Administration Windhoek, 26 June 1959 and 16 May 1959; BAC 123 f. 7/8/2/1 (iii),Chief Bantu Commissioner SWA to Sec. Bantu Affairs, Windhoek, 8 February 1960.

[24] NAN, WAT 159 f. 90 (ii), H.J. Van Eck to Dr. O. Wipplinger, Johannesburg, 21 February 1963 and document following entitled "Estimated Costs of 1,800 Cusec Canal"; WAT 3 f. 17(ii), Sketch; WAT 147 f. 81/22/1(ix), Director Water Affairs Ovamboland, Canal Scheme Construction Program, 1963/64.

[25] NAN, WWA [WAT?] 636 f. 31/3(I), Senior Inspector N.H. Schwartz, Owambo-Report on Waterinstallation, 22 May-2 June 1972.

permitted for greater densities of human and animal populations, even in areas where no human settlement previously had been possible. Because a pipeline ultimately connected the canal to the Kunene River, the canal held water permanently, even during severe droughts. In many areas, the canals, boreholes, and dams thus improved water availability. In other areas, however, the effect was exactly the opposite: the new water infrastructure decreased water availability. The canals - especially the Ovamboland canal from the Kunene to Okatana - cut diagonally through the southern floodplain drainage lines and quite effectively redirected floodwater from the seasonal watercourses towards Okatana (and later Oshakati and Ondangwa).[26] That directing the water in the floodplain environment away from the areas south of the canal (including the Etosha Park) might decrease water availability was considered, but it was thought to be easily fixed with colonial technology and the impact that it caused has not been taken into account in later environmental analyses of Ovamboland and the Etosha Park. The issue was raised during a 1961 "tribal" meeting in Uukwambi; after the secretary of the meeting had already noted in the minutes "[n]o more speakers," a Paulus Siyemba warned: "It will be difficult because the canal has cut off the water."[27] The Bantu Affairs Commissioner for Ovamboland, however, took note of this warning and reported to his superior in Windhoek that: "the inhabitants of those areas where canals have been dug to lead water to storage dams… have objected because their water in the pans and storage/gathering places nearby their huts is led away." The Director of Water Affairs conceded that the canal, which redirected the floodwaters descending from the north, effectively functioned as a dam that prevented water drainage further south, and he recommended that sluices be constructed at all the 18 flood channels that the canal cut through in order to allow water to flow south of the canal when required.[28]

Although work crews installed pipes through the causeway dams to allow floodwater to pass, the dams at best delayed the passage of water downstream. The

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[26] NAN, WAT 147 f. 81/22/1(ix), Director Water Affairs Ovamboland, Canal Scheme Construction Program 1963/64. See also WWA [WAT?] 640 f. 31/3/2/1(I), Director Water Affairs, Memo Watersupply Capacity of Oshakati-Ondangwa Scheme, 15 July 1966; WWA [WAT?] 637 f. 31/3/1(ii), Owambo Master Plan: Notes of Meeting Water Affairs with Commissioner-General, Oshakati, 15 March 1972.

[27] NAN, BAC 44 f. 1/15/4/17 Minutes of the annual and quarterly meetings held at Uukwambi on 15 June 1961.

[28] NAN, WAT 146 f. 81/22(vii), Bantu Affairs Commissioner to Chief Bantu Commissioner Windhoek, n.d., appendix to Chief Bantu Commissioner SWA to Director Water Affairs Windhoek, Windhoek, 11 July 1961; WAT 147, f. 81/22/1(ix), Director Water Affairs Ovamboland, Canal Scheme Construction Program 1963/64.

roads themselves were intended to ensure all-weather communications and had been built above the high-water mark in order to facilitate water storage upstream. Between 1953 and 1958, work crews constructed sluices at approximately 50 locations along the road to allow the water to pass through. The road, however, continued to be damaged by floods. Between 1964 and 1967, the administration upgraded the Oshakati-Ombalantu road to a gravel road provided with concrete bridges and "drifts" (fords) to improve all-weather access to the canal as well as to protect the canal itself against flood damage. The effective damming of at least 18 floodwater channels by the road/canal combination, however, also resulted in higher losses through evaporation and percolation upstream. As a result, the amount of floodwater downstream of the Ovamboland canal and the Ondangwa-Ombalantu-Ruacana road decreased.[29] On the other hand, because downstream run-off was obstructed, flood levels may have increased directly north of the canal, potentially damaging crop fields. Moreover, silt deposited upstream of the canal/"dam" may have clogged up the inlets to pipes and sluices, and may also have caused fields to flood.[30]

Secondly, the changes had significant effects on water access and management. "Traditional" water holes were overwhelmingly "private" resources controlled by individuals and individual households.[31] Repair, maintenance, and water hole construction relied on locally available tools, materials and knowledge. Under colonial rule, some of the best sites for harvesting water through water holes were transformed into water storage dam facilities under vague notions of "communal" tenure that on occasion resulted in de facto water alienation. In the 1950s and 1960s, for example, the administration requested that African owners of individual water holes and wells allow colonial dams to be constructed on the sites of their water sources because the dams would benefit the community as a whole. Memories of this sacrifice by local inhabitants, however, were short-lived. In 1970, the management of Onandjokwe hospital prohibited local villagers' access to "its" dam, even though Johannes Nkana claimed that his father had owned a water hole on

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[29] W. Bertelsmann, "Wasserbau im Ovamboland," SWA Annual, 1959, pp. 141-144; WWA [WAT?] 456 f. 30/4/7(iii), Acting Chief Road Engineers to Administrator-in-Executive-Committee, 22 November 1967.
[30] On siltification processes and flooding, see, for example, B. Dalal-Clayton, Environmental Aspects of the Bangladesh Flood Action Plan. International Institute for Environment and Development (IIED), Issues Series No. 1 (1990), p. 11.
[31] On the private ownership of water holes, see, for example, NAN, WWA [WAT?] 637 f. 31/3/1(ii), Department Water Affairs, Report Re. Watersupply Ovamboland Schools, Appendix to Acting Chief Inspector to Director Water Affairs Windhoek, Otjiwarongo, 13 May 1970.

the site where the dam had been constructed in 1958.[32] Also in 1970, the doctor at Onakayale hospital requested that the colonial administration construct a second dam at Onakayale village so that the existing dam could be reserved for use by the hospital, the labor recruitment depot, and the local school. The doctor explained that although most of the local households relied on water holes, during drought conditions, they had come to depend on the water taps at the hospital and the school.[33]

Colonial officials typically considered the new water storage dams to be government property. In addition to highly specialized technology and materials, constructing a dam (as well as repairing and maintaining it) required mobilizing a large labor force and/or a bulldozer. Individual households and even an entire village did not have the capacity to repair and maintain a water storage dam, let alone to construct one. Dam ownership was vaguely defined, sometimes as "communal," but more often as "governmental," which frequently was personalized in the form of the local representative of the colonial government: the district headman.[34]

Although headmen were held responsible for maintaining the dams, colonial officials interfered frequently. For example, in 1957, the colonial administration decided to equip all the new dams with goat-proof fence. In addition, hand pumps were installed to limit the number of cattle that could be watered at each dam, with the aim of preventing overgrazing and trampling.[35] Finally, in the mid-1960s, the colonial administration prohibited wading, swimming, and fishing in the dams.[36]

By the early 1970s, agricultural extension officers effectively supervised dam maintenance and repair; they inspected the dams, reported where fences around the dams had been damaged, and held meetings with the local populations to urge them to maintain the dams and to encourage them to dig new ones. Coincidentally, people increasingly began to expect the government to care for existing dams and to build

[32] NAN, WAT 148 f. 81/22(xiii), Director Water Affairs to Bantu Commissioner, Windhoek, 23 and 24 March 1966 and BOS, District Record Book Oshikango, pp. 10-11; OVA 33 f. 5/3/1-7, Senior Magistrate Ondangwa to Superintendent Onandjokwe Lutheran Hospital, Ondangwa, 4 March 1970.

[33] NAN, WWA 649 f. 31/3/2/22, Dr. Enzlin to Director Water Affairs Windhoek, Onakayale Hospital, 18 January 1970.

[34] NAN, WWA 637 f. 31/3/1(ii), Water Affairs, Report Watersupply Ovamboland Schools, appendix to Acting Chief Inspector to Director Water Affairs Windhoek, Otjiwarongo, 13 May 1970.

[35] NAN, BOS, District Record Book Oshikango, pp. 10-11. BAC 44 f. 1/15/4/17, Minutes quarterly meetings held at 4 centers in the Oukwanyama Tribal area June 7-21 1957.

[36] NAN, WAT 148 f. 81/22, Director Water Affairs, Circular to all Departments and Branches of the Administration of Ovamboland, Windhoek, 4 January 1966.

new ones.[37] The water storage dams were fewer in number and therefore less readily available to households than the numerous indigenous technology water holes. An agricultural extension worker who in 1971 urged village headmen and villagers to fence their dams was asked "how can you come here to talk about dams; we have no dams and pumps here. The dams are far away. But we would like the department to dig dams for us."[38] In 1980, Ovamboland had 393 livestock dams, 130 reservoir dams, over 160 km (106 miles) of pipeline, 206 boreholes, and 95 government wells (see map 8).[39]

Drought conditions during the late 1960s proved that the dams and the canals were unable to sustain the increased demand for water, especially in the new towns that emerged along the main canal. In 1967, trucks hauled water to the Oshakati area, where taps had to be closed because of the lack of water, and water was sold to the inhabitants of the rural areas around Oshakati in drums. Illegal tapping of water may have accounted for over one third of total "consumption:" a 1970 report noted that the main gauge indicated a total water consumption of over 15,000 m3 yet the total registered by user gauges amounted to less than 10,000 m3. By the end of 1970, the Oshakati-Ondangwa "complex" was so short of water that it had to be rationed. The emergency pipeline that the administration constructed along the road from Angola to Oshakati was initially intended to be a temporary solution.[40]

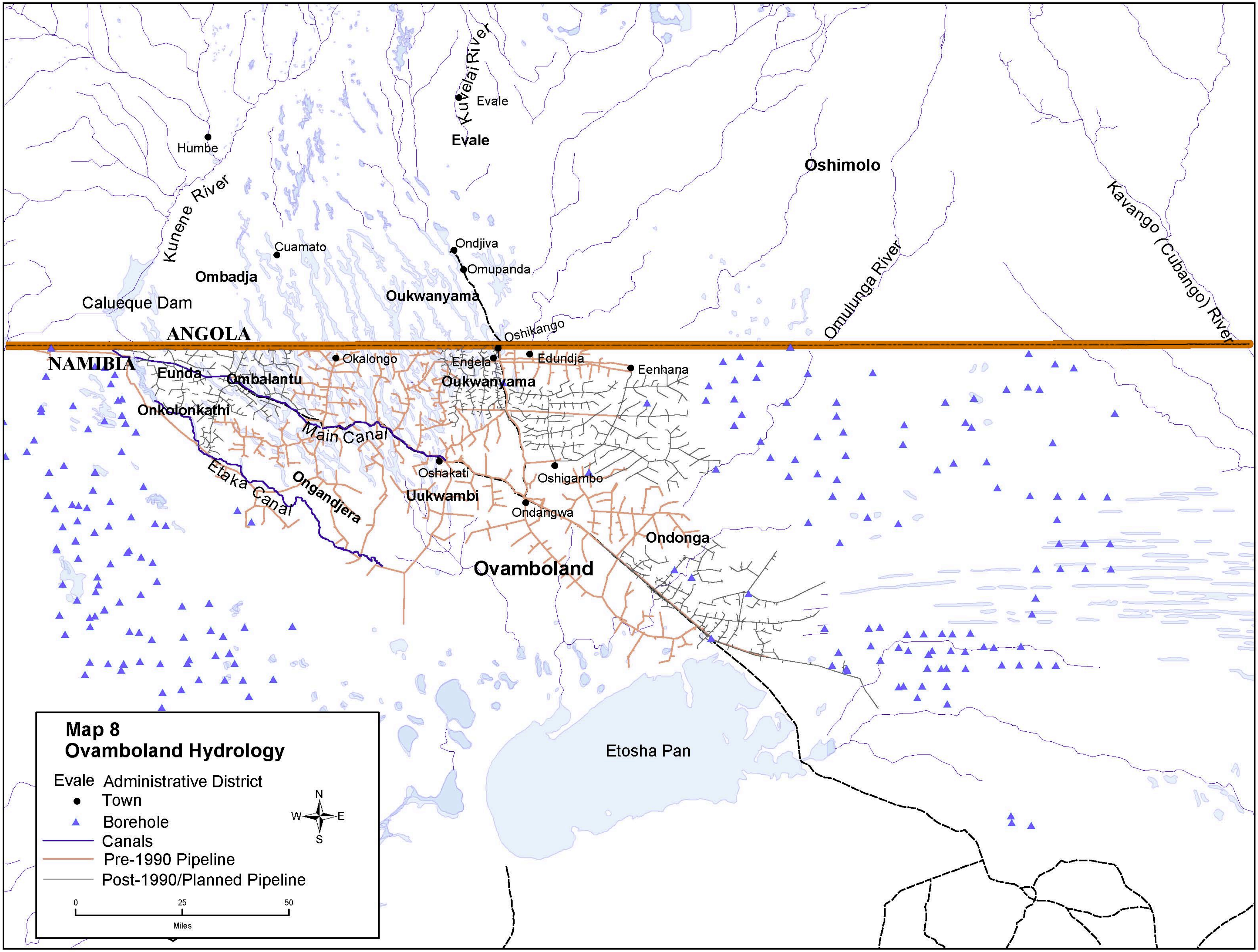
The colonial water system was expanded and upgraded in the late 1970s. Construction was begun on a permanent pipeline between Ogongo-Oshakati-Ondangwa in 1976, and the pipeline feeding Kunene water from the Ruacana dam to the canal was reviewed in 1977. At the same time, the administration added a fish-grate pipeline system that was extended to areas close to the Ondangwa-Oshikango road, including Omafo, Eenhana and Omungwalume, to facilitate relocating

[37] Agricultural extension officers' reports, NAN, OVA 61 and OVA 59, f. 7/10/3-7. See also OVA 33 f. 5/3/1-7, letter initialed S.L.B., n.p. 18 January [1973] and memo Oukwanyama Tribal Authority to Director Works, Ohangwena, 11 January 1973; Headman Mupupu Ngwali to Director Works, Onankali, 25 September 1972; Director of Works Ovamboland to Director Works, Ondangwa, 4 December 1971. Only one senior headman was praised for his careful water management, AHE/BAC ½ f. (15)N1/1/5/7, Questionnaire on Vilho Weyulu 11/3/1968.

[38] NAN, OVA 61, Monthly Reports Agriculture, Moses Nandjebo, report 1/8/71-28/8/71.

[39] NAN, OVA 49 f. 6/9/1(I), Sec. Agriculture to Sec. Department Chief Minister, Ondangwa, 13 May 1980.

[40] NAN, WWA 640 f. 31/3/2/1, Report by H.W. Stengel, 23 October 1967; OVA 33 f. 5/3/2-7, Director Water Affairs to Chief Director Owambo Government, Ondangwa, 4 February 1970; WWA 644 f. 31/3/2/3(v), Director Water Affairs to Chief Roads Engineer, Windhoek, 19 February 1971.



Map 8
Ovamboland Hydrology
Evale Administrative District
Town
Borehole
Canals
Pre-1990 Pipeline
Post-1990/Planned Pipeline
N
W
E
S
0
25
50
Miles
Kuvelai River
Evale
Evale
Humbe
Kunene River
Oshimolo
Kavango (Cubango) River
Cuamato
Ondjiva
Omupanda
Ombadja
Oukwanyama
Calueque Dam
Oshikango
Omulunga River
ANGOLA
NAMIBIA
Okalongo
Engela
Edundja
Eenhana
Eunda
Ombalantu
Oukwanyama
Onkolonkathi
Main Canal
Etaka Canal
Oshakati
Oshigambo
Ongandjera
Uukwambi
Ondangwa
Ondonga
Ovamboland
Etosha Pan

"squatters" from along the Angolan border.[41] As with the canal, the availability of a permanent water supply permitted a much higher density of people and animals than before. This factor is very clearly reflected in the settlement patterns that developed following the construction of the canal and the pipeline: these areas presently are the most densely settled locations in Ovamboland, as well as the areas where the use of other environmental resources (woody vegetation and grazing) is the heaviest. Water demand surpassed supply during the early 1990s; in the dry seasons, the pressure in the system was so low that no water from the pipeline was available at the northern and southern extremities at Odibo and Okatana respectively.[42]

Well and Water Hole Technology

The history of water and water management in Ovamboland, however, is neither a linear narrative about the victory of Culture over Nature nor a linear story about the decline of indigenous knowledge and practices in the face of Western science and technology. In fact, the 1991 census found that only 24% of Ovamboland's 100,000 households relied on piped water; a mere 9% drew water from boreholes, and 8% obtained water from the canals. The remainder relied on water holes and wells.[43] Moreover, indigenous knowledge proved to be far from static and/or resistant to innovation. Well technology, for example, was rapidly integrated into Ovamboland's bodies of indigenous technology and knowledge. While water holes are an unambiguously "indigenous" technology, categorizing wells is more challenging. First, well technology and its knowledge base in general are neither a Western monopoly nor invention, and the technology is not a product of modern Science. Secondly, before the colonial era, wells were rare in Ovamboland. Thirdly, well technology spread rapidly in Ovamboland in the colonial era after local well builders adopted it to local environmental conditions.

Wells were a relative rarity in Ovamboland until after the 1940s. Asked in 1993 when the well they relied on for their drinking and cooking water had been dug, only 5% of those surveyed specified that it had been dug before the respondent's

[41] NAN, OVA 40 f. 6/6/1-7 Telex Sec. Water Affairs to Director [Water Affairs], Windhoek, 18 June 1976; WWA 640 f. 31/3/2/1(I), Report C. Bon, Ovamboland Pipelines, October 1977; WWA 637 f. 31/3/1(iii), Sec. Agriculture to Sec. Department Chief Minister, Ondangwa, 2 December 1976.
[42] Personal observations, author, 1991-1993. A study in the western constituencies of eastern Ovamboland showed that population densities especially increased close to the pipeline system, see Erkkilä, "Living on the Land," p. 72, figure 40.
[43] Namibia, 1991 Census, Report A, Statistical Tables, vol. v, table H06.

birth; 4% of respondents did not know when it had been dug; 25% of respondents reported that the well had been dug during their lifetime; and over 55% of respondents claimed that the well concerned had been dug between 1983 and 1993.[44] Wells tapped deeper aquifers, penetrating the clay and rock strata directly below the generally thin sandy top layers. Piercing the rocky strata required specialized tools (for example, pick-axes and shovels) and the work was labor intensive, difficult and hazardous. In addition, constructing a well was a risky investment because of the presence of saline aquifers and the threat of collapse.[45] As a result, it was often "big men," the missions, or the colonial authorities who pioneered well construction or who sponsored well building, and who consequently derived management control over these resources, supervising its use and organizing its repair and maintenance.[46] In 1936, the Ovamboland administration claimed that hundreds of wells had been dug under the supervision of its staff.[47] If such "big men" as village headmen, headmen (chiefs) or kings took the initiative to construct a source of water, that source became the property of the community involved. Well technology – next to dams and water holes – was critical in the colonization of the eastern part of Ovamboland, outside of the floodplain environment, especially from the 1940s onward.[48]

Well technology, however, was rapidly disseminated and unlike colonial dams and boreholes wells, like water holes were principally an individually controlled resource.[49] During the 1940s through the 1960s, wells were a local elite resource because, compared to a water hole, digging a well demanded additional human resources as well as specialized tools and technology. During the dry season of 1969/1970, a pastor at Omunholo in Eastern Ovamboland denied teachers and students access to water from his well, perhaps in part have to protect his claims to the water source by resisting its designation as a "school well." The Department of Water

[44] Kreike, "Recreating Eden," chapter 9; NAN, RCO 8, RCO to Director Works, Ondangwa, 29 March 1918; and OMITI 3.11 (N=170).
[45] Kreike, "Recreating Eden," chapter 9; NAN A450, 7 f. 2/10, Annual Report Ovamboland 1940.
[46] NAN, A450, 9 f. 2/38, "Property Rights."
[47] Paulus Nandenga, interview by author, Oshomokwiyu, 28 March 1993. See also NAN, A450, 13 f. 3/21/7 SWA Commission, "Memo of Reg[ard] Findings of the Constitutional Commissions in so far as they affect the Administration of Native Affairs 1936."
[48] Kreike, "Recreating Eden," ch. 9.
[49] For government owned wells, see NAN, OVA 33 f. 5/3/2-7, Senior Technician Republic South Africa to Director Works, Bantu Affairs Ondangwa, Oshakati, 15 September 1970.

Affairs inspected and increasingly effectively controlled the school wells and water holes.[50]

In 1993, fifty-four percent of the sampled households that participated in the OMITI survey relied wholly or partially on water from a well.[51] Slightly over half (51%) of the wells had been dug by neighboring households. In at least 21% of the cases, the household proper had dug the well in question (two respondents specified that they had hired somebody to dig the well), while in 3% of the cases, the (village)headman and the "government" each had dug the well.[52] Sixty-seven percent of the wells used in 1993 by the sampled households contained shafts lined with wood, while 8% of households relied on wells with a metal, brick, or concrete lining. In addition, a plate covered 37% of the wells, and 13% were fenced. In 36% of the cases, users hauled water up with a winch; only 6% of the covered wells were equipped with a hand pump.[53] Half of the respondents emphasized that every one who used the well contributed to its repair and maintenance, with 15% of respondents mentioning that the heads of neighboring households contributed to well maintenance (these households probably also used the well). In addition, 39% of respondents stated that the well's owner was responsible for maintaining and repairing the wells, while 3% and 2% placed the onus on respectively the government and the village headman.[54] Of the households that used a well, 91% contributed to the well's maintenance, principally in the form of labor, but sometimes in the form of money or food donations.[55]

In many areas, however, well technology was not effective. As a result, wells were available to fewer households. Villagers typically considered wells to be the

[50] NAN, WWA [WAT?] 637 f. 31/3/1(ii), Department Water Affairs, Report Watersupply Ovamboland Schools, appendix to Acting Chief Inspector to Director Water Affairs Windhoek, Otjiwarongo, 13 May 1970. On school wells, see WWA [WAT?] 636 f. 31/1(I), Owambo: Report Wells at Schools and Clinics, Inspection 22 May – 1 June 1972. In 1973, the responsibility for school wells equipped with a handpump was delegated to the individual schools, WWA [WAT?] 637 f. 31/3/1(ii), Director Water Affairs to Chief Director Ovambo Government, n.p., 16 March 1973. See also ibid, A.H.I. Bon to Pieterse, n.p., 11 October 1972 Contract D. Homateni, Headmaster, Pymaknu, Ongandjera, 21 November 1972.
[51] OMITI 3.5 (N=324).
[52] OMITI 3.10 (N=176).
[53] OMITI 3.13 (N=159).
[54] OMITI 3.6 (N=169). The categories "all the people who use the well" and the "heads of neighboring households" probably overlap.
[55] OMITI 3.7 (N=182). Of those who specified what they had contributed, 79% mentioned labor, 5% mentioned money and 5% mentioned food, OMITI 3.8 (N=38).

property of headmen, chiefs, missions or the village (or the government).[56] In 1993, 40% of households sampled in the OMITI survey stated that wells were an important source of water during the dry season. Of these households, two of every three wells were privately owned; the remaining third were communal wells.[57]

Colonial Science and Plantation Forestry

Colonial science seemed to offer a solution to the increasing population pressure on Ovamboland's natural woody vegetation: scientific plantation forestry. Experiments to identify suitable species in the 1960s led to the establishment of large eucalyptus plantations in Ovamboland during the 1970s and 1980s. By the early 1990s, however, although these plantations had contributed to reforestation, they had contributed little to local wood needs. The remainder of this chapter analyzes colonial forestry as a process, highlighting how, where, and when what species and what propagation techniques were favored, demonstrating that foresters took a lot of shortcuts that further compromised the scientific base of the project. Moreover, in contrast to the experience with water and water management, colonial foresters made little or no effort to build on or make use of any indigenous knowledge regarding the propagation and management of trees and forests.

In 1964, Ovamboland was assigned its own forester. Initially, however, the forester primarily assisted in setting up the commercial exploitation of naturally occurring Transvaal teak (omuuva) trees which, albeit small-scale, nevertheless by the late 1960s led to suitable trees being cut down as far east as Eenhana, far beyond the floodplain.[58] Small-scale tree planting trials to identify suitable plantation species took place at different sites in Ovamboland throughout the 1960s. In 1960, the colonial administration established an irrigated perimeter and dry land plots at

[56] On well technology, see Kreike, "Recreating Eden," chapter 8. Well technology was rapidly appropriated by Ovambo innovators. The senior headman of eastern Oukwanyama, Elia Weyulu was considered a well pioneer in eastern Ovamboland. See, NAN, AHE/BAC ½ f. (15) N1/5/8, Questionnaire on [Headman] Elia Weyulu 11/3/1968.

[57] OMITI 3.1.1.

[58] NAN, AHE (BAC) 1/343 f. (14) N8/17/4, District Forest Officer,"Report on pitsawing operations in the Northern Bantu Territories," Grootfontein, 1 April 1965 and 1/352 f. (14) N8/21/4, Annual Report Agriculture Oukwanyama for 1964; AHE 1/342 f. (66) N8/17/2 (I:1964-1969), Native Agriculture: Trust Forests: Main File, Quarterly Report District Forest Official of the SWA Administration, 30 June 1967 and Annual Reports District Forest Official of the SWA Administration for 1965/66 and 1968/1969 and Quarterly Report, 31 June 1966; BAC 132 f. HN 8/18/3/1/1 Trust Farming Projects (1960-1962), Agriculture Officer to Bantu Commissioner, Grootfontein, 30 July 1961 Report on Work on Okatana Irrigation Scheme, 30 July-11 September 1961 and HN 8/21/4/1, Quarterly Report Agriculture Ovamboland for the Quarter ending 30 June 1958.

Okatana for crop trials. In May 1961, colonial staff planted eight treelings each of Eucalyptus camaldulensis, E. cladurelex, Prosopis juliflora, Callistris robusta, Casuarina cunninghamiana, Setura seliqua, and Rubenia pseudoacacia. In addition, the salt-tolerant fodder bush Atriplex munularia was planted in seedbeds in August and transplanted in January/February (during the rainy season). By August 1961, all Prospopis and Casuarina had survived, and six of the E. camaldulensis, but only three of the eight E. Cladurelex. Of the eight Callitris, half survived but were doing badly; the Setaru did "reasonably," and the Rubenia's performance was very weak. Atriplex did very well.

In January 1962, workers planted 337 new trees (apparently treelings) at Okatana, including Prosopis juliflora, Acacia cyanophylla, Robina pseudo-acacia, Casuarina cunninghamia, Casuarina equisitifolia, Phoenix dactylifera, and eight different subspecies of eucalyptus (including E. camaldulensis and E. robusta). Eucalyptus species constituted almost two thirds of all treelings and 18-30 of each species or subspecies were planted. The treelings were watered once weekly with three gallons of water each. By July, 51 (mostly eucalyptus) of the 337 saplings had been killed by ants, despite the application of dieldrin. By November 1963, Prosopis juliflora, Acacia cyanophyllo, Casuarina, E. camaldulensis, and E. polyantehmus had a survival rate of close to 50% or higher. Only eight of 55 Phoenix dactylifera survived. Commenting on what became known as the "Ovambo Trial," the district forester was especially enthusiastic about the results with E. camaldulensis and concluded that it was highly suited for use in Ovamboland.[59]

In March 1964, a further 370 treelings (Eucalyptus camadulensis and E. saligna, Casuarina cunninghaminia and Quercus subeu) were planted at Okatana and Oshikango. Drought destroyed the Oshikango plantings in the same year and drought, termites, poor soil conditions, and frost wiped out the Okatana trial plantings in less than four years. In June 1966, a small irrigated experimental Eucalyptus plantation was established at Oshikoto Lake just south of Ovamboland. In 1968, 64 treelings

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[59] NAN, BAC 132 f. HN8/18/3/1/1, sketch map "Section of Okatana where trees will be planted" appendix to District Forester to Chief Bantu Commissioner, Grootfontein, 6 October 1960; Agriculture Officer to Bantu Commissioner, Grootfontein, 30 July 1961, Report on Work on Okatana Irrigation Scheme, 30 July-11 September 1961; Chief Bantu Commissioner to Bantu Commissioner Grootfontein, Windhoek, 3 August 1961; Agriculture Officer Grootfontein to Bantu Commissioner, Grootfontein, 31 July 1962 and Chief Bantu Commissioner to Bantu Commissioner Ondangwa, [Windhoek], 4 September 1962; Agriculture Officer Grootfontein to Bantu Commissioner, Grootfontein, 31 July and 25 September 1962; AHE 1/342 f. (66) N8/17/2, Native Agriculture: Trust Forests: District Forest Official SWA Administration, Quarterly Report, 31 December 1963.

each of Eucalyptus camaldulensis, Parkinsonia (aculeata?), Casuarina cunninghamiana, and Populus wislizenii were planted at a new plantation at Oponono Lake, 40 km (26 miles) south of Ondangwa. The eucalyptus and the Casuarina treelings developed reasonably well.[60]

The relative success of eucalyptus encouraged larger trials with the species to select provenances suitable for the environmental conditions in north central Namibia and to assure a future supply of construction and firewood for Ovamboland. An additional objective of the trials was to test their potential as sources of nectar for bees, because Ovamboland was considered to be short of natural food for bees.[61] The directorate of forestry in the 1970s established three large forestry plantations in Ovamboland: at Onuno, at Onankali, and at Leeukop.

The first provenance trial established at the Onuno plantation (Ovambo/1) with Eucalyptus camaldulensis and Eucalyptus tereticornis started in 1973 and formed part of a series of provenance trials with eucalyptus throughout Namibia and South Africa. The plantation was located along the Ondangwa-Oshikango road, about 16 km (10 miles) south of Oshikango. At Onuno, no restricting solonetz B horizont underlay the very sandy A horizont within the first 4 meters.[62] The first treelings, grown from seeds planted in September 1973, were transplanted to the Onuno plantation on March 18-19, 1974. Although reports are contradictory, it seems that some soil preparation took place prior to planting, and that plastic covers and fertilizer were selectively applied. The plot was laid out in a rectangular lattice pattern with three replications; each plot held 5 rows of 5 trees. The total area covered by the trial was 2.6 ha. This 1973/1974 trial series (Ovambo/1), however, was abandoned in 1982.

A contemporary trial at Onuno known as Ovambo/2 experimented with Eucalyptus citriodora and Eucalyptus hybrids. A number of Eucalyptus citriodora seedlings were planted at Onuno on April 29, 1974. The original planting did not follow any particular design, no replications were used, and six rows of seven trees were planted in plots of varying sizes. The trial covered a total area of 0.18 ha. and

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[60] NAN, AHE 1/342 f. (66) N8/17/2 (I-ii), Native Agriculture: Trust Forests, District Forest Official SWA Administration, Annual Reports 1965/1966 and 1968-1969; and Quarterly Reports, 31 March and 31 December 1964; 31 June 1966; and 30 December 1968.

[61] Kreike, "An Inventory of Trials with Exotic Tree Species in Northern Namibia."

[62] Archives of the Forestry Officer Ondangwa at Ondangwa, file "forestry 1/5/3 Oununo woodlots (trial)," J.L. van Wyk to Secretary for Forestry Pretoria, Ondangwa June 8, 1977.

involved Eucalyptus hybrids of E. tereticornis x E. saligna x E. grandis from Mauritius and a hybrid of E. grandis x E. tereticornis.

A second series of trial plantings of Eucalyptus camaldulensis and Eucalyptus tereticornis was inaugurated during the 1977/78 season with seed received from Pretoria. Twelve provenances of Eucalyptus camaldulensis and three provenances of Eucalyptus tereticornis were seeded in the nursery in August 1977. Because agricultural implements were unavailable, the soil was not prepared and no fertilizer was applied. The seedlings were planted at Onuno in early March, 1978. To replicate the competition conditions of the 1973/74 trial, a row of Eucalyptus tereticornis that were from the same provenances as the actual trial planting trees were planted around the trial lot as a screen.

A 1989 survey identified 238 surviving trees from the 1973/1974 trials at Onuno. One 2.8 ha plot with E. tereticornis (probably from Ovambo/1) had 160 trees (57 trees/ha) with an average height of 8.7 m. and a diameter at breast height (dbh) of 12.7 cm. Two plots with a total area of 2.9 ha planted in 1977 with a mixture of E. camaldulensis and E. tereticornis held 757 trees in 1989 (giving a tree density of 239-400/ha) with an average height of 8.2 m. and an average dbh of 7.8-8.2 cm. A 3.2 ha plot planted in 1977/1978 held 1,468 E. camaldulensis (an average tree density of 459/ha) with an average height of 7.5 m. and an average dbh of 8.3 cm.

A second major forest plantation was established in 1976 at Onankali, about 40 km (27 miles) southeast of Ondangwa on the Ondangwa-Tsumeb road. Eucalyptus camaldulensis and Eucalyptus tereticornis were the principal species for plantings in 1976/1977, 1977/1978, and 1978/1979, all located on the western side of the road in what was called block A. In 1976 and 1977, over 5,000 seedlings were planted with a 2.7x2.7 m. spacing in compartment 1 of block A. All the seedlings were either E. camaldulensis or E. tereticornis except for 1,000 hybrid E. camaldulensis x E. tereticornis. In 1989, the surviving trees from this trial varied in height, averaging 5.2-8.1 m., while the average dbh varied from 5.9 to 8.3 cm.

During the 1977/1978 trial series at Onankali, 11,800 treelings were planted with a 3x3 meter (10x10 feet) spacing in early 1978, including 2,120 E. camaldulensis and 680 E. tereticornis that had been grown from seed collected from the 1973/1974 provenance trial trees from the Onuno plantation. The other 9,000 treelings were E. tereticornis that had been grown from seed imported from South Africa and supplied by Pretoria. The 1977/1978 trial was located in block A, compartment 2.

A third series of trials initiated in 1978/1979 involved 14,790 seedlings planted in compartment 3 of block A at Onankali. Again, the principal species were E. camaldulensis (5,370 treelings planted) and E. tereticornis (5,110). The principal other species used were E. citriodora, E. gomocephala, and E. paniculata. In 1979, the Onankali plantation contained approximately 5,700 Eucalyptus trees of different species on 10 ha. At least 30,000 trees had been planted, however, suggesting a survival rate of 19 percent for the 1976/1977, 1977/1978, and 1978/1979 trial series. The surviving trees included approximately 700 Eucalyptus gomphocephala, approximately 2000 Eucalyptus tereticornis, and approximately 3000 Eucalyptus camaldulensis.

In 1989, the most prevalent remaining species in block A were Eucalyptus camaldulensis and Eucalyptus tereticornis, although tree lots of some of the other species could also be found. The average height of the E. tereticornis trees that had been planted in 1979 varied from 6.6-12.6 m.; average dbh varied from 7.7-13.7 cm. E. camaldulensis from the same series had an average height of 6.6 m. and an average dbh of 5.6 cm. While the report provided no actual numbers of surviving trees, the survival rate in one measured plot was 60 percent; in a second plot, the survival rate was 80 percent. A plot with E. citriodora, however, had a mere survival rate of two percent.

Other trials took place on the eastern side of the road in block B. The 1979/1980 series in block B, compartment 1, contained 38,375 treelings, including 27,600 E. camaldulensis, 8,800 E. tereticornis, E. citriodora, and E. gomphocephala, as well as 1,780 Grevillea robusta. In 1989, the survival rate of E. camaldulensis in compartment B1 was 80%, but few of the other eucalyptus had survived, and all of the Grevillia had perished.[63]

In February 1980, another 17,108 seedlings were planted in compartment 2 of block B. The trial consisted mainly of Eucalyptus citriodora (10,814 seedlings), Eucalyptus camaldulensis (3,060), and Eucalyptus gomphocephala (3,234). When compartment B2 was surveyed in 1989, most of the trees on the half closest to the road had been cut down because they were badly formed. Still, the survival rate was 90%, with measured trees boasting an average height of 7.7 m. and an average dbh of 7.5 cm. The last plantings at Onankali took place in 1982 in compartment 3 of block

[63] The 1989 report listed E. sideroxylon amongst the surviving trees and did not mention E. gomphocephala although the former had not been part of the trial, and the latter had been.

B and included 1,040 E. grandis. In 1989, the survival rate in compartment B3 was 80%, and the average height and dbh were 4.5 m and 4.4 cm respectively.

In 1976, the directorate of forestry established a third smaller plantation forest known as Leeukop in the far south of Ovamboland along the Ondangwa-Tsumeb road, about 100-120 km. from Ondangwa. The first 630 seedlings planted in April of 1976 were damaged leftover seedlings from the Onuno plantation that had been kept in the bags for three years. Another batch of seedlings planted at Leeukop was grown from seed originally sown in November 1975. The species used were Eucalyptus citriodora, Eucalyptus camaldulensis, Eucalyptus polyanthemos, and Eucalyptus tereticornis. A second series of seedlings planted in 1977/78 consisted of Eucalyptus camaldulensis and Eucalyptus tereticornis.[64]

In his report about the 1973/74 eucalyptus provenance trials in Namibia and South Africa, Kevin Darrow concluded that "[I]n the dry to arid regions ... Eucalyptus camaldulensis was superior in survival and growth to Eucalyptus tereticornis, although neither showed satisfactory development." He emphasized that irrigation or accessible groundwater reserves were critical conditions for the success of eucalyptus plantations. Height growth in Ovamboland after 44 months was very good (the best lots exceeding 6m. in height), especially compared to a mean height of only 1.9 m in the Okavango region to the east of Ovamboland. Basal area increment throughout Darrow's semi-arid Zone 2 (which included northern Namibia) was poor, and although performance in the Ovambo trials was much better than in any other Zone 2 trial, even the Ovambo trials' results in this area attained only a fraction of the performance in Zone 1. Stem forms of both subspecies in either zone were typically poor to bad. For northern Namibia, where the ground water table was relatively high, Darrow recommended Eucalyptus tereticornis, because it outperformed Eucalyptus camaldulensis in growth and stem form. Darrow added that "the northern provenances of the latter may…provide some good seed lots."[65]

During a 1983 meeting, foresters conceded that the eucalyptus projects in Ovamboland had not been very successful, singling out the late 1970s and early 1980s

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[64] For a more detailed description of tree trials in north central Namibia, see Kreike, "An Inventory of Trials with Exotic Tree Species in Northern Namibia."

[65] K. Darrow, "Provenance-type Trials of Eucalyptus Camaldulensis and Eucalyptus Tereticornis in South Africa and South-West Africa: Eight-year Results," South African Forestry Journal, No. 124 (March 1983), pp. 13-22. See also R. Hilbert, "Importance of Provenance Research and Tree Breeding to Achieve Higher Yields," (Paper presented at the 10th regular meeting of the SARCUSS Standing Committee for Forestry held at Sabie, RSA, May 20-24, 1985).

drought years as the main cause.[66] Plans formulated in 1987 to greatly extend the size of the Onankali plantation in 1991 were postponed when Namibia was decolonized in 1989. The forester who conducted the 1989 survey of the Onankali plantation trials concluded that, overall, the trials in block A had been successful.[67]

The results of the trials had been mixed at best, even though they demonstrated that eucalyptus could be grown in Ovamboland. During the early 1990s eucalyptus trees could not only be seen on the plantations but also occasionally as an on-farm tree. In fact, fifteen percent of the 1993 OMITI survey respondents mentioned having planted eucalyptus seedlings, while 17% of the respondents listed eucalyptus amongst trees that they desired principally for shade.[68]

But if the objectives for establishing the forest plantations are taken into account, the forest plantations were a resounding failure. Ovamboland's population required not the timber trees the foresters sought to grow but poles and sticks. Not a single farm was constructed with eucalyptus wood as it proved extremely vulnerable to termites and other local pests and had to be treated with insecticides and preservatives before and after it was harvested.

Conclusion

Although water technology and resource management mitigated the impact of environmental constraints and/or enhanced environmental opportunities, and in the process affected the environment, humans did not gain full dominance. Eastern Ovamboland, for example, is a mosaic environment with stark contrasts. The local hydrology of eastern Ovamboland prevented the development of a dense settlement pattern: in contrast to the floodplain, where villages closely abut one another, villages are separated by large stretches of forest. The local character of environmental change serves to further complicate linear models of environmental change because it suggests that environmental change does not necessarily "blanket" over whatever

[66] NAO, OVA 56 f. 7/1-7, Report Foresters Meeting Rundu, 24 March 1983.
[67] The discussion of tree trials in north-central Namibia is based on Kreike, "An Inventory of Trials with Exotic Tree Species in Northern Namibia." The Oponono lake trial plot was established in 1968, AHE 1/342 f. (66) N8/17/2 (I:1964-1969), Native Agriculture: Trust Forests: Main File, Quarterly Report District Forest Official of the SWA Administration, 30 December 1968.
[68] OMITI 4.4.12, 4.4.30. During the early 1990s the DAPP nursery at Ombalantu sold Eucalyptus seedlings. DAPP produced 800 Eucalyptus seedlings annually and its annual plantings reflected expected demand, Sheuyange Tufaneni (2nd year student, Agriculture, Ogongo Agricultural College, report of a field trip to the DAPP nursery, Ombalantu, n.d. [July 1993].

previously existed, but rather develops like a patchwork. Moreover, different patches may experience different patterns of environmental change, and at different speeds.

Ovamboland's canal system was state-built, state-controlled, and state-managed. It was also originally designed to tame the floods as much as it aimed to harvest water. Operating within a modernization paradigm, Ovamboland's colonial rulers considered scientific water management based on scientific technology (irrigation) to be key to halting environmental degradation and to jumpstarting economic development in Ovamboland. Colonial dams and royal dams also fit within the classic hydraulic society analysis. But the transformation of the water infrastructure that took place in the Ovambo floodplain was neither an accomplishment of western science nor strictly a product of the colonial era. Rather, colonial science and technology built on and interacted with the local water harvesting system, and in the 1990s its core technology – water holes – were to many households still critical year-round sources of water for many households. In brief, the colonial administration and its engineers failed to bring water management in Ovamboland under centralized scientific control. The thousands of water holes that continued to exist were individually owned and managed. In this respect, Ovamboland's existence as a decentralized hydraulic society is by no means unique: the elaborate water management systems of other African societies as well as those of the pre-Columbian era Mayas and the early modern era Low Countries were managed by local communities (cities, water boards), and not by a centralized state.[69]

The history of water harvesting in 20th century Ovamboland thus addresses the issue of levels of analysis as well as the question of dominance. In environmentally deterministic analysis, challenging hydraulic environmental conditions (for example water scarcity or flooding, or both) and the resultant need for intensive water management is sometimes seen to give rise to elaborate and highly centralized societies. Moreover, despite their environmentally deterministic origins, the hydraulic societies that are the product of the specific human-nature interaction are considered to be emblematic of the triumph of human dominance, or culture over nature, outclassed in this respect only by urban societies. Yet, the main sources of water were not constructed, controlled, or managed by the state.

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[69] The Shambaa irrigation system was decentralized, see Feierman, Peasant Intellectuals, pp. 64-65.

While in the field of hydrology, colonial experts from the 1930s through the 1960s eagerly expanded upon and made use of local technology and knowledge by locating large water reservoirs on the sites of water hole systems and by sponsoring well digging, experts in the field of forestry in the 1960s through the 1980s took the opposite tack. Scientific forestry in Ovamboland aimed to create large state-controlled plantations with fast-growing seed-grown exotics. The eucalyptus plantations, however, were hardly examples of good science. Experiments were inconsistently executed, and the foresters involved failed to maintain proper documentation: subsequent follow up assessments of the trials to measure tree growth and the survival rate relied on a substantial dose of guesswork because researchers had no records about which trees had been planted and where, or what inputs were used. In addition, despite the rhetoric that they were to provide local fuel and construction wood, the plantations in fact were conceived and managed to produce conventional timber trees. Ovambo farms and palisades, however, did not require the timber size-trunks produced by full-grown trees but rather poles and sticks from trees and bush. Hence, successful as reforestation, in terms of output, the eucalyptus plantations were a dismal failure: not a single homestead or palisade was constructed using plantation-grown wood.

The history of water and tree use and management in 20th century Ovamboland underlines the importance of utilizing concepts that bridge the Nature-Culture and related Science-Tradition dichotomies. Environmental change cannot be exclusively understood within a binary framework, but needs to incorporate the possibility of a third outcome (for example, an organic machine) or even outcome<u>s</u> (for example, mosaic environments). Moreover, analysis should include “and-and,” instead of merely “or-or” options as outcomes. The possibility that multiple outcomes might occur further problematizes analyzing environmental change in terms of a singular process.

CHAPTER 10
ENVIRONMENTAL INFRASTRUCTURE

The preceding chapter demonstrated that Western science and technology failed to unambiguously transform Ovamboland's Nature into Culture. By the 1990s, Ovamboland's colonial water infrastructure of canals, pipelines, dams, and boreholes could be termed an "organic machine" to emphasize the limits of the colonial scientific project. Colonial water projects had dramatically changed Ovamboland's hydraulic system and influenced the local environment, but without conquering that environment or gaining a full understanding of its dynamics.

Moreover, although colonial and postcolonial officials and experts gained insights into indigenous environmental knowledge and management practices, the analysis and the description of environmental dynamics in Ovamboland in particular and the non-Western world in general remained and remains constricted by the parameters of the Nature-Culture dichotomy. Notably, even as the potential of indigenous environmental agency is increasingly acknowledged, the ensuing processes and outcomes of, and motivations for environmental change continue to be confined to the realm of Nature. Thus, for example, even when officials and experts reported that such fruit trees as the marula occurred almost exclusively on farms, they nevertheless continued to be categorized as wild wilderness trees, i.e., relics from a natural vegetation. As a rule, valuable indigenous fruit trees in the tropical regions of Africa, Asia, and the Americas are considered to be wild trees, i.e., markers and products of Nature. And, even when an association with human settlement is acknowledged or even if human agency is recognized in propagating the trees, the trees nevertheless are regarded at best as semi-domesticated species: i.e. tentatively advancing toward the gateway from Nature and the wild to Culture and the domesticated, from part of Nature, to part of Culture.

It may be more fruitful to introduce a new analytical category to assess such "natural" resources as marula and other fruit trees and to move beyond the Nature-Culture dichotomy: the resources can be regarded as "environmental infrastructure." Environmental infrastructure consists of the resources that are used by a society or a community that are derived from nature, but that in terms of their origins, composition, form, and/or functioning cannot be classified as not "pristine," i.e., untouched by human (or in some cases – non-human) agency. "Infrastructure" typically refers to technological improvements (i.e. Culture), for example, roads, bridges, schools, and health facilities. The concept of "environmental infrastructure" goes one level "below" (technical) infrastructure and refers to local "natural" resources that serve as the basic foundation for rural communities and societies. Environmental infrastructure may include fruit trees, indigenous water holes and wells, farms (living quarters and storage facilities, palisades), fields (fences or demarcated clearings), seed banks, coppice woodland, pastures, ritual or sacred sites, and herbal "gardens." Indeed, environmental infrastructure may refer to entire landscapes that are either "humanized" (cultivated landscapes) or "wild" (since humans define it as such).

Whereas White's concept of the organic machine problematizes, disaggregates, and challenges the category Culture in the Nature-Culture dichotomy, the analytical and descriptive concept of "environmental infrastructure" problematizes, disaggregates, and challenges the category Nature. Using the lens of environmental infrastructure, this chapter highlights the extent to which survival and livelihoods were and are dependent on an infrastructure that is neither wholly Natural nor wholly Cultural in origins, design, and form. The chapter first discusses the water component of Ovamboland's environmental infrastructure, followed by the field/soil and off-farm woodland components.

The history of indigenous water management demonstrates that the inhabitants of Ovamboland did not live "by Nature," the area lacks any natural dry-season surface sources of water. Moreover, Ovamboland farmers did not perceive themselves to be living "by Nature;" to the contrary, they were proud of their efforts to make Ovamboland's soils fertile. Finally, upon closer scrutiny, not only are on-farm fruit trees in actuality <u>not</u> wild, but also the "wild" mopane bushland that marks Ovamboland is actually human created and human maintained coppice woodland. In other words, Ovamboland's environment is neither Nature nor Culture; rather, it is environmental infrastructure, both conceptually and physically. The chapter discusses various components of environmental infrastructure (woody vegetation, water, and land/soil) and the environmental infrastructure at the level of Ovamboland as a whole.

Woodland Coppice, Clones, and Environmental Infrastructure

Although many farms by the 1960s were marked by fruit trees, colonial experts stressed that the off-farm woody vegetation in and around the villages consisted largely of bush, which they regarded as a degraded remnant of a past natural forest. Although wood harvesting was especially severe when refugees and migrants streamed into the ofuka-wilderness in the 1920s and 1930s, deforestation beyond the areas selected as actual fields was somewhat less destructive. Settlers removed poles and branches without killing the plants and many woody vegetation species in Ovamboland had the ability to re-sprout. In fact, Ovamboland's ubiquitous bushland – especially its mopane bushland – is neither natural nor degraded. To the contrary, it is coppice woodland maintained through vegetative reproduction.

The western seed paradigm that is fixated on and that privileges seed-based sexual reproduction undervalues the importance of asexual vegetative reproduction, even though, ironically the latter is the more common and more effective method of propagation for many tropical (and non-tropical) plants. The very definition of domesticates has a clear bias in favor of sexual reproduction and evolution-as-progress. Domestic species are thus defined by two characteristics: they are dependent on human assistance for their reproduction; and their production has been improved (for example, they yield more and/or larger fruit) through selection and breeding. Sexual reproduction facilitates human control, manipulation, and improvement (i.e., evolution-as-progress).[1]

Western images of the wild non-West intersect with the seed paradigm. Vegetative propagation marks the fields of horticulture and plantation agriculture and although some have identified it as cutting edge modern technology for forestry, non-

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[1] For examples of the strong emphasis on seed/sexual reproduction, see K.J. Frey, ed., Historical Perspectives in Plant Science (Ames: Iowa State University Press, 1994), for example chapter 7 by J.W. Dudley, "Plant Breeding – A Vital Part of Improvement in Crop Yields, Quality and Production Efficiency," pp. 163-177. See also Tomlinson and Zimmermann, Tropical Trees as Living Systems, chapters 3-6. Piot and Le Houérou acknowledge the possibility of propagation by cuttings but they reject it as too costly and too complicated, J. Piot, "Management and Utilization Methods for Ligneous Forages: Natural Stands and Artificial Plantations," and H.N. Le Houérou, "Planting and Management Methods for Browse Trees and Shrubs," Le Houérou, Browse in Africa, p. 345 and pp. 351-359 (especially 353), respectively. In agroforestry projects, the emphasis was on seed nurseries and seedlings. Kerkhof, for example, hardly refers to vegetative propagation in his overview of agroforestry, Kerkhof, Agroforestry in Africa. In Franzel et al. the overwhelming emphasis is also on seed propagation, see Franzel et al., Development and Agroforestry. In the southern African miombo woodlands, most regeneration is through coppice and root suckers, E. Chidumayo and P. Frost, "Population Biology of Miombo Trees," Campbell, The Miombo in Transition, pp. 64-71. Kajembe noted that in Central Tanzania, when local farmers planted trees, they did so mainly through cuttings,

western indigenous vegetative propagation– if it is even acknowledged – is seen to be hallmark of primitivism.[2] At best, the use of vegetative propagation qualifies the species involved as semi-domesticated, implying a preliminary stage of development on a unilinear path to domesticated status within the framework of a Nature (wild)-Culture (domesticated) dichotomy.[3] But, the state of domestication, for example, may not be an evolutionary end point: examples of domesticates gone wild abound.

Ovamboland's vegetation is heavily dominated by mopane. Much of the mopane vegetation in the floodplain consists of low bush with occasional tall trees: the low bush is considered "stunted" because it is cut at ground level following which it re-sprouts and the tall single stem trees are considered the natural or climax form of mopane.[4] The occurrence of the tall trees amongst the bush, however, is not by mere chance. Rather, mopane bush interspersed with the occasional full-grown tree is the typical appearance of "coppice-with-standards" woodland that results from careful and deliberate human management. Moreover, contrary to being in decline, the mopane vegetation may in fact be a more dominant species – especially in the middle floodplain – and it may actually be yielding a higher biomass production now than it did in the 1890s. Rackham has demonstrated that England's woodland cover from the Middle Ages through the early twentieth century shows remarkable continuity despite high levels of wood consumption. One of the principal factors that made this possible was that much of the woodland was heavily managed, principally in the form of coppice-with-standards, which made the coppice woodlands a cultural landscape. The regularly coppiced bush was interspersed with occasional tall full-grown trees to provide timber and to facilitate seed production. Rackham identifies coppice management as the technology that enabled England to rely on wood for construction

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Kajembe, Indigenous Management Systems, p. 110. Most regeneration in British woodlands was through coppice and suckers, Rackham, Trees and Woodland in the British Landscape, p. 8.

[2] Westoby, Introduction to World Forestry, p. 13.

A number of important plantation trees are vegetatively propagated, for example, the rubber tree Herca brasiliensis. Banana (Musa spp.) vegetatively reproduces through lateral stolon stools, Hallé, Oldeman, Tomlinson, Tropical Trees and Forests, pp. 25, 121-122, 124-125.

[3] Fairhead and Leach, Reframing Deforestation, p. 193, reject the usefulness of the domesticate/wild dichotomy. Alcorn rejects the dichotomy and points out that cultivated plant may not always be domesticated and domesticated plants may not always be that carefully cultivated, see J.B. Alcorn, "Huastec Noncrop Resource Management: Implications for Prehistoric Rain Forest Management," Human Ecology, 9, no. 4 (1981), pp. 400-401. Bonnéhin considers the cultivation of wild plants as a second stage of domestication and notes that genetic manipulation of plants (a third stage of domestication) may be too costly for farmers, Bonnéhin, "Domestication paysanne des arbres fruitiers forestiers," pp. 1-2, 16-17, 61, 67.

and domestic and industrial fuel consumption whereas others had argued, for example, that the enormous wood demand for iron smelting had deforested the English environment since the Middle Ages.[5]

Similarly, G. Leach and R. Mearns have argued that the fuel-wood crisis in Africa has been exaggerated as a contributing factor to deforestation. Because much of the fuel wood is harvested by cutting poles and sticks at ground-level (coppicing) or by cutting branches (pollarding), which allows for re-growth.[6] Many African woody species demonstrate strong coppice re-growth and in the miombo woodlands, regeneration through coppice re-growth and root suckers is much more prevalent than seed propagation. Maintaining a few seed-bearing adult plants is important to long-term use because harvesting shoots repeatedly prevents or reduces seed production.[7] Depending on the length of the coppice, trials with indigenous Acacia tortilis at Morwa in southeastern Botswana produced a coppice re-growth of 1.8 to 9.4 ton per hectare per year between 1976 and 1985. During the same trials, the Australian native Eucalyptus camaldulensis, which is also known for its coppice vigor, showed a coppice re-growth of 1.25 ton per hectare per year. But 75% of the Eucalyptus trees perished during the trial period, resulting in a loss rate that was seven to ten times higher than that of the indigenous woodland coppice.[8]

Bush and mopane bush are omni-present in late 19th century and early 20th century descriptions of the Ovambo floodplain. In early twentieth century Ombadja,

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[4] See, for example, Erkkilä and Siiskonen, Forestry in Namibia, pp. 47, 127, 169, 174-177, 179, 183; A.B. Cunningham, "Low-Cost Housing Needs, Wood Use and Woodlands," Piearce and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 283-291.

[5] Rackham, Trees and Woodland in the British Landscape, pp. 59-90. Trees and other plants grow from meristems, cell tissue that can divide. Apical meristems are located in the stem, buds, and root tips, but meristematic tissue is distributed throughout the tree between its wood and bark tissue, see T.T. Kozlowski, P.J. Kramer, S.G. Pallardy, The Physiological Ecology of Woody Plants (San Diego: Academic Press, 1991), p. 7.

[6] Leach and Mearns, Beyond the Fuelwood Crisis, pp. 10-12.

[7] G.D. Piearce, "Natural Regeneration of Indigenous Trees: The Key to Successful Management," Piearce, and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 114, 116. On the miombo, see E.N. Chidumayo, "Silvicultural Characteristics and Management of Miombo Woodland," in the same volume, pp. 124-133. See also E.N. Chidumayo and P. Frost, "Population Biology of Miombo Trees," Campbell, The Miombo in Transition, pp. 64-71. Gillet and Piot stress that overexploitation of woody vegetation in the Sahel causes deforestation but they acknowledge that a number of species show vigorous coppice and lopping regrowth, see H. Gillet, "Observations on the Causes of Devastation of Ligenous Plants in the Sahel and their Resistance to Destruction" and J. Piot, "Management and Utilization Methods for Ligneous Forages: Natural Stands and Artificial Plantations," Le Houérou, Browse in Africa, pp. 127-129 and p. 344 respectively. Pollarding and coppicing are also used in central Tanzania, see Kajembe, Indigenous Management Systems, p. 114.

[8] T. Tutema, "Possibilities for the Management of Indigenous Woodlands in Southern Africa," Piearce, and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 134-142.

ridges with dense bush and dispersed trees separated the wide oshana floodchannels. The bush became less dense close to the Ombadja heartlands, where the villages were concentrated. In the center of Ombadja's oshilongo, the middle slopes were not used for crop cultivation because they became easily waterlogged. But they were covered with dense stands of young mopane and other bush, including thorn bush, in addition to containing occasional large mopane and tamboti (omuhongo) trees, that is, vegetation with the telltale appearance of "coppice-with-standards" woodland.[9]

A 1928 description of the middle floodplain offers a transect of the floodplain vegetation cover from west to east:

> Between Points [border beacons] 2 and 3 worthless sandveld starts, overgrown with average bush and poor grazing. At point 4 grey loam soil appears in some 'laagtes' [low areas, i.e. floodchannels] which soon predominates and continues up to point 6. This part, overgrown with Mopane bush, has also only a little poor grazing…. From Point 6 to 12 the country is nearly always the same - sparse Mopane bush on grey soil, which is often thinly covered with sand and there is to certain extent often very heavy sand in the vast treeless 'laagtes' [floodchannels]. There are also a few dune-like parts…. Between Points 14 and 16 one comes across several distinct omurambas [floodchannels] from 300 to 1000 m[eter] broad, between which dunes up to a height of 10 m[eter] lie. The omurambas are devoid of bushes and trees, while the interspersed dunes are thickly overgrown with bush. Mopane is no longer predominant. The first Ukuanyama [Oukwanyama] werft [farm] is at Point 16. The country becomes more open; the Oschanas [floodchannels] have wider but less distinct courses, they are lost in a confusion of branches, islands, 'laagtes' and flats. The werfts are on the dune-like banks; the bush has been destroyed. Everywhere one sees the beautiful Onjandi [jackalberry] trees or wild figs.[10]

The challenges of keeping open the cut line that marked the Angolan-South West African border and Ovamboland's roads attest to the resilience of the vegetation and suggest that bush encroachment is potentially as much a threat in Ovamboland as it is further south in the Tsumeb and Grootfontein regions. A 1928 report noted that the border cut line was almost indistinguishable at the end of the rainy season and a follow-up report added that keeping the borderline open was difficult because "[t]he

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Erkkilä and Siiskonen stressed the enormous potential of (scientific) coppice forestry of mopane, see Erkkilä and Siiskonen, Forestry in Namibia, pp. 179 and 183.

[9] Lima, A Campanha, pp. 14-18, 111-122, 175-183, 200-203; CNDIH, Avulsos, Caixa 3703, Processo Missão de Estudos no Sul de Angola, Relatório do Mez de Outubro [1914] (this report ascribed the shrub size of woody vegetation to aridity) and Caixa 4130, Governo do Distrito 31-20.1, Relatório sobre a Occupação, Lubango 22 May 1909; Petrus Shanika Hipetwa, interview by author, Oshiteyatemo, 17 June 1993.

scrub, particularly mopane, grows exceptionally quickly."[11] Because of their incessant efforts to keep the Angolan-Namibian borderline free of tree and bush vegetation, colonial officials were painfully aware that mopane vegetation especially had remarkable coppice vigor and that it could not be permanently removed unless it was burnt or dug out and the stumps removed.[12] In 1927, a report concluded that what appeared to be the encroachment of mopane bush was contributing to silting up the floodplain's seasonal watercourses becoming and the author of the report suggested clearing the flood channels with dam-scrapers and plows.[13] Indeed, according to a missionary, the resilience of mopane was one of the reasons that the Ovambo regarded mopane to be a tree with "spirit."[14] Mopane and tamboti principally were cut down for construction purposes and to clear land for fields. The head of the colonial administration in Ovamboland commented in 1931 that there was "fortunately an abundant supply" of these species.[15]

A mopane "forest" that separated Omduda and Onaihanga villages in early 1941 consisted of tree and bush. From the eastern edge of the forest, where a young man had been killed in a quarrel, the few mopane trees and bushes did not obscure the view of the accused killer's father's homestead, one thousand meters away. Visibility in all

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[10] NAN, KAB 1 (iii), Volkmann, 30 October 1928, "Report on the Agricultural and Political Conditions at The Angola Boundary"; RCO 9, f. 10/1916/1 (ii), RCO to Sec. Protectorate, 18 February 1917; RCO 10, f. 15/1916/1, RCO and Hahn, Preliminary memo re. Ovamboland and Chief Mandume, [1916].

[11] NAN, NAO 17 f. 10/3 (i), UGR to O/C NAO, Namakunde, 18 April 1928, O/C NAO to Sec. SWA, 24 December 1927, to Clarke, Ondangwa, 4 March and 11 April 1928, and to Charlie, Ondangwa, 11 April 1928. See also, NAO 17 f. 10/3 (I-ii), NCO to Sec. SWA, Ondangwa, 2 May 1933 and NCO to Clarke, Ondangwa, 3 May 1934 and NCO to Sec. SWA, Ondangwa, 22 July 1937; NAO 18, 20-21 f. 11/1 (I, xii-xvi, xix), Monthly Reports Ovamboland, September 1925, June 1939, March-November 1940, January-July 1941and Quarterly Reports Ovamboland, January-March 1942, April-September 1943, April-June 1946; NAO 25, f. 16/1, NCO to Sec. SWA, Ondangwa, 18 December 1942; NAO 43 f. 35/1 (iv), NCO to Graig, Ondangwa, 22 June 1943; NAO 60-61, f. 12/1 (I-ii), Quarterly Reports Ovamboland, April-September 1949, October-December 1951 and April-June 1953.

[12] NAN, KAB 1 (ii), Submissions to Administrator, Secretary, & Attorney-General of SWA 1927, C.N. Manning (Magistrate Rehoboth), Secretary 1926 and 1927 Commission, Rehoboth, 15 December 1927, to F.P. Courtney-Clarke, Assistant-Secretary SWA, Windhoek. On the coppice vigor of woody vegetation, especially mopane, see also NAO 17 f. 10/3 (i), O/C NAO to Sec. SWA, 24 December 1927 and KAB 1 (ii), Submissions Manning to Administrator, Secretary, & Attorney-General of SWA, Rehoboth, December 15, 1927; SWAA 3 f. Administration, Forestry: Indigenous Forests Ovambo A1/2 (I), NCO to CNC, Ondangwa, 2 June 1941. Omwoolo bush also could not be removed permanently if the roots were not removed, Kaulikalelwa Oshitina Muhonghwo, interview by author, Ondaanya, 1 February 1993.

[13] NAN, KAB Volume 1, (vi), Draft Report Kunene Water Commission, Olusandja, July [1927].

[14] AVEM, RMG 2630 C/k 7, C. Sckär, "Kurze Geschichte der Ovakuanjama," appendix to C. Sckär to Inspector, Namakunde, 2 October 1912. See also NAN, A450, 9, f. 2/39, "Hahn, Rough notes," p. 57. Hahn in 1935 emphasized that mopane "was one of the most useful trees they [the Ovambos] have, and is used for all kind of purposes," A450, 12, f. 3/21/5, SWA Commission: Minutes of Evidence vol. 12, Ukualuthi, 13 August 1935, pp. 649-650.

[15] NAN, NAO 44 f. 37/1, NCO to Sec. SWA, Ondangwa 20 April 1931.

other directions was poor, although the victim's homestead was 700 meters away on the western side of the forest. Bush vegetation in between the various trees on the crime site was only 2 feet (0.6 meter) high. When the crime transpired, a group of young men had been cutting poles to rebuild a homestead that had been moved to a new site within the farm plot. The two-foot high bush may have been the re-growth that had sprouted after the poles had been cut. Clearly, the pole cutting had been very selective or the bush vegetation would have been more open.[16]

The newly appointed agricultural officer for Ovamboland in 1957 considered the bush vegetation to be not only useless but also identified "dwarf" mopane bush, black thorn (okadilanghono or Acacia mellifera), and buffalo thorn (omukekete) as potentially dangerous bush encroachers. He noted that even in densely inhabited areas where other species had become rare, these "undesirable" species appeared abundant. The newly arrived official erroneously ascribed their abundance to their unsuitability as construction materials and fuel, even though the opposite was true.[17] Another contemporary report emphasized that although mopane was cut in large quantities, it was known to regrow fast.[18] The South African Deputy Secretary for Forestry visited Ovamboland in 1961 and, travelling along the border road from east to west, observed that 20-25 miles east of Oshikango the vegetation changed radically from a "more or less closed forest" east of that point to a much more open landscape with a few large fruit trees dotting fields and stressed that "the landscape is really all grassland with large patches of factually pure mopaniveld in the form of bush."[19] In 1970, during a brief consultancy to the area, a South African expert noted that the large mopane bushlands between Oshakati and Ombalantu "appear undeveloped and effectively useless, except perhaps as emergency pasturage," although in fact they must have been very heavily used over a sustained period.[20]

To ensure a supply of mopane wood, households may have relied more on its coppice vigor than on seed propagation; in addition to soil and other conditions, this

[16] NAN, NAO 46 f. 45/1/8, Testimony Hamnyela Nashipili, Grootfontein, 5 May 1941, Statements Hamnyela Nashipili, Dirk Jacobus Greyling, Martin Kapenda, Namkoloka Nashipili, Ondangwa, 12 February 1941.
[17] NAN, BAC 131 f. HN 8/17/4, Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957.
[18] NAN, SWAA 3 f. A1/2 (I), Acting Sec. SWA, "Preservation of trees," 14 May 1957.
[19] NAN, BAC 131 f. HN 8/17/2, Deputy Secretary of Forestry,"Report of a visit by the Deputy Secretary of Forestry to South West Africa: 17-29 April 1961," Pretoria, 10 May 1961.
[20] NAN, OVA 57, f. 7/2-7, Report on visit to SWA, 3-15 November 1969, appendix to Dr. H.A. Lueckhoff to Chief Director Department of Bantu Affairs, Ondangwa, 3 April 1970.

factor would also explain why mopane stands typically consisted mostly of brushwood and small trees with only occasional larger trees of seed bearing age.[21] In 1976, five small demarcated plots that included patchy spots that were separated by farms near Onankali, 55 miles south of Ondangwa on the road to Tsumeb measured 10,600 m2. The area contained 2,743 mopane bushes with an average height of six to eight feet (1.8 to 2.3 meters), that is 2,588 suitable construction poles per hectare, assuming that there is one suitable pole per stool (often a mopane stool has more than one stem). After the measurements had been taken, the mopane bush was subjected to different regimes of coppice and thinning management. The trials indicated that with careful management, mopane could produce good dropper-size poles for use in fences in three to four years.[22]

At Ogongo, four smaller mopane trial plots were established and measured within a larger plot that had been laid out in 1971 at the site of the Agricultural College. Measurements showed that per hectare, the plot counted on average 174 mopane trees, 865 mopane bushes, and 608 mopane saplings (see table 10.1).[23]

Table 10.1 Estimates of Mopane Bush land Productivity in Ovamboland

Description	*Location*	*Year*	*Nr. poles produced*
Five demarcated mopane plots	Onankali	1976	2,588/ha
Four plots in a larger fenced area	Ogongo Agricultural College	1969	1,000/ha

The experiments were short-lived: the plots at Onankali were cut clear in August 1976, but not before mopane coppice vigor had impressed the forestry officials.[24] Both the Onankali and Ogongo mopane trial plots consisted of patches that were (in the case of the former) and had been (in the case of the latter) close to farms,

[21] The reliance on coppice rather than seed is suggested by Erastus Shilongo, interview by author, Olupanda (Okalongo), 21 June 1993.
[22] NAN, OVA 58 f.7/7/1-7, Department of Agriculture and Forestry to Department of Forestry Pretoria, Ondangwa, 14 September 1976 and Department of Forestry Pretoria to Secretary of Agriculture, Owambo, Pretoria, 24 June 1976.
[23] NAN, OVA f. L6/8/1/1, D.P.J. Opperman and C.L. Prinsloo, Botanical Survey and Physical Planning of the Orongo [Ogongo] Trial Area, Ovamboland, appendix to D. Opperman to Director Agriculture Ondangwa, Windhoek, 28 July 1969. The density per ha was derived from the number of plants counted in 25 circle quadrants with a radius of 30 feet each. The total surface of 25 circle quadrants with a 30 feet radius is 0.785 ha. The figures provided in the report were thus multiplied by a factor of 1.27.
[24] NAN, OVA 58 f. 7/7/1-7, Agriculture and Forestry Ondangwa to Forestry Pretoria, 14 September 1976 and Sec. Dept. Forestry Pretoria to Sec. Agriculture and Forestry Owambo, 24 June 1976; OVA 6 f. 2/8/3-7 (i), weekly reports, 9, 16 and 30 July, and 27 August 1976.

and they therefore would have been heavily used as a source of construction and firewood before the plots had been appropriated for colonial experiments.[25]

If the trees and bushes are counted as suitable for use as palisade poles, the Ogongo mopane bush would have yielded approximately 1,000 poles per ha, and the Onankali mopane bush more than double that amount at 2,500 poles per ha. If a yield of 1,000 mopane poles per hectare is taken as being more representative of mopane bush land composition in Ovamboland, the construction of the new 6,000 homesteads that were founded in the middle floodplain between 1915 and 1933 would have deforested 6,000 ha (in mopane equivalencies), or an average of 352 ha. per year to produce the poles for the palisades alone. Constructing the palisades of the 18,386 homesteads existing in 1933 Ovamboland as a whole, with an average 100 meter palisade requiring 1,000 poles, would have required roughly 18,000 ha of mopane bush land. The total surface area of Ovamboland was 4.5 million ha., although only a portion of the area was mopane bush.[26]

Presuming that homesteads continued to be constructed in the same way, the 90,918 "traditional" homesteads that were counted in the 1991 Ovamboland censuswould have required more than four times as much mopane, i.e., 90,000 ha. of the Ogongo type mopane bush land or 36,000 ha. of the higher density Onankali type mopane bush land (see table 10.2).[27]

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[25] In order to establish Ogongo Agricultural College, where the mopane plots were located, almost 50 farms were destroyed, NAN, BAC 132 f. HN 8/18/3/1/1 Trust Farming Projects (1960-1962), Agriculture Officer to Bantu Commissioner, Grootfontein, 22 December 1962, Report on an Inspection Tour to Ovambo 11-18 December 1961; AHE (BAC) 1/346 f. (15)N8/19/4/4(I), Report of the SWA Planning Committee for Agricultural Training Centers, appendix to Chief Bantu Affairs Commissioner SWA to Bantu Affairs Commissioners Ondangwa, Runtu, and Oshikango, [Windhoek], 8 April 1965; Bantu Affairs Commissioner to Chief Bantu Commissioner, Ondangwa, 30 December 1965 and Chief Bantu Commissioner SWA to Secretary Bantu Administration and Development, Windhoek, 11 January 1966; and Bantu Affairs Commissioner to Chief Bantu Commissioner, Ondangwa, 16 May 1966. The Onankali mopane plots were separated by Ovambo farms, NAN, OVA 58 f.7/7/1-7, Department of Agriculture and Forestry to Department of Forestry Pretoria, Ondangwa, 14 September 1976 and Department of Forestry Pretoria to Secretary of Agriculture, Owambo, Pretoria, 24 June 1976. Erkkilä and Siiskonen stress that mopane is the most popular tree species for construction. They seem to suggest that mopane was mainly used in the form of adult full-grown trees, but coppice poles served as the principal construction wood, see Erkkilä and Siiskonen, Forestry in Namibia, pp. 151-152. Erkkilä's 2001 study also appears to emphasize the use of larger and smaller mopane (and other) trees, rather than coppice bush, see Erkkilä, "Living on the Land, " p. 52.

[26] NAN, OVA 43, f. 6/5/4, [Dr. J.G.V. Joubert], Final Report "Research on the Potential and Use of Shona pastures in Owambo," Appendix to Sec. Plural Relations [formerly Bantu Affairs] to Sec. Agriculture Owambo, Pretoria, 5 June 1979.

Table 10.2 Total Estimated Wood Use for Palisade Construction in Ovamboland

Year	*Nr. homesteads*	*Presumed length palisade (meters)*	*Nr. poles required per homestead (palisade only)*	*Mopane production area required (in ha) Onankali type (2,588 poles/ha)*	*Mopane production area required (in ha) Ogongo type (1,000 poles/ha)*
1933	18,386	50-100	500-1000	3,677-7,354	9,000-18,000
1991	90,918	50-100	500-1000	18,000-36,000	45,000-90,000

In reality, the figures probably overestimate the impact on mopane because many other trees besides mopane were used for the construction of palisades. Still, the 1993 OMITI survey indicated that mopane was the most important source of construction wood by far. Respondents mentioned mopane as a source of wood for the enclosure, huts, and fences by respectively 85%, 83%, and 63%, followed by silver cluster leaf (omwoolo) which was mentioned by 30%, 37%, and 19% respectively. Additional sources for enclosure poles were leadwood (omukuku), tamboti (omuhongo), Rhodesian teak (omupapa), Rhodesian bushwillow (omupupwaheke or Combretum mechowianum) and wild seringa (omutundungu) each mentioned by approximately 14% of the respondents. For constructing huts, additional sources were hairy lavender fever berry (ombango or Croton gratissimus), real fan palm (omulunga), and Lowveld cluster leaf (omuhama), which were mentioned by 19%, 6%, and 4% of respondents respectively.[28]

The durability of wood types varied. Mid-1950s colonial reports estimated that a homestead's poles were replaced every two or two-five years, but noted that it had become less common to do so, and that in areas where trees were scarce, grain stalks were used instead of poles. The durability of the most important sources of wood, however, was higher than the colonial estimates. In addition, when a homestead or cattle kraal was moved to a new location on the farm plot, many of the poles were recycled. In 1993, Julius Abraham was still using a few of the wild seringa and tamboti poles on his Olupito farm that his father originally had used in the late 1920s and early 1930s.[29] In 1993, one of every three households surveyed mentioned that

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[27] Namibia, 1991 Census, Report A, Statistical Tables, vol. v, tables H01 and H02.
[28] OMITI 4.3.3, 4.3.9, and 4.3.12. On the importance of mopane as a construction material, see also NAN, BAC 133 f. HN 8/21/4/1, Agricultural Officer Ovamboland, Agricultural Report Ovamboland 1955/1956; Erkkilä and Siiskonen, Forestry in Namibia, p. 161; Erkkilä, "Living on the Land, " p. 100.
[29] NAN, A450, vol. 9, file 2/36, C.H.L. Hahn, "Preliminary Notes on Certain Customs of the Ovambo," Journal of the SWA Scientific Society, Vol. III (1927/28), pp. 16-18; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956 and Agricultural Officer to NCO, "Report of travel to the northwestern part of Ovamboland from 20-22 June 1956," Ondangwa, 4 July 1956; and f. HN 8/17/4,

mopane poles needed to be replaced annually. According to 14% of respondents, however, replacement was required every two to five years, while 15% reported that it should be done every six to 10 years, and one in four stated that mopane poles only needed to be replaced every 11-20 years. Thirteen percent of respondents estimated that silver cluster leaf (omwoolo) poles should be replaced annually; 14% of respondents estimated it was necessary to do so every two to five years, 12% of respondents every six to 10 years, and 7% of respondents 11-20 years. Camel thorn (omwonde) and Rhodesian teak (omupapa) were both sources of poles that were used on a much smaller scale, although they were also very hardy; Rhodesian teak poles on average were more durable even than mopane. Overall, according to 40% of respondents, mopane poles, which were the most commonly used construction material, lasted for more than five years. Silver cluster leaf was less durable, and lasted for over five years, according to 19% of the respondents. On the other hand, however, silver cluster leaf poles planted in the ground could develop roots.[30]

With careful tree and bush management, not every thornbush branch or pole that was cut was a bush or a tree lost. Where the woody vegetation was not considered to pose an obstacle to growing crops, it was more often than not coppiced or pruned with the intention of allowing it to re-grow. In the 1993 OMITI survey, tree coppicing was practiced by 19% of respondents or members of their households and pruning was practiced by almost half (48%).[31] If they were cut at ground level, large trees did not survive, with the exception of Rhodesian bushwillow, corkwood (omboo, generic for commiphora spp.) and marula, which even developed shoots from the roots that were left after their trunks had been removed. Young and small trees that had been cut at ground level recovered slowly, but bushes rapidly regained their former height. This was especially true for jackalberry, (Kalahari) apple leaf (omupanda), red bushwillow (omunaluko), Transvaal saffron (omudengambwa or Cassine transvaalensis), leadwood (omukuku), and Russet bushwillow (omukadhikuku or Combretum hereroense). Most trees (including mopane) developed shoots when the trunk was cut at sufficient height. When fire was used, however, a tree would not

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Agricultural Officer Ovamboland to Bantu Commissioners Ondangwa and Oshikango, 28 January 1957; Julius Abraham, interview by author, Olupito, 16 and 18 June 1993. Moses Kakoto used a few new poles when he moved his homestead in 1992, interview by author, Okongo, 17 February 1993.

[30] OMITI 4.3.4. On omwoolo, interviews by author: Kalolina Naholo, Ohamwaala, 26-27 January 1993, Kaulikalelwa Oshitina Muhonghwo, Ondaanya, 1 February 1993, and Philippus Haidima, Odibo, 9 December 1992. In eastern Ovamboland, where mopane was less commonly used, Erkkilä estimated that a pole would have to be replaced after 15 years, Erkkilä, "Living on the Land," p. 91.

recover. Timing was critical; to ensure re-growth, trees could only be cut down during the rainy season, when they had leaves. One interviewee noted that the older generations possessed this intricate indigenous knowledge about coppice and pruning management, but that it was being lost.[32]

The most frequently coppiced species were mopane (mentioned by 31% of respondents), marula (17%), real fan palm (16%), and birdplum (13%); silver cluster leaf (omwoolo), leadwood (omukuku), fig, jackalberry, and camel thorn each were mentioned by 5-7% of respondents.[33] When multiple-stem mopane coppice stools were reduced to one shoot to allow a 6-12 feet (2-4 meter) distance between individual plants, proper ground clearing and pruning meant that mopane shoots had the potential to grow into straight poles of a suitable size for building palisades, huts, and fences within 3-5 years.[34] Coppiced silver leaf cluster (omwoolo) took 2-4 years to grow back to a size sufficiently large for the palisade, i.e. a length of 5-7 feet (1.5-2

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[31] OMITI 4.4.19 and 4.4.21.

[32] Erastus Shilongo, interview by author, Olupanda, 21 June 1993. Zimbabwean research noted that most miombo species coppice optimally if cut higher up the trunk rather than lower down. Chidumayo and Frost consider approximately 1.3 meter (approx. 4 feet) above ground level best. The research probably refers to coppice from the trunks of adult trees, rather than coppice from a stool, see E. Chidumayo and P. Frost, "Population Biology of Miombo Trees," Campbell, The Miombo in Transition, pp. 64-71 and P.T. Mushove and J.T. Makoni, "Coppicing Ability of Colophospermum mopane," Piearce and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 226-230.

[33] OMITI 4.4.20. The agricultural officer noted "that where the Mopane is thinned a lot, much Mopane coppice grows. Therefore it may be possible to use Mopane for the above purpose until a more suitable exotic is found," NAN, BAC 133 f. HN 8/21/4/1, Agricultural Officer to NCO, "Report of travel to the northwestern part of Ovamboland from 20-22 June 1956," Ondangwa, 4 July 1956. Mushove and Makoni noted that cut mopane seemed to produce a higher biomass than uncut mopane, see Mushove and Makoni, "Coppicing Ability of Colophospermum mopane," Piearce and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 226-230. In referring to miombo coppice, Chidumayo emphasized that woody plant density was three times higher in young regrowth than in old growth miombo, see E.N. Chidumayo, "Silvicultural Characteristics and Management of Miombo Woodland," in the same volume, pp. 124-133.

[34] NAN, OVA 58 f.7/7/1-7, Department of Forestry Pretoria to Department of Agriculture and Forestry Owambo, Pretoria, 24 June 1976. Careful cultivation of mopane could produce 4-5 meters long poles with a thickness of 15 cm in 5 years, informal interview by author with an elderly man, Ondobe, 28 January 1993. See also Erastus Shilongo, interview by author, Olupanda (Okalongo), 21 June 1993. Mushove and Makoni noted that mopane coppice shoots showed linear growth for seven years before the growth rate tapered off, Mushove and Makoni, "Coppicing Ability of Colophospermum mopane," Piearce and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 226-230. In the coppice woodlands of Medieval to 19th century England, a five year coppice cycle was not uncommon, Rackham, Trees and Woodland in the British Landscape, pp. 59-90. In Zimbabwe's miombo, Brachystegia spiciformis and Julbernardia globiflora coppice reached a height of 3 meters after 4 years, I.M. Grundy, "Regeneration of Brachystegia spiciformis and Julbernardia globiflora in Zimbabwean Woodland," Piearce and Gumbo, The Ecology and Management of Indigenous Forests in Southern Africa, pp. 191-196. In dry miombo the average mean stem regrowth of four species including Julbernardia globiflora and Uapaca kirkiana was 1.11 meters after three years and 2.69 meters after six years, E. Chidumayo and P. Frost, "Population Biology of Miombo Trees," Campbell, The Miombo in Transition, p. 68, table 3.4

meters) and a thickness of about 4 inch (10 centimeter).[35] Mopane did not occur east of the floodplain beyond Omutwewondjaba, which may be related to the occasional occurrence of frost, but other tree species, such as, for example, silver leaf cluster, were employed for similar roles purposes.[36]

Pruning trees and bush was practiced by almost half (48%) of the households that participated in the 1993 OMITI survey.[37] It was common for mopane to be pruned (mentioned by 54% of pruning households), along with birdplum (20%), real fan palm (19%), marula (15%), jackalberry (7%), silver leaf cluster (7%), tamboti (7%), Rhodesian teak (6%), and Rhodesian bushwillow (omupupwaheke) (5%). The practice of pruning was also mentioned in connection with buffalo thorn (omukekete), (Kalahari) apple leaf (omupanda), and fig (4% each), and camel thorn, leadwood (omukuku), and omutyuula (various Acacia spp.), which received mentions of 2-3% each.[38] Other trees that responded favorably to pruning were red bushwillow (omunaluko) and Russet bushwillow (omukadikudiku).[39]

In brief, woodland vegetation was coppiced and pruned, with coppice and pruning cycles that sustained high levels of production of mopane and other suitable species for use in building palisades, hunts, and fences. The indigenous knowledge that made this possible contributes strong evidence of the importance of human agency in creating and maintaining an environmental infrastructure in a "natural" resource – bush and trees – critical to supporting a key local livelihood: farming.

Water Harvesting and the Environmental Infrastructure

In Ovamboland, as elsewhere in the world, water conditions shaped where humans could settle and in what concentrations. People established homesteads and fields on the area's low sandy ridges because of the frequent flooding in the lower-lying land between the ridges. The nature of human settlement in turn affected the environment because settlers cleared land for farms, cultivated the soil, and

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[35] Kalolina Naholo, interview by author, Ohamwaala, 26-27 January 1993.
[36] Mopane occurs abundantly as far east as Omutwewondjaba but is absent further east, at for example Omundaunghilo, personal observations author, Omutwewondjaba, 15 July 1993. On mopane brush and its vulnerability to frost that occurs in the east, see, for example, Helemiah Hamutenya, interview by author, Omuulu Weembaxu, 17 July 1993. In the surveyed farms in the western part of eastern Ovamboland, Erkkilä noted that only in the far west in Ondobe was mopane used extensively, see Erkkilä, "Living on the Land," p. 86.
[37] OMITI 4.4.19 and 4.4.21.
[38] OMITI 4.4.22.
[39] Erastus Shilongo, interview by author, Olupanda (Okalongo), 21 June 1993.

introduced livestock to the area. Because water was scarce in the new villages during the dry season, the further growth of the village populations could only be sustained by herding the cattle to distant cattle posts for the duration of the dry season. Environmental conditions, however, not only offered challenges; they also brought opportunities: the extreme semi-aridness of the region made it tse tse fly free and thus an important cattle-breeding area. Thus, by definition, nature was neither hostile nor hospitable.

The Ovambo floodplain dominates the western half of the Kuvelai-Oshimolo watershed, which is delineated by the Kunene River in the west, the Kavango (Cubango) River in the northeast and east, and the Etosha Pan in the south. Although the Kuvelai-Oshimolo watershed lacks any permanent rivers, the Ovambo floodplain consists of an inland delta of rain-fed seasonal watercourses. The flat terrain slopes gently towards the Etosha Pan to the south. The climate is semi-arid: the moving rainfall average over ten years between 1940/1941 and 1998/1999 measured at two locations in the southern floodplain was between 400-600 mm, with 96% of rain falling in the months of November to April, but heavily concentrated in January, February, and March.[40] Local rains and rains from the northern part of the watershed, which reach the delta in the form of a seasonal flood (efundja), collect in a maze of watercourses which intersect the floodplain. Drainage is north to south and in years of heavy rains the flood feeds the Etosha Pan. The eastern half of the watershed contains only a handful of watercourses. Early in the long dry season, the surface water in the shallow watercourses and pans is consumed, or it has evaporated or percolated into the soil.

The missionary Carl Hugo Hahn reached Ondonga on the southeastern edge of the floodplain early in the dry season of 1857. Even before he entered the actual floodplain, he noted an increasing number of sources of water. He described dry watercourses marked by regular flooding, water holes, wells, "dams" and a large number of small "pans."[41]

A Portuguese soldier who participated in the invasion of the Ombadja kingdoms in the far northwest of the floodplain in the early 1900s described the water holes that were the main dry season sources of water in the floodplain:

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[40] Mendelsohn, el Obeid, and Roberts, A Profile of North-Central Namibia, pp. 9-11.

> When the rain water supplies have dried up they open up some pools or cacimbas in locations where there are small lenses of underground water that have been formed through infiltration and where a clay layer prevents the rainwater from percolating to a great depth. These deposits [of water] are fairly frequent, but give little water; just enough for the support of a few families when the consumption is limited to use for food and drink....sometimes these deposits are reached at a depth of 3-4 meters, producing 30-40 liters in 24 hours.[42]

Möller described a water hole at Onoholongo southwest of Olukonda on his 1895-1896 travels:

> [it] is a funnel-shaped depression about 50 meters in diameter, in the middle of which there are two holes about one meter in diameter that human hands have deepened to wells. At the bottom of these the water of the lower layers of the surrounding sand-veld, which sinks down and is stored after each rain, gathers. In order to water all the oxen six of my men had to stand the one above the other on steps in the well and haul up the water in buckets....before they all had had enough to drink the well was empty and we had to let the water run in during the night.[43]

Another important improved source of water consisted of dams or ponds. Groups of households, the inhabitants of a village, or subjects mobilized by kings or headmen deepened natural pans (small depressions where water collected during the rains) and used the earth to heighten the banks. An alternative was to construct a small dike (or dam) on the edge of a seasonal watercourse. In the latter case, the dam not only gathered water from local rains, but also harvested floodwater. Deepened and improved pans were known as oitenemba and they were clearly distinguished from natural pans. Some, if not all, of the "pans" and "dams" that the missionary Hahn described in 1856 may actually have been oitenemba or indigenous dams. It was this human-made rural water infrastructure of water holes (and some wells) and dams that supplied the bulk of human and (domestic) animal needs during the long dry season in the Ovambo floodplain, and which facilitated the high population densities.[44]

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[41] Lau, Carl Hugo Hahn Diaries, Part IV 1856-1860, No. 23 Reise zu den Ovandonga, pp. 975-1081. See also AVEM, RMG 2599 C/i 19, Bernsmann, Ondjiva, December 1891 and Omburo, 6 January 1892; Wülfhorst, Aus den Anfangstagen, pp. 12-16; and Marquardsen, Angola, p. 43.

[42] "Campanha do Cuamato," Portugal em Africa, vol. 14 (September 1907), no. 165, pp. 443-448.

[43] Möller, Journey in Africa, pp. 142-143.

[44] Marquardsen, Angola, p. 97; "Campanha do Cuamato," Portugal em Africa, 14 (September 1907), 165: 443-448; and de Lima, A Campanha dos Cuamatos, pp. 136-140.

Refugees, Migrants and the Absence of an Environmental Water Infrastructure

Refugees and migrants from the northern floodplain placed increased pressure on dry season water resources in Ovamboland's villages. Before colonial occupation in 1915, much of the middle floodplain along the Angolan-Namibian border had been ofuka-wilderness marked by the absence of a water harvesting infrastructure. The scarcity of a water harvesting infrastructure in the border area of Ovamboland that absorbed massive numbers of refugees and migrants from the Portuguese colony of Angola had two major consequences. First, the influx of people multiplied the effects of both seasonal and annual drought conditions. The lack of a dry season water infrastructure became abundantly clear during the 1929-1931 Famine of the Dams, which affected all of Ovamboland. The drought was marked by severe water scarcity and crop failures, and government food aid was necessary to prevent starvation. A large share of the food aid was distributed through food for work projects that expanded the water infrastructure of wells and reservoirs, or "dams" thus giving rise to the Ovambo name for the event: Ondjala yomatale, "the Famine of the Dams."[45]

Secondly, strife related to access to and control over (year-round) sources of water increased. The situation manifested itself at several different levels. The South African colonial authorities demanded guarantees from their Portuguese counterparts that they would not cut off the floodwater to Ovamboland because the African population was dependent on it.[46] In addition, conflicts occurred between neighboring Ovambo communities. For example, early during the dry season of 1928, the only disturbance "of note" was "a clash of Ukuanyama [Kwanyama] and Ondonga natives over some waterholes which are claimed to be in Ukuanyama [Oukwanyama] on the one hand and in Ondonga on the other." The South African official in charge of Ovamboland added that water and grazing conditions "have become very bad indeed and natives all over the country are having a hard struggle to find water for their stock."[47] The monthly report for September noted with alarm that because of the water shortage, a significant number of refugees who previously had fled from Angola to Ovamboland had returned to Angola.[48] In October, the official reported "[t]here are frequent ... quarrels in connection with the watering of cattle. The

[45] NAN, NAO 105, Diaries Native Commissioner, Diary 1929, entries 15 January and 22 February 1929; A450, 7, f. 2/10, Annual Report Ovamboland 1940. See also Kreike, "Recreating Eden," ch. 5.
[46] NAN, KAB 1, part VI Reports 1926-1927.
[47] NAN, NAO 18 f. 11/1 (i), Monthly Reports for Ovamboland July and August 1928.
[48] NAN, NAO 18 f. 11/1 (i), Monthly Report for Ovamboland September 1928.

Ovambo will never water another man's cattle if he can help it, but in many instances he is now compelled to water strange cattle to prevent their jumping into his precious well ….In the north western areas conditions are appalling."[49]

The existing limited number of water holes drew on shallow highly localized aquifers that each could sustain only a small number of people and animals during the dry season and a 1966 report noted that a water hole could sustain at most only several households while usually could be relied on for water right through to the beginning of the rainy season; in drought years, however, they could run dry earlier. In addition, occurred, for example, in 1953, elephants destroyed crops and water sources in southwestern Ovamboland: "[the elephants] filled up the water holes with earth so that the poor people have difficulty always in obtaining water [sic]."[50] A 1970s example illustrates the widespread use of waterholes: of the 33 homesteads at Ongwediva whose lands were alienated in 1976-1978, eight had wells or water holes, including two homesteads that had two sources of water each and one that had three sources of water.[51]

The construction, ownership, and management of water holes was highly individualized. The people who organized digging a water hole were considered to be the owners of the resource. Often, the owners were private persons and their water holes could and would be inherited by their legal heir(s).[52] The owner managed the water hole and could restrict its use in times of scarcity, and regular users were expected to participate in repairs and maintenance.[53] If a water hole ran dry after

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[49] NAN, NAO 18 f. 11/1 (i), Monthly Report for Ovamboland October 1928 and RCO 4 f. 3/1919, Manning, Memo re[garding] Ipumbu, 19 February 1921.

[50] See NAN NAO 18 f. 11/1 (I), Monthly Report Ovamboland, September 1926; A450, 7, f. 2/18, Annual Report 1938; WAT 66 f. 70/13/2 (ii), Sec. SWA to Sec. Bantu Administration Pretoria, Windhoek, 21 January 1966; NAO 46, Investigation Diary: Murder of young Ovambo Female, Nimungu Iyambo on or about 24th July 194; NAO 67 f. 24/14, Tribal Secretary for Chief Shetuatha Mbashu (Ukwaluthi) to NCO, Government Camp Oom Piet, Uukwaluuthi, 22 September 1953; and interviews by author: Kaulikalwa Muhonghwo, Ondaanya, 29 January 1993 and Joseph Nghudika, interview by author, Onamahoka, 3 February 1993.

[51] NAN, OVA 55 f. 6/20/1 (I), J.P. Mulligan, Department of Agriculture, Payment of Ovambo houses Ongwediva, 25 July 1978 and Sec. Agriculture to Sec. Chief Minister, 29 November 1976.

[52] Interviews by author: Kulaumoni Haifeke, Oshomukwiyu, 11 May 1993 and Paulus Nandenga, Oshomokwiyu, 28 March 1993. On ownership, see also NAN, RCO 10 f. 15/1916/1, Manning and Hahn, Preliminary Memo for Ex[pedition] Force [1915 or 1916] and RCO to Staff Officer Union Forces in South West Africa, 3 December 1916; NAO 13 f. 6/2/5 (I) NCO to Sec. SWA, Ondangwa, 3 August 1934; NAO 99 f. 42/11 (ii), Ndjuluua, Ondangwa, 12 December 1950, Appendix to Chief Kambonde to NCO, Okarolo, 15 December 1950 and Pingan ya Paulus to Master Nakale, 6 November 1950; WAT 66 f. 70/13/2 (ii), Sec. SWA to Sec. Bantu Administration Pretoria, Windhoek, 21 January 1966.

[53] See interviews, Kulaumoni Haifeke, Oshomukwiyu, 11 May 1993 and Kaulikalwa Muhonghwo, Ondaanya, 29 January 1993 and NAN, A450, 9 f. 2/38, "Property Rights."

heavy use, people were allowed to draw water from another water hole.[54] Although the ownership of water holes that were located within the fenced area of a farm was often transferred along with the farm, it seems that they could also be transferred separately from the land itself.[55] The long-serving Native Commissioner Hahn concluded that "[t]he water itself is incapable of ownership. The occupier of a waterhole has the right to draw his own requirements before anyone else. Thereafter the neighbors are entitled to draw [water] provided they have assisted in the annual opening up and cleaning of the waterhole after the rains."[56]

In 1993, 51% of the OMITI survey respondents relied exclusively or additionally on "traditional" water holes. In 93% of the cases, the water holes were owned by individuals; only 7% of the water holes were "communal" property. The water holes were high maintenance resources: 87% of the households that used water holes emphasized that they needed to be periodically repaired and cleaned, and most of the households consequently supplied the requisite labor (98%).[57]

The 1991 census found that almost 60% of Ovamboland's nearly 100,000 households relied on "wells" (referring to water holes and wells combined) as a source of water.[58] Water holes and indigenous dams (etenembi) remained in use and even made a virtual comeback during 1992 (see Table 10.3). Because of the early 1990s drought conditions, villagers repaired old indigenous dams, water holes, and even entire water hole systems (etambi) that had fallen into disuse.[59]

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[54] Interviews by author: Kulaumoni Haifeke, Oshomukwiyu, 11 May 1993 and Paulus Nandenga, Oshomokwiyu, 28 March 1993. On ownership, see also NAN, RCO 10 f. 15/1916/1, Manning and Hahn, Preliminary Memo for Ex[pedition] Force [1915 or 1916] and RCO to Staff Officer Union Forces in South West Africa, 3 December 1916; NAO 13 f. 6/2/5 (I) NCO to Sec. SWA, Ondangwa, 3 August 1934; NAO 99 f. 42/11 (ii), Ndjuluua, Ondangwa, 12 December 1950, Appendix to Chief Kambonde to NCO, Okarolo, 15 December 1950 and Pingan ya Paulus to Master Nakale, 6 November 1950; WAT 66 f. 70/13/2 (ii), Sec. SWA to Sec. Bantu Administration Pretoria, Windhoek, 21 January 1966.
[55] See NAN, A450, 9 f. 2/38, "Property Rights" [Mss].
[56] NAN, A450, 9 f. 2/38, "Property Rights." See also E. Kreike, "Historical Dynamics of Land Tenure in Ovamboland" NEPRU working paper no. 2 for the National Land Reform Conference, Windhoek, Namibia, June 1991.
[57] OMITI 3.15 (N=277), 3.16 (N=163), 3.17 (N=162), 3.18 (N=143), 3.19 (N=130). On the private ownership of water holes, see also, for example, NAN, WWA [WAT?] 637 f. 31/3/1(ii), Department Water Affairs, Report Re. Watersupply Ovamboland Schools, Appendix to Acting Chief Inspector to Director Water Affairs Windhoek, Otjiwarongo, 13 May 1970.
[58] Namibia, 1991 Census, Report A, Statistical Tables, vol. v, table H06.
[59] Kulaumoni Haifeke, interview by author, Oshomukwiyu, 11 May 1993.

Table 10.3 Main Sources of Water for Drinking and Cooking in 1993[60]

	Ediva (Pan)	*Oshana (Watercourse)*	*Waterhole*	*Well*	*Dam*	*Canal*	*Pipeline*
Rainy Season	60	19	14	21	2	5	10
Dry Season	5	0.3	25	40	3	11	27

In short, the colonial water infrastructure of storage dams, canals, and pipelines did not replace the indigenous water harvesting infrastructure.

The Land and Environmental Infrastructure: Making Soils Fertile

Western soil scientists consider the unused soil of natural, pristine, or climax vegetation as containing its optimum fertility; human use depletes this fertility.[61] In contrast to western soil scientists, the inhabitants of Ovamboland did not regard human soil use as being by definition detrimental to the soil. Nor did they take the pre-human-use soil as the benchmark and "full" mark for assessing soil history. In fact, Ovamboland's farmers had an almost diametrically opposite view to conventional western scientific ideas: humans literally build up the soil.[62]

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[60] OMITI 3.1.0 and 3.1.1.

[61] Huxley states that soil formation requires hundreds of years, and that soil losses are "effectively irreplaceable in our lifetime." See Huxley, Tropical Agroforestry, pp. 51, 132, 261, 265, 276-277, 280, 283. See also Longman and Jeník, Tropical Forest and its Environment, pp. 20-21, 24, 27-29. Most chapters in Nair present soil as natural givens, see for example, P. Poscher, "An Evaluation of the Acacia albida based Agroforestry Practices in the Hararghe Highlands of Eastern Ethiopa" and J.C. Okafor and E.C.M. Fernandes, "The Compound Farms of South-Eastern Nigeria: A Predominant Agroforestry Homegarden System with Crops and Small Livestock," Nair, Agroforestry Systems in the Tropics, pp. 385-400, (especially 387-388) and pp. 411-426 respectively. G. Schroth and F.L. Sinclair, Impacts of Trees on the Fertility of Agricultural Soils," G. Schroth and F.L. Sinclair, eds., Trees, Crops and Soil Fertility: Concepts and Research Methods (Wallingford, UK. & Cambridge, USA: Cabi Publishing, 2003), pp. 6-7, stress that decreasing soil fertility appears to mark many farmed areas of the tropics.

[62] This local Ovamboland view meshes with what Young calls a new paradigm of soil management that is based on soil biological processes and enhancing soil organic matter. Morover, it fits with a body of literature on Latin America and Africa that stresses anthropogenic origins of certain soils. On the new soil management paradigm, see Young, Agroforestry for Soil Management, pp. 23-25. Young, however, emphasizes natural processes of soil organic matter build-up, although he concedes that soil organic matter can be restored, see pp. 29, 99-110. Anthropogenic soils may be more fertile than "natural" soils in any given environment because of the history of the building up of organic matter as a result of human action, including applying manure and household debris (middens, decaying wood). See for example, Richards, Indigenous Agricultural Revolution, pp. 55-71; W.E.A. van Beek and P.M. Banga, "The Dogon and their Trees" and J. Pottier and A. Nkundabashaka, "Intolerable Environment: Toward a Cultural reading of Agrarian Practice and Policy in Rwanda," Parkin and Croll, Bush Base: Forest Farm, p. 64 and pp. 146-168 respectively; Fairhead and Leach, Misreading the African Landscape, pp. 87-88, 90-92, 126-130, 140-142, 194-202; Mazzucato and Niemeijer, Rethinking Soil and Water Conservation, pp. 157-163, 178, table 6.1, and 181-201. For a good example on Latin America, see E. Graham and D.M. Prendergast, "Maya Urbanism and Ecological Change," Steen and Tucker, Changing Tropical Forest, pp. 102-109. Mende farmers in Sierra Leone preferred locations that had been inhabited in the past as sites for tree crops because they considered such areas as fertile, Fairhead and Leach, Reframing Deforestation, p. 149.

Ovamboland's farmers applied manure and other organic matter, constructed raised beds or mounds, and employed a homestead fallow system in order to optimize soil conditions for sustained crop cultivation. After having been expelled from his farm, Holongo Amshelelonanda lamented "[m]y late land is a very good land. I am the person who made in [sic: it?] good and fertile by manuring it."[63] In the early 1900s, a German missionary emphasized that one of the first converts had made a major sacrifice by abandoning his old established farm to move closer to the mission because the farm had been fertile. After moving to the mission, he had had to clear a new plot in the bush land and start from scratch.[64] In 1966, the head of the colonial administration in Ovamboland met with villagers in Ogongo to discuss their removal for the construction of what later became the Ogongo Agricultural College. The farmers pointed out that their fields were fertile and well cultivated and that they wanted to be paid compensation because it required great effort to clear the forests, fertilize the soil with manure and fence the land. Despite being offered alternative land, they insisted that they would have to invest heavily in the new land, and that it would never be as productive as the land that they were being asked to abandon. The head of the colonial administration in Ovamboland advised his superior to make an exception and to pay them compensation.[65]

Converting a plot in the ofuka-wilderness into a farm with good soils was a major undertaking. First, it required clearing the vegetation. Next, the soil was literally built up by constructing raised beds or mounds where the millet and other crops would be grown. Manure and other organic matter were carried onto selected fields and fallow cycles also increased soil organic matter.[66]

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[63] NAN, NAO 100 f. 42/11 (iv), Chief Kambonde to NCO, 8 August 1952, and Statement Holongo Amshelelonanda at Ondangwa, 4 July 1952.
[64] Wülfhorst, Moses, p. 14-15.
[65] NAN, AHE (BAC) 1/346 f. (15) N8/19/4/4 (I), Bantu Affairs Commissioner to Chief Bantu Commissioner, Ondangwa, 16 May 1966.
[66] These technologies are widely used throughout Africa, see for example, Richards, Indigenous Agricultural Revolution, pp. 55-71; L.C. Gray, "Investing in Soil Quality: Farmer Responses to Land Scarcity in Southwestern Burkina Faso," Bassett and Crummey, African Savannas, p. 75-76; W.E.A. van Beek and P.M. Banga, "The Dogon and their Trees" and J. Pottier and A. Nkundabashaka, "Intolerable Environment: Toward a Cultural Reading of Agrarian Practice and Policy in Rwanda," Parkin and Croll, Bush Base: Forest Farm, p. 64 and pp. 146-168, respectively; Fairhead and Leach, Misreading the African Landscape, pp. 87-88, 90-92, 126-130, 140-142, 194-202; Mazzucato and Niemeijer, Rethinking Soil and Water Conservation, pp. 181-201.

The mounds or cultivation beds (pl. oimungu) were separated by "paths" (pl. eendjila).[67] The mounds varied in size from 3-12 feet (1-4 meter) in length to 3-12 feet (1-4 meter) in width, and they had a height of 6-16 inch (15-40 cm). Mounding increased the depth of the fertile topsoil for the plants that were grown on top of the beds, in addition to protecting crops from flooding, and the practice favored root development through better aeration. Indeed, in a 1957 letter to the Native Commissioner, the agricultural officer questioned whether plowing was really an improvement upon Ovamboland's mound cultivation:

> the raised bed cultivation methods, as they are practiced by the Ovambo, give more satisfactory results than the common plow in the fields. Therefore different tools and cultivation methods should be tested in order to create more favorable growth conditions for the crops.[68]

Enhancing soil fertility by applying organic matter required medium- to long-term investment. Depending upon their individual circumstances, farmers improved their soils by applying manure, ashes, termite mound earth, and silt that was scooped out from water holes and water reservoirs.[69] Cattle manure especially was a critical resource: it was essential in creating fields when a village was first settled and it was important for maintaining the soil fertility on fields that were subjected to almost continuous cropping. Colonial agricultural experts emphasized that crop cultivation in Ovamboland was extremely dependent upon manure. The director of the department of agriculture for South West Africa wrote in 1947:

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[67] Lea Paulus, interview with author, Onandjaba, 17 June 1993; NAN, NAO 11, f. 6/2/1 (I), Annual Reports Ovamboland FMS 1934 and 1937; A450, 12, f. 3/21/5, SWA Commission: Minutes of Evidence vol. 12, 13 August 1935, Hahn, p. 651 and vol. 14, Eedes, p. 746; A450 7, f. 2/18, Annual Report Ovamboland 1943; NAO 62 f. 12/5, Agricultural Report Ovamboland 1953; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956. See also Lau, Carl Hugo Hahn Tagebücher, 22-23, 27 July 1857; AVEM, RMG 2599 C/i 19, Beersmann, Omburo, 6 January 1892; NAN, A233, J. Chapman, 1903-1916, 1876[?] [pp.61-62] and NAO 104 Anderson to Hahn, Jordan diary; Möller, Journey, p. 110.

[68] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957 and BAC 132 f. HN 8/18/3/1/1 Trust Farming Projects, Agricultural Officer Ovamboland to NCO, Ondangwa, 1 March 1957. In 1965, the Chief Bantu Commissioner for South West Africa expressed strong reservations about the use of the plow in Ovamboland, see AHE (BAC) 1/346 f. (15) N8/19/4/4 (I),Chief Bantu Commissioner SWA to Principal Agricultural College Arabie, Marble Hall, Transvaal, Windhoek, 13 July 1965.

[69] On manure use, see NAN, NAO 62 f. 12/5, Agricultural Report Ovamboland, Omafu, 30 November 1953; Kalolina Naholo, interview with author, Ohamwaala, 26 and 27 January 1993. On ashes, see Kalolina Naholo, interview by author, Ohamwaala, 26-27 January 1993 and NAN, A450, 12, f. 3/21/5, SWA Commission: Minutes of Evidence, Otjikango, 9 August 1935, Gawthorne (CEM), p. 568. See also A450, 7, f. 2/18, Annual Report Ovamboland 1937 and NAO 64 f. 19/1 (i), Telegram NCO to Commandant Fourie, Ondangwa, 25 September 1953.

> It must be pointed out that the annual Mohangu [pearl millet] crop is very largely dependent on the supply of manure which by normal standards is very heavily supplied in Ovamboland. As the country is becoming gradually more and more denuded the stock that can be maintained in the cultivated area during the winter will become less and less. Accordingly the supply of manure will also diminish.[70]

A 1958 report estimated that 1 to 1.5 tons of manure was applied per 2 morgen (1.7 ha) on a total of 74,000 morgen (approximately 50,000 ha), with a grand total of 100,000 tons/year. Indeed, colonial experts considered the amount of available manure to be a major constraint on field size. Interviewees similarly underscored the importance of manure.[71]

Another method to improve the soil was the practice of the homestead fallow. Ovamboland's farmers moved the family homestead every one to four years and often the livestock kraals as well, but within the confines of the original clearing. The new homestead was constructed to the east of the old one, and the old homestead site subsequently became a field.[72] In 1993, for example, Julius Abraham lived on the

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[70] NAN, AGR 538 f. 68/7 (i), Director of Agriculture Windhoek, 26 October 1949, Agricultural Survey of Ovamboland with Reference to Agricultural and Stock Improvement in that Area.

[71] NAN, NAO 62 f. 12/5, Agricultural Report Ovamboland 1953. On manure use AGR 538 f. 68/7 (i), Director of Agriculture Windhoek, 26 October 1949, Agricultural Survey of Ovamboland with Reference to Agricultural and Stock Improvement in that Area; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957; BAC 133 f. HN 8/21/4/1, Quarterly Report Agriculture Ovamboland for the Quarter ending 30 June 1958; BOS (Bantoesake Komissaris Oshikango 1958-1965), Oshikango Stamsecretaris G. Kautwima to Omutonateli Wowilonga, Ohangewena, 1 March 1967. On the restrictions on access to manure by household members, see Joseph Nghudika, interview with author, Onamahoka, 3 February 1993. The 1958 estimate of the amounts of manure applied may be on the high side but they do not seem to be totally off the mark in the light of Dicko-Toure's research on cattle fecal matter production. Based on a herd size of 90 head of cattle, he calculated an average fecal matter production of 3 kg per day per head. In 1958, veterinary staff inoculated 333,000 head of cattle in Ovamboland. Conservatively using a figure of 300,000 cattle that remain in the villages for a 150 day/year producing 3 kg fecal matter per day yields a fecal matter production of 135,000 ton. Given that cattle were herded in the villages and on the edge of the villages during the day and confined to the on-farm cattle enclosures during the night, approximately half of the fecal matter (62,500 ton) was likely to have been deposited on-farm. In addition, because cattle were allowed to graze in the fields after the harvest for one month the entire production of fecal matter during this period probably was deposited on-farm, which adds another 13,500 tons to the 62,500 tons giving a total of 76,000 tons. The 1958 colonial report presumes that the manure would be evenly distributed over the 74,000 morgen (50,000 ha) which would mean an average annual addition of 1 ton per morgen or 1 ton per 0.85 ha. Cattle manure, however, was not spread over all the fields on a single farm and it also was not evenly distributed over the fields that did receive manure. Moreover, some households would have received more cattle manure and others less, or none at all. Cattle manure, however, was one of several methods used to fertilize fields. Goat manure, highly organic soil matter, and ashes were also spread over crop fields. On the production of fecal matter, see M.S. Dicko-Toure, "Measuring the Secondary Production of Pasture: An Applied Example in the Study of an Extensive Production System in Mali," Le Houérou, Browse in Africa, pp. 247-253.

[72] Möller, Journey, p. 126. The main entrance of the homestead faced east, NAN, A450, 9, f. 2/38, "Tribal laws and customs of the Ovambos." See also RCO 10, f. 15/1916/1, RCO and Hahn, Preliminary memo re. Ovamboland and Chief Mandume, [1916]; Märta Salokoski, "Symbolic Power

same farm plot that his father had cleared in the 1920s, but his homestead was located across the field from where his father's original homestead had been established. Although the homesteads usually were moved over a short distance, the operation was nevertheless extremely labor intensive. A household might receive assistance from clan relatives and neighbors for up to 2-3 days. In the case of royal homesteads in the pre-colonial floodplain, the move could require the labor of up to 100 men. Homestead buildings typically were moved during the end of the dry season, from as early as August to as late as early December. Young men and boys performed most of the hard work, but it was organized and led by older men, who designed the plan for the new homestead and selected the materials.[73] In 1941, an official found that his investigation of a crime site was hampered because the homestead had just been moved, "[all] that remained of the old kraal…was the outside circle of poles and one grass-roof-shelter….there was a circular space of about 25 to 30 yards diameter, enclosed with poles planted close to one another." In his testimony, the owner, Natanael Tshavura, explained that he had moved the homestead in September 1940 "because it was dilapidated. It is our custom to shift our kraals every 3-4 years to a different part of the field. That evening I had provided beer and food for the people

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of Kings in Pre-Colonial Ovambo Societies" (Helsinki, University of Helsinki: Licensiate Thesis, 1992), pp. 154, 200.

[73] Julius Abraham, interview by author, Olupito, 16 and 18 June 1993; Möller, Journey, pp. 112, 126; AVEM 2518, C/h 34, Speiker, Ondjiva, 19-24 July 1906 and RMG 2630 C/k 7, Sckär, "Kurze Geschichte der Ovakuanjama," appendix Sckär to Inspector, Namakunde, 2 October 1912; NAN, A450, vol. 12, f. 3/21/5, SWA Commission: Minutes of Evidence (1935), vol. 9 August 9, 1935, evidence by Rev. Gawthorne (Anglican Mission), p. 569, and f. 2/35, Anonymous, "Ovambo Customs" (1926), and f. 2/36, C.H.L. Hahn, "Preliminary Notes on Certain Customs of the Ovambo," Journal SWA Scientific Society, vol. 3 (1927/28), pp. 16-18, and f. 2/38, "Property Rights" and "Tribal Laws and the Customs of the Ovambos," and vol. 10, f. 2/40, an outline written on blue paper mentioned on p. 2 "[f]ields moved periodically" and "[p]eriodically [the houses are] shifted." See also, RCO 4, f. 3/1919, Ipumbu to NCO, Ukuambi, 23 October 1923; NAO 44 f. 37/1, O/C Oshikango to NCO, Oshikango, 17 March 1931 and NCO to Sec. SWA, Ondangwa 20 April 1931; NAO 19 f. 11/1 (vii), Monthly Reports Ovamboland, June & July 1934; NAO 45 f. 45/1, NCO to Sec. SWA, 17 February 1941; NAO 46 f. 45/1/8, Testimony Hamnyela Nashipili, Grootfontein, 5 May 1941, Statements Hamnyela Nashipili, Dirk Jacobus Greyling, Martin Kapenda, Namkoloka Nashipili, Ondangwa, 12 February 1941; NAO 91 f. 36/1 (iii), subfile 36/1/70, Statement Ananias Ruben, Ondangwa, 4 September 1953; NAO 20 f. 11/1 (xiv), Monthly Reports Ovamboland, January-February 1941; NAO 67 f. 24/14, The tribal Secretary for the Chief Shetuatha Mbashu (Uukwaluthi) to NCO, Government Camp, Oom Piet, Uukualuuthi, 22 September 1953; BAC 133 f. HN 8/21/4/1, Agricultural Officer Ovamboland, Agricultural Report Ovamboland, 1955/1956. In the above-mentioned document "Ovambo Customs," the Ovambo (word for the removal is given as oluthilu. Compare G.W.R. Tobias and B.H.C. Turvey, English-Kwanyama Dictionary (Johannesburg: Witwatersrand University Press, 1991 [reprint; first published 1954]), p. 118: "-dulika: move a kraal to a new site across the garden" and B.H.C. Turvey (comp.) and W. Zimmermann and G.B. Taapopi (eds.), Kwanyama-English Dictionary (Johannesburg:Witwatersrand University Press, 1977), p. 83: oludilu: removal of homestead to a new site. The -th- in the Ondonga spelling is generally spelled a -d- in the dialect of Oukwanyama.

who had been helping me in the morning….about thirty people."[74] The homestead fallow was restricted to the fields of the husband and wife; it was not practiced for the fields of junior household members.[75]

Despite claims that it had become less frequent, the homestead fallow was still widely used in the early 1990s.[76] In 1993, 82% of surveyed households had moved their homesteads to have access to the highly fertile location in order to grow millet and the Ovambo spinaches. The frequency of the new rotation, however, was increasingly constrained by the availability of labor. While 69% of the OMITI survey respondents emphasized that it was useful to rotate the homestead in the fields, 42% of the respondents who said that it was not useful mentioned that the practice required a high labor input. Still, of 194 households 71% had rotated their homestead during the last five years, 9% had last done so in the last 6-10 years, 8% had done so in the last 11-20 years ago, and 3% had last rotated the homestead more than 20 years ago. The homestead-fallow cycle highlights the close link between crop cultivation and woody vegetation. A fair amount of the rich vegetative contents on the former homestead sites was derived from decaying woody materials, including the palisade poles.[77]

Not all fields were fertilized and not all the fields that received organic matter were fertilized equally. Until the 1950s, the arable land of individual farms in the

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[74] NAO 46, f. 45/1/5, Greyling, Investigation Diary: death of Kasmia Shivuka Hingo, Ondangwa, [1941] and statement Natanael Tshavura, appendices to NCO to Attorny-General, Ondangwa, 24 February 1941. See also interviews by author: Nahango Hailonga, Onamahoka, 4 February 1993 and cf. Joseph Nghudika, Onamahoka, 3 February 1993; NAN, NAO 19 f. 11/1 (vii), Monthly Reports Ovamboland, June-July 1934; A450, 9, f. 2/38 "Tribal laws and customs of the Ovambos" and f. 2/29, "Hahn, Rough notes on tribal customs of Ovambo;" NAO 46, f. 45/1/2, statement Kenatuka Keivanga, 9 March 1939, Rex vs Chiwetha Hiyanga, Chief Warden Windhoek Gaol to NCO, Windhoek, 23 November 1942.

[75] Joseph Nghudika, interview with author, Onamahoka, 3 February 1993.

[76] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Reports Ovamboland 1955-1956 and 1956-1957. Philippus Haidima mentioned the lack of poles as a restraint in moving his homestead more regularly; when he last moved his homestead in 1990 he obtained some replacement poles from just across the border in Angola, interview by author, Odibo, 9 December 1992. The last time Kaulikalelwa Oshitina Muhonghwo moved her homestead was ten years ago, Kaulikalelwa Oshitina Muhonghwo, interview by author, Ondaanya, 1 February 1993. On shifting homesteads and the fertility of the site, see also interviews by author: Moses Kakoto, Okongo, 17 February 1993; Joseph Kambangula Omboloka, 25 February 1993; Philippus Haidima, Odibo, 9 December 1992; and Joseph Nghudika, Onamahoka, 3 February 1993.

[77] OMITI A5.2.8-A5.2.11; NAN, BAC 133 f. HN 8/21/4/1, Agricultural Officer to NCO, "Report of travel," Ondangwa, 4 July 1956 and Agricultural Report Ovamboland 1956/1957; interviews by author: Joseph Kambangula, Omboloka, 25 February 1993, Kaulikalelwa Oshitina Muhonghwo, Ondaanya, 1 February 1993; Philippus Haidima, Odibo, 9 December 1992; Moses Kakoto, Okongo, 17 February 1993. An abandoned homestead site in Oukwanyama was called elunda. Based on a survey of 246 households, Erkkilä found that between 1992 and 1996, 45% of households had moved the homestead within the farm plot, Erkkilä, "Living on the Land, " pp. 92-95.

Ondonga and Oukwanyama districts was subdivided. In 1920s and 1930s Oukwanyama, upon being allocated a farm, the husband and wife divided the cleared plot in two parts: one for the husband and one for the wife. In polygamous households, each of the wives received a field, but not at the expense of the share that had been allocated to the first or "great wife." The homestead was rotated between the fields of the husband and the first wife, but not to the fields of the co-wives.[78] In addition, fields could be allotted by the owner(s) of the farm to individual members of the household, including children, and to recently married men and their spouses, who often lived with the husband's parents before the couple received a farm of their own. In Oukwanyama, such an individual field was called an oshikokola.[79] Junior members of the households who had been allocated fields, however, rarely had access to manure.[80] Social status thus contributed in important ways to an individual's ability to create and maintain a fertile soil-based environmental infrastructure.

Paying for Environmental Infrastructure

The introduction of land fees – one-time payments to the local headman upon the allocation of a farm plot to the occupants – is not merely a mechanistic outcome of population pressure creating land scarcity and "the market" consequently putting a price on the land. Rather, the payment of land fees reflects the increase of a farm plot's value as a result of the improvements that were made to the land by previous occupants, i.e., providing a plot of land with an environmental infrastructure. Land fees were only paid for turnkey farm plots, i.e. plots that had been cleared and provided with huts, palisades, fences, fields, and (access to) water sources. Land fees were not requested for unimproved plots that lacked any environmental infrastructure.

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[78] Joseph Nghudika, interview by author, Onamahoka, 3 Februay 1993; Kreike, "Recreating Eden," ch. 6.

[79] Kreike, "Recreating Eden," ch. 6 and NAN, NAO 91, f. 36/1 (iii), statement Titus Muatelai Kakonda, Ondangwa, 10 May 1954. Sub-allocating fields to individual household members seems to have been quite common. See. for example, M.J. Watts, "Idioms of Land and Labor: Producing Politics and Rice in Senegambia," T.J. Bassett and D.E. Crummey, eds., Land in African Agrarian Systems (Madison: University of Wisconsin Press, 1993), pp. 157-193, especially 176.

[80] NAN, NAO 62 f. 12/5, Agricultural Report Ovamboland 1953. On manure use, see AGR 538 f. 68/7 (i), Director of Agriculture Windhoek, 26 October 1949, Agricultural Survey of Ovamboland with Reference to Agricultural and Stock Improvement in that Area; BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957; BAC 133 f. HN 8/21/4/1, Quarterly Report Agricultura Ovamboland for the Quarter ending 30 June 1958; BOS (Bantoesake Komissaris Oshikango 1958-1965), Oshikango Stamsecretaris G. Kautwima to Omutonateli Wowilonga, Ohangewena, 1 March 1967. On the restrictions on access to manure by household members, see Joseph Nghudika, interview with author, Onamahoka, 3 February 1993.

Prime farmland in the floodplain became increasingly scarce in the 1930s, 1940s, and 1950s. Established farms that became available upon the death of the (male) owner or as a result of marital separation often required a long wait, and they came at a high price. In Oukwanyama and Uukwambi, only married couples could apply for land for a farm plot. In a dispute about the allocation of a farm in Uukwambi in 1934, for example, a (village) headman wrote to the Native Commissioner: "I told the boy that he must first get a woman and that after he was married I would give him a kraal."[81] The couple who received the farm enjoyed lifelong tenure or "occupational rights" of the plot. Upon the death of the owner(s) of the farm, the plot reverted to the (village) headman for re-allocation.[82] If the owners moved to another farm plot, they could not take the poles or the roofs from their old home to the new location. Construction materials could be removed only if the homestead site was moved within the farm plot.[83] Land fee payments became increasingly common in the 1940s and 1950s because established farms with their improved soil fertility and other infrastructure were highly valued. During the same time, adult and married men lived with their parents for increasingly longer periods of time before they were able to apply for a farm plot.[84]

The fear of eviction underscored the high value of farms and environmental infrastructure. Land tenure was not equally secure in all districts. Chiefs and headmen especially in pre-1940s Ondonga used land eviction as a punishment for crimes and accusations of witchcraft. Moreover, the individual's inability to cultivate a farm frequently served as a pretext for a headman to take away a prime farm and to re-sell it to a relative, a land-hungry young man, or a wealthy older man. The former occupants were either chased from the village (in the case of crimes or accusations of

[81] Kreike, "Recreating Eden," ch. 6 and NAN, NAO 100, f. 42/11 (iv), Dadilepo Elia Nakale to NCO, Luderitz, 15 June 1952; NAO 104, file "Ukuambi Affairs 1932-33," Iyambo Nule to Hahn [NCO], Onimnandi, Uukwambi, n.d. [received Ondangwa, 13 June 1934]; NAO 100, f. 42/11 (iv), subfile 42/11/365, I. Risto Kueenda to NCO, Oniipa Opleidingskool, P.K. Ondangwa, 2 October 1952.
[82] NAN, A450, vol. 23, D6, Land Tenure.
[83] NAN, A450, vol. 23, D6, Land Tenure and vol. 9, f. 2/38, "Property rights" and "Chieftainship (Ouhamba)" and vol. 10, f. 2/40, "Liability of Ezimo (Epata)" and pencil-written mss with letterhead Suidwes-Afrika-SWA with questions regarding Ovambo law; the first question is: "write about right of appeal;" A450, vol. 8, file 2/20, translation of a letter from Muanyangapu Ambunda to Native Commissioner, dated 3 February, 1941. A person evicted from his farm in early 1950s Ondangwa was ordered to remove his property but was explicitly told not to take any of the huts or sticks, NAO 100, f. 42/11 (iv), statement Nangoro Ninguendja, Ondangwa, 9 October 1952.
[84] In 1954 Oshamba village in Ondonga, Kapula Shilongo, who already had a tribal trust tax number, still lived on his father's farm, NAN, NAO 91, f. 36/1 (iii), subfile 36/1/76, statement Kapula Shilongo. See also, Kreike, "Recreating Eden," ch. 6.

witchcraft) or they were re-allocated to a much smaller plot.[85] People who were evicted were usually allowed to remain on their farm until after they had harvested any standing crops.[86] The existence of a bad omen that Hahn recorded is also suggestive that concerns about eviction ran high during his tenure as Native Commissioner: "[a] view of [a] rat nembundu. If seen in day time it is a sign that it is lost and looking for a home [and it] will mean that the man who saw it will be chased out of his kraal."[87]

The high value of land with environmental infrastructure is also illustrated by power struggles over the control over such land. Beginning in the late 1920s, in order to consolidate colonial rule and to create a cadre of headmen that would be loyal to his administration, Native Commissioner Hahn elevated a few chosen headmen – who were often his personal favorites – to the newly created rank of "senior" or "councilor" headmen. Hahn purposefully undermined the positions of the former kings by establishing a direct personal and institutional link between the councilor headmen and the local colonial administration. Hahn designated the senior headmen as the heads of subdistricts and grouped them into tribal councils that assisted the colonial officials and the remaining chiefs (kings) in administering the districts. In effect, the remaining headmen were demoted to village headmen ("sub-headmen" in colonial language).[88] In his efforts to shore up his "senior" headmen in the district of

[85] NAN, A450, 9, f. 2/39, "Hahn, Rough notes on the tribal customs Ovamboland," pp. 59-60 and A450, 12, f. 3/21/5, SWA Commission: Minutes of Evidence, Sitting at Ukualuthi, 12 August 1935, Hahn, pp. 631-632, and vol. 23, D6, Land Tenure; NAO 9, f. 5/1, Administrator [SWA] to Chief Martin, Windhoek, n.d. [May, 1937?] and blue note with heading "Chief Martin," n.d. but inserted between letters dated 6 April and 26 August 1929 and Bjorklund to NCO, Onajena, 10 June 1934; and f. 5/2, Enquiry in presence of Council of Headmen, Uukuambi, 27 May 1937; NAO 98, f. 42/11 (I), Ushona Shimi to NCO, Ongandjera, 16 October 1947 and NCO to Ushona Shimi, Ondangwa, 10 October 1947 and NCO to Kambonde, Ondangwa, 10 October 1947 Kaimbi Mundjele to NCO, Ombalantu, November 1948 and n.d. (received 14 January 1949) and NCO to Ombalantu Headmen, Ondangwa, 12 November and 18 December 1948; NAO 91, f. 36/1 (iii), ANC to NCO, Oshikango, 29 October 1953; NAO 104, file "Ukuambi Affairs 1932-33," RCM to NCO, Uukwambi, 24 June 1934; NAO 11, f. 5/8, UGR to O/C NAO, Omafo, 8 November 1928 and complaint against Headman Kalipi, 23 July 1928, attached to UGR to O/C NAO, Omafo, 8 November 1928; NAO 100, f. 42/11 (iv), statement Nangoro Ninduendja, Ondangwa, 9 October 1952; NAO 99, f. 42/11 (ii), N. Ndjuluua [to NCO?], Ondangwa, 12 December 1950; NAO 105, Diaries NCO, Diary 1928, 16 July 1928; NAO 10 f. 5/6/1, statement Hinikamba, Oshikango, 1 April 1939.
[86] NAN, A450, vol. 23, D6, Land Tenure.
[87] NAN, A450, 10, f. 2/40, "Oshitila."
[88] NAN, NAO 10, f. 5/7, O/C NAO to NCO, Oshikango, 31 August 1938 and 26 June 1940; ANC to NCO, Oshikango, 2 November 1940; NAO 98, f. 42/11 (I), NCO to Kambonde, Ondangwa, 10 October 1947 and Ntinda Shivute to NCO, Oshendje, October 1947 and Kambonde to NCO, Okaroko, 25 October 1947. On the extension of the council system, see A450, 7, f. 2/18, Annual Report Ovamboland 1935; NAO 10, f. 5/7, O/C NAO to NCO, Oshikango, 31 August 1938 and 26 June 1940; NAO 51, f. 3/13, memo NCO, Ondangwa, 30 November 1947, and Allen and Bruwer Blignaut, Proceedings of an enquiry held at Ombalantu on 15 July 1954 into the allegations against Headmen

Oukwanyama, Native Commissioner Hahn attempted to grant them monopoly power over clearing land for any new farms: "[i]n Ukuanyama a Native is only allowed to cut down trees when clearing new lands and no land may be cleared without the prior authority of the Councillor Headman of the Area."[89]

Land Fees

Because the cash-starved colonial administration could not pay the headmen it so heavily depended upon for day-to-day rule, the headmen, with the approval and the encouragement of colonial officials, began to demand a one-time land fee when a farm was allocated. Although a land fee had been charged in the form of cattle or other livestock in 1920s Uukwambi, with the amount depending upon the size of the plot and the quality of its environmental infrastructure, land fees in Oukwanyama and the Onkolonkathi/Eunda districts were uncommon before the 1930s. By the late 1930s, however, the practice had spread throughout Ovamboland, including the Oukwanyama and Eunda districts, and by 1950, land fees were common in Ondonga district. In Ondonga, Angula paid a land fee of three pounds for his farm in 1927. A decade later, Otto Kasava paid three pound and 15 shilling and a "male cattle" for his Eputu farm. In Eunda, the land fee for a farm in the late 1930s to mid-1940s was one head of cattle, while in the Endola area of Oukwanyama the land fee for two different farms in 1951 was one ox each.[90] The headmen who had been selected by the colonial administration as senior or councilor headmen in the 1930s additionally raised revenue by selling villages after a village headman had passed away or had stepped down. Because the villages and subdistricts contained a finite number of villages and farms respectively, and since the farms and villages were allocated for a lifetime, a quick way to increase revenue was to subdivide the farms and villages. Alternatively, village headmen could allow a few more applicants to clear a farm in an old village.

Hishitile Shiweda and Naundjoba Anghuna; NAO 104, file "Ukuambi Affairs 1932-33," Iyambo Nule to Hahn, n.p., n.d., received Ondangwa, 15 November 1934 (two letters) and Iyambo Nule to NCO, Onimnandi, Uukwambi, n.d. [received 13 June 1934]; NAO 51, f. 3/3, NCO to CNC, Ondangwa, 25 June 1948 and ANC to NCO, Oshikango, 16 June 1948; Kreike, "Recreating Eden," ch. 4.

[89] NAN, NAO 44 f. 37/1 ANC to NCO, Oshikango, 24 March 1942.

[90] NAN, A450, vol. 23, D6, Land Tenure; vol 9, f. 2/39, "Hahn, Rough notes on the tribal customs Ovamboland," pp. 59-60; and vol. 10 f. 5/6/1, statement Hinikamba, Oshikango, 1 April 1939; NAO 99, f. 42/11 (ii), N. Ndjuluua [to NCO?], Ondangwa, 12 December 1950; NAO 9, f. 5/1, blue note with heading "Chief Martin," n.d. but inserted between letters dated 6 April and 26 August 1929; NAO 99, f. 42/11 (ii), Otto Kasava to Master Nakale, Namutoni, 3 October 1949 and Ashimbanga Mupolo to NCO, Eunda, 13 October 1950; NAO 100, f. 42/11 (iv), Dadilepo Nakale to NCO, Luderitz, 15 June 1952; Kreike, "Recreating Eden," ch. 6.

In the 1950s, land in the floodplain had become so precious that at times headmen even succeeded in extracting a land fee for the uncleared bush plots.[91]

Headmen could waive the land fee if a farm was "inherited" by matrilineal (clan) relatives, a practice that was more frequent in the southwestern districts, although it may not have been uncommon throughout colonial Ovamboland. Moreover, a headman could also waive the land fee for applicants who were his relatives. Nevertheless, a land fee typically was required, and the principle of land inheritance was open to challenge by headmen who were under pressure from their own relatives, friends, and clients to allocate farms to them when they became available. [92]

Complaints that the land fees were too high and that they were arbitrarily set by the headmen were frequent. In 1957, a common land fee was one head of cattle or more. In 1961, the fee varied from 40 to 60 South African Rand plus a head of cattle in Oukwanyama and 60 to 80 Rand plus one head of cattle or 40 Rand plus two cattle in Ondonga. In 1967, 25 households that lost their farms as a result of road upgrades received monetary compensation based on the size of their holdings. The compensation may reflect land fee levels at the time: eleven households received a compensation of 1-10 Rand, six received 11-20 Rand, and five received more than 20 Rand. In 1970, the land fee varied from 20-200 Rand. Of a 360 household sample surveyed in 1993, 80% had paid a land fee, using livestock, cash, or a combination thereof. Cash payments varied from one to one thousand Rand. Land fees had been paid entirely in cash by 66% of the respondents, in cattle only by 19% of the respondents, and by a combination of cash and cattle (usually 1-2 head of cattle plus up to 1,000 Rand) by 6% of respondents. In 2% of the cases, the land fee had been paid in the form of 1-2 goats. Of the 165 households that had paid entirely in cash, 19% had paid up to 10 Rand, 42% had paid 11-100 Rand, and 38% had paid from

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[91] NAN, BAC 44 f. 1/15/4/17, Minutes of Meetings, June 7-21, 1957; BOS, NC to CNC, Oshikango, 24 June 1958; NAO 10 f. 5/6/1, statement Hinikamba, Oshikango, 1 April 1939.

[92] NAN, NAO 10 f. 5/6/1, statement Hinikamba, Oshikango, 1 April 1939; NAO 55 f. 5/4, Roads Department to NCO, Windhoek, 14 May 1952 and ANC to NCO, Oshikango, 14 June 1952; NAO 104, file "Ukuambi Affairs 1932-33," RCM to NCO, Uukwambi, 24 June 1934; NAO 55, f. 5/4, subfile 5/4/69, NCO to ANC, Ondangwa 6 May 1952, translation of a telegram from Spota Kakelo, Okahandja, 6 May 1952 and telegram [?] NCO to Spota Kakelo, [Ondangwa], 8 May 1952; NAO 99, f. 42/11 (ii), NCO to Chief Kambonde, Ondangwa, 6 May 1950; Augustus David to NCO, Abenab Mine, 29 April 1950; and NCO to Magistrate Grootfontein, Ondangwa, 29 May 1950. On relatives and land fees, see Paulus Wanakashimba, interview with author, Odimbo, 10-11 February 1993. For an example, see NAN, NAO 91, f. 36/1 (iii), subfile 36/1/50, statement Titus Muatelai Kakonda, Ondangwa, 10 May 1954.

101-1000 Rand. Most of the respondents (61%) mentioned that the village headman had allocated the farm, and in 68% of the cases the land fees had been paid to the village headman. In 24% and 6% of the cases the land fee had been paid to the senior (or councilor) headman and the king/chief respectively. The king, however, had only actually allocated the farm in 4% of the cases, a situation that probably reflects the custom in some districts of sharing the land fee between the (village) headman and the kings.[93]

Land Tenure and Deforestation

The subdivision of farms and villages caused further deforestation because more of the farm plot and the village commons respectively were converted to fields. A second homestead with fields on an existing farm plot commonly was located in the old farm's (bush)fallow. Subdividing a village transformed more of its remaining forestland into farms and fields. The practice of sub-dividing villages, which could contain 10-100 farms each, mushroomed in the 1940s and 1950s. In 1938, Holongo Ameshelelonanda paid a fee of 10 pounds (20 Rand), 2 oxen, and 2 heifers to King Martin of Ondonga for the position of village headman of a part of Oshiyagaya village after the village had been sub-divided.[94] Often, the colonial administration was unaware that the villages had been subdivided. One reason for the secrecy may have been that officials wanted to limit the number of households per village to prevent "overpopulation." In 1956, the agricultural officer for Ovamboland reported that chiefs and headmen derived "great richness" from the sale of farms "and would therefore not support any scheme that establishes the number of kraals per ward based on the agricultural potential of the said ward [village]."[95] In 1952, Ondonga was found to contain 603 villages, although the colonial administration had had only 456 villages on its books. The rapid increase of the number of villages in Oukwanyama in

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[93] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1955/1956; BAC 45 f. HN 1/15/4/21, Minutes Tribal Meeting Oukwanyama, 12 June-14 July 1961; BOS, NA to Omuhona [T.G. Strydom], H 15, North Camp, Oranjemund, 27 March 1961 and Tribal Secretary G. Kautwima to Omutonateli Wowilonga, Ohangewena, 1 March 1967; OVJ 15 f. j.12/1, "Minutes of the elected Committee on land ownership...," Oshakati, 4 December 1970, appendix Secretary of the Interior to Secretary Justice, Ondangwa, 9 November 1973; OVA 53 f. 6/18/2-7 (iii), Sec. SWA to Sec. Agriculture Owambo, Windhoek, 24 June 1974, Appendices A-C; OMITI 5.1.2-5.1.5.

[94] NAN, NAO 100 f. 42/11 (iv), Chief Kambonde to NCO, 8 August 1952 and Statement Holongo Amshelelonanda at Ondangwa, 4 July 1952; NAO 104, file "Ukuambi Affairs 1932-33," Iyambo Nule to Hahn, n.p., n.d., received Ondangwa, 15 November 1934 (two letters) and Onimnandi, Uukwambi, n.d. [received Ondangwa, 13 June 1934]. See also NAO 99, f. 42/11 (ii), statement Mingana Shikongo, 28 October 1950.

the 1950s and early 1960s was partly a result of the founding of new villages in ofuka wilderness areas (principally in eastern Ovamboland), and partly due to the subdivision of old villages.[96]

Given the pressure from the colonial administration and the senior headmen, the village headmen in turn also sought to profit from the high value of farmland (i.e. land with an environmental infrastructure). Single women with good farms became a principal target of greedy village headmen in the 1940s and 1950s. Indeed, most of the documented evictions, which often resulted in the subsequent subdivision of the farm plot and its resale, involved single (typically elderly) women or women whose husbands were away on long migrant labor contracts.[97]

Conclusion

Human inhabitation in Ovamboland was dependent on an extensive environmental infrastructure that humans grafted upon and shaped from and with local natural resources. Ovamboland's woodlands were able to supply a large demand for fire- and construction-wood because they were shaped into coppice bush vegetation. The main source of wood was not timber (trees) but poles and sticks, and the local population did not harvest the entire individual plant, but rather parts of it, without killing it, and thereby consciously allowing it to regrow to continue to produce poles and sticks.

In addition, the water holes and reservoirs that the first European explorers to Ovamboland reported were not natural: Ovamboland's semi-arid environment lacked and lacks any natural sources of surface water during the dry season. Rather, the local inhabitants dug the thousands of water holes that sustained their villages, making use of the existence of numerous highly localized and low-yielding subterraneous water lenses. Moreover, the water holes were primitive or inefficient either. The fact that the majority of Ovamboland's households were dependent on water holes by the early

[95] NAN, BAC 133 f. HN 8/21/4/1, Agricultural Report Ovamboland, 1955/1956.
[96] NAN, NAO 51, f. 3/2, NCO to Chief Kambonde, Ondangwa, 12 December 1951 and Chief Kambonde to NCO, Okaroko, 18 April 1952; NAO 100 f. 42/11 (iv), Chief Kambonde (Ondonga), 8 August 1952, to NCO and Statement Holongo Amshelelonanda at Ondangwa, 4 July 1952; Chief Kambonde to NCO, Okaloko, 21 January 1954 and NCO to Chief Kambonde, [Ondangwa], 19 January 1954; BAC 44 f. 1/15/4/17, Meeting held at Ombalantu, 19 September 1960; AHE (BAC) ½ f. (16) N1/1/5/3, Bantu Affairs Commissioner Oshikango to Chief Bantu Affairs Commissioner Windhoek, Oshikango, 17 December 1964 and Minutes of a Meeting held at Okalongo on 11 January 1965.
[97] See, for example, NAN, NAO 98 f. 42/11 (I), Dalengelue Aitana to NCO, Ombalantu, 21 January 1948 and NCO to headman Dalengelue Aitana, Ondangwa, 26 January 1948.

1990s, is a testament to their efficiency relative to the scientific innovations that colonialism introduced.

Finally, the soils in the fields where farmers grew their crops were built up through mounding and the application of such organic materials as manure, and fertility was also enhanced through a system of fallow cycles. Moreover, environmental infrastructure was not the product of a one-time investment of labor and capital. Coppice woodland needed to be maintained through continuous management and use; cutting bush too short or too often or ceasing coppice management changed its form, product, and nature. Water holes and reservoirs had to be re-dug, cleaned and sometimes deepened on a regular basis, requiring investments not only by their owners but also by user-communities ranging from several neighboring households (in the case of water holes) to neighborhoods and even entire villages (in the case of reservoirs). Failure to maintain fields and their soils – dependent upon clearing, burning, cultivating, manuring, cropping, pasturing, and fallowing – changed not only soil composition but also its vegetation cover.

Thus Ovamboland's bushlands, its water sources, its, and its soils were neither natural nor wild. They are also not Culture, however, because they were neither tools to dominate Nature nor the product of human domination over Nature. Rather, Ovamboland's inhabitants worked <u>with</u> Nature, shaping the local environment, for example, by constructing water holes to tap local water lenses. The environmental infrastructure that they produced was not static but highly dynamic. Climate and weather patterns, for example, impact environmental infrastructure directly and indirectly through influencing the human architects of environmental infrastructure. Political, social, economic, and social factors also influence the architects of nature and thus the ways in which they physically and mentally map, shape, and re-shape environmental infrastructure, a process that is continuous. Environmental infrastructure is thus outcome and process, because it is always <u>in process.</u>

CHAPTER 11
CONCLUSION

The process of environmental change cannot be measured solely in terms of a linear Nature-to-Culture (or wild-to-domestic) dichotomy, and it is not necessarily singular, homogenous, synchronous, self-contained, or even coherent. Rather, environmental dynamics are inherently complex, consisting of multiple strands, trajectories, and sub-processes that may converge and diverge, and intertwine and unwind in dissynchronous asymmetry. Research in environmental change (or rather change<u>s</u>) thus requires empirical investigation across semantic fields and disciplines and the use of multiple models and theories, multiple levels of analysis, and multiple sources.

The dominant paradigms that currently are employed to analyze environmental change, that is, the modernization, the declinist, and the inclinist paradigms, do not always fully capture the intricacies of environmental change that results from Human-Nature interactions. Largely mutually exclusive in their application, the three competing paradigms stress the role of western science and indigenous knowledge in analyzing how people understand and manage their physical environments. The modernization paradigm considers a degree of environmental degradation to be an acceptable price of progress and economic growth and emphasizes the need for the scientific management of environmental resources. In contrast, the declinist paradigm identifies science and modernity itself as the main cause of environmental destruction. The emerging inclinist paradigm emphasizes the need to embrace indigenous knowledge and resource management in order to counter environmental degradation.

The paradigms give rise to at least two paradoxes. The presence of the ruins of Palenque and other cities in what are assumed to be the earth's last pristine forests constitutes one paradox. Simultaneous deforestation and reforestation processes in Ovamboland constitute another.

The study constructs a historical framework to analyze processes of environmental change over time at multiple levels (the macro-level of Ovamboland and the micro-level of individuals and individuals households, for example) employing a variety of sources. Moreover, the study explicitly highlights trans-sectoral and trans-disciplinary interactions because vegetation changes, for example, might result from not just environmental dynamics, but may also originate equally in, for example, the political, social, and/or economic realms.

When used as absolute benchmarks, such “State of Nature” derived concepts as (natural) climax (vegetation) and (natural) biodiversity obscure as much as they reveal. Ovamboland’s wilderness, its wildlife and its “wild” Bushmen, were not in a state of nature in the immediate pre-colonial era. In fact, in the late 1890s, the wilderness of Ovamboland barely hid the ruins of a once prosperous kingdom, hunting and disease had reduced its wildlife populations to a low, and its Bushmen were commercial hunters,. Present-day states of Nature (or states of Culture) are equally problematic benchmarks. Presumed relic islands of natural vegetation may upon closer look be far from pristine. Using the present as a absolute benchmark “state of Culture” outcome along a Nature-to-Culture gradient of environmental change is also teleological because the present is not the only and necessary outcome from past processes that, moreover, may not have fully run their course.

An alternative method to assess evironmental change is to establish a series of empirically derived analytical benchmarks.[1] These multiple and historical benchmarks are by definition relational, not absolute. As demonstrated by environmental change in Ovamboland, comparing an 1890s state of the environment with a 1990s state of the environment may at first glance suggest that little or no change has occurred. The apparent continuity between the two moments in time, however, conceals dramatic vegetation change: deforestation and reforestation in the timeframe of less than a century! Only the use of multiple measuring points and a focus on the processes of change facilitates detecting environmental changes. Such change can be gradual but it can also occur quite rapidly: the 1896-1897 Rinderpest epizootic, for example, decimated susceptible wild and domestic animal populations across the African continent.

By focusing on arguments related to the population pressure arguments caused by humans and animals, chapters 5 and 6 highlight the limitations of a unilinear Nature-to-Culture framework that depicts populations and their environments as homogenous entities and describes their interactions as mechanistic. Chapter 5 demonstrates that the impact of population density on the forest environment is

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[1] For examples of such an approach see, R. Harms, Games against Nature: An Eco-cultural History of the Nunu of Equatorial Africa (Cambridge: Cambridge University Press, 1987); McCann, People of the Plow; and Knapen, Forests of Fortune?.

ambiguous. Moreover, "population" is not merely a quantitative factor; its qualitative properties must also be carefully addressed. For example, until the 1940s, Ovamboland's human inhabitants exerted their most important influence through migrations and flight motivated by security concerns, and not through the mechanics of any "population bomb." Late 19th and early 20th century violence, including two decades of destructive colonial conquest, led to population concentrations in fortified settlements. As the security conditions improved from the late 1920s onward, however, the population from Namibia's Ovamboland, augmented by refugees from Angola, fanned out to settle the ofuka wilderness stretches that previously had separated the pre-colonial polities, transforming forest and bush land into expanses of farms and fields. The extent to which Ovamboland's ofuka-wilderness was cleared in the 1920s and 1930s by thousands of settlers from the northern and southern floodplain polities shocked the officials and missionaries who witnessed the accompanying effects. The process of the deforestation of wilderness areas by African settlers in north central Namibia was replicated in other colonies across the continent in the early colonial era, providing fertile ground for models of explanation from the west, including those derived from the Dust Bowl experience in the United States.[2]

While alarmist colonial reports about deforestation in 1920s and 1930s should not be taken at face value they should also not by definition, always, and across the board be read against the grain and reading, against the grain should not become

[2] The classic study on the dustbowl is D. Worster, Dust Bowl: The Southern Plains in the 1930s (Oxford: Oxford University Press, 1982 [first published 1979]). On the impact of the American dustbowl experience in Africa, see D. Anderson, "Depression, Dust Bowl, Demography, and Drought: The Colonial State and Soil Conservation in East Africa during the 1930s," G. Maddox, ed. Colonialism and Nationalism in Africa, vol. 2: The Colonial Epoch in Africa (New York: Garland, 1993), pp. 209-231 and Williams, who views the dustbowl as "one of the defining moments in American and global environmental history," Williams, Deforesting the Earth, pp. 432-433. According to Grove, the American dustbowl came to dominate environmental discourse among colonial officials worldwide only after the 1930s; previously, ideas and practices from Indian colonial forestry and South Africa had been central to the discussion. R. Grove, "Colonial Conservation, Ecological Hegemony and Popular Resistance: Towards a Global Synthesis," MacKenzie, Imperialism and the Natural World, pp. 15-50, especially 22-25. Grove rejects the idea that (colonial) conservationism and environmentalism developed as a response to the massive environmental change that colonialism engendered, and to protect colonial and white settler interests, Grove, Green Imperialism, p. 480. I agree with Grove that the roots of environmentalism go deeper, but the impact of the African (re-)colonization of wilderness areas across the continent and the 1920s droughts build on pre-existing fears of desiccation as well as the cumulative record of local colonial officials who observed the phenomenon. Mandala stresses that "the dynamics of intervention [with conservation] had a local origin," although his emphasis is on explaining post-WWII conservation projects, see Mandala, Work and Control in a Peasant Economy, pp. 191-217.

"reading things into."[3] In addition, the notion that colonial science was only a mere handmaiden of colonial supremacy should be revisited.[4] At the same time, however, colonial officials' zeal for and commitment to conservation should not be idealized. Native Commissioner C.H.L. Hahn, for example, downplayed reports from his subalterns and missionaries about the extent of the 1920s and 1930s deforestation in Ovamboland, and neither he nor his successor H.L.P. Eedes implemented or enforced South Africa's conservation legislation and policies in Ovamboland except for those pertaining to game. Ironically, the success of colonial wildlife conservation may additionally have contributed to deforestation. Deprived of firearms by a colonial disarmament campaign, Ovamboland's inhabitants and their livelihoods were left vulnerable to marauding wildlife. Heavily fortified and fenced farms – consuming large amounts of wood – were an effective defense against wild animals even after political security had improved and the tree castles were no longer needed for protection against human predation.

Whereas wilderness pioneers clearly were responsible for deforestation, the evidence concerning the impact of their livestock is contradictory at best. Available data suggest a rapid increase in livestock figures from the 1950s through the 1970s, but a decline in the 1980s, defying a unilinear progressive trend. No clear evidence emerges to support the thesis that a livestock population explosion resulted in overgrazing in Ovamboland. Moreover, the presumed cultural catalyst behind the thesis of the cattle population explosion in Ovamboland, the "bovine mystique" or cattle complex theory is a myth. Before the imposition of colonial restrictions on the movement and sale of cattle, the Ovambo floodplain was a major exporter of cattle. Even during the colonial era, there was a thriving trade in cattle and cattle products in Ovamboland and between Ovamboland and the Portuguese colony of Angola. Interestingly, in the case of indigenous domestic livestock in Africa and India, "traditional culture" is identified as the cause of environmental decline and the (capitalist) market is seen as the solution, while in the realm of wild resources (wildlife, forest, fish), market forces spell environmental decline and "traditional culture" is regarded as a (theoretical or practical) solution.

[3] For reading colonial documents against the grain, see Moore and Vaughan, Cutting down Trees; Fairhead and Leach, Misreading the African Landscape.
[4] Beinart and McGregor, Social History and African Environments, pp. 17-21.

The fundamental question that the Ovambo Paradox raises is whether contradictory outcomes (i.e., deforestation and reforestation in Ovamboland) are merely a product of the use of different valuations of the same process and/or the same outcome, or whether they are the result of the co-occurrence of multiple (sub) processes of environmental change. As emphasized in chapters 7 and 8, trees and bushes are overwhelmingly cut and propagated by individuals or by groups of individuals, processes that occur tree by tree, and bush by bush. In Latin America, Asia, and even more so in Africa, individual farmers cut down trees and bushes, not machines or timber crews; the process is individual and manual, not collective and industrial. Deforestation in Ovamboland was real: people cut trees and bush to clear fields.

Paradoxically, as underscored in chapter 8, the very sites that suffered the most severe deforestation, that is, individual farms and fields and their immediate surroundings, were also the loci of the most dramatic reforestation: farmers actively encouraged the regeneration and growth of selected tree species. In short, the loss of forest vegetation as a result of the settlement of "wilderness" areas did not result in an unequivocally degraded environment because African settlers enriched their farmlands with new trees and bushes.

The notion that deforestation and reforestation are often the work of individuals or small groups of individuals has important implications because it makes deforestation, reforestation, and environmental change not just environmental issues but – because human agents of change are embedded in and the product of a host of relationships – the processes of change also involve, for example, the social, political, economic, and cultural realms. Focusing predominantly on the trees or the forest or even the forest-people relationship may not be sufficiently inclusive. People's motivations to cut down trees and to propagate trees, for example, may not emerge from any specific considerations about trees or forests. In Ovamboland, for example, women appear to be the greener gender because they played a major role in propagating and managing the magnificient fruit trees that tower over many a floodplain farm. Yet, women were not motivated by environmental concerns; with their control over land and crops heavily challenged, women diverted part of their efforts to a relatively less contested resource: fruit trees. Fruit was not only food, it was also the raw material for producing alcoholic beverages that could be converted into (cash) income, in addition to being used to facilitate the social relationships that were essential to gaining access to land, labor, livestock, and a whole lot more. Because they provided cash income, fruit and liquor were also economic resources. In the recent past, fruit trees were therefore the subject and object of power and, in more contemporary times, trees and bush continue to be objects and subjects of power and politics. A focus on forests (as per conventional forestry), and even a focus on trees-and-people (as in social forestry), may thus limit a researcher's field of vision. Instead, understanding tree-people relationship requires looking beyond the tree itself: such relationships people-people, people-animal, people-plant, and plant-plant and animal-animal are at least equally important. Just as much of the volume of a tree or bush lies underground, aspects of the processes and the factors that affect forests and trees, and the people who interact with them, may occur beyond the outlines that are permitted by models that are framed by a modernization, declinist, or inclinist paradigm.

The analysis concerning Ovamboland's hydrological history in chapter 9 demonstrates that, between the late 1800s and the late 1900s, the local environment was never fully dominated by humans, and it was never a natural landscape. Rather than being a fully cultural landscape or an entirely natural landscape, the interaction of human communities with their local resources led to hybrid and mosaic environment. In semi-arid Ovamboland, settlement patterns were entirely dependent upon a human-made water infrastructure. Humans shaped the environment in Ovamboland through the use of indigenous science and western science, creating a system of water holes and canals that supported human settlement and livestock in a region that lacks any natural permanent sources of surface water during the dry season. The environmental impact of the rising human and domestic animal populations in Ovamboland was mediated by and through the quality of the area's hydrological infrastructure and its spatial distribution.

While the hydrology of Ovamboland shaped settlement patterns and density, the process did not occur in any mechanical way. Moreover, the impact was indirect: rains, floods, soils, and drainage offered opportunities as well as serious constraints. For example, the floodplain contains numerous small water lenses are harvested through thousands of low-yielding water holes. Many households had and have their own water hole. East of the floodplain, however, settlement was supported by deep-shaft well and borehole technology. Individual aquifers are larger, and they are far in between, conditions that gave rise to a very different settlement pattern. Whereas villages in the floodplain border one another, in eastern Ovamboland, villages were established in isolation. From the 1970s onward, the canal and pipeline system supported an even denser human and domestic animal concentration in the southeastern part of the floodplain, with Oshakati and Ondangwa as the main towns.

Scientific hydraulics successfully provided additional water supplies throughout the year, supporting much greater population numbers and far larger population densities, and it facilitated irrigated horticulture and irrigated tree nurseries. Its environmental impact, however, has not been fully evaluated. The first canal that was dug – from Ombalantu to Oshakati – did only too well what was intended: it diverted the flood and local rainwater away from southwestern Ovamboland towards southeastern Ovamboland's administrative center (which subsequently evolved into the area's commercial and urban center). The Etaka canal did not correct the situation for the area of southwestern Ovamboland that is wedged between the main canal to the north and the Etaka canal to the south. As a result, since the completion of the main canal (and the Oshakati all-weather road), this section of Ovamboland has been entirely deprived of any floodwater from the north. Despite its irregular pattern, however, vegetation, animals, and human life in the floodplain in the past were and continue to be critically dependent upon the flood. Due to the lack of research, the impact of the reduction of the water supply over the last 30-40 years on, for example, woody vegetation can only be imagined. The water supplies that are being provided to the region through the extension of the pipeline system compensate for losses in domestic consumption, but because of the limited volume, they can not compensate for the deficiency for the environment as a whole.

The colonial dams (water reservoirs) that were built in the 1950s and 1960s may in part be construed as being parasitic on the pre-existing indigenous water-harvesting infrastructure of water holes. Yet, the household and village water-harvesting infrastructure has proven to be highly adaptive, for example by incorporating well technology, and it continues to be a major source of water for Ovamboland's inhabitants. Thus, the conventional view of indigenous technological knowledge and western science and technology has serious limitations. In Ovamboland, as elsewhere, the two bodies of knowledge interacted; in fact, in the case of water reservoirs and wells, the two were interdependent. Moreover, the 20th century history of water use and management in Ovamboland supports neither a linear narrative of the triumph of western water technology, nor a linear narrative of the decline of traditional indigenous water harvesting technology. Rather, the efforts of colonial officials and experts resulted in a water infrastructure that can be categorized as an organic machine. Colonial water projects were human-made and based on western science and technology and caused substantial environmental change by allowing higher population concentrations and densities and urbanization. The continued occurrence of floods and droughts, however, highlighted that colonial engineers were unsuccessful in conquering Nature, despite heavy borrowing from indigenous knowledge. In addition, colonial scientists did not fully understand the dynamics of Ovamboland's ecosystem. Whereas colonial water projects were partially successful in reaching their objectives (sustaining a large population), colonial plantation forestry projects were an outright failure: the plantations did not contribute to the populations's demand for forest products at all.

White's concept of the organic machine problematizes the category "Culture" in the Nature-Culture dichotomy. Building on White's concept, the study introduces the concept of "environmental infrastructure" in chapter 10 to refer to the large (and growing) gray area between the Nature-Culture poles. Cultivated landscapes and landscapes subject to human fire regimes, abandoned cities, villages, rural landscapes, farms and fields, semi-domesticated trees, coppice woodlands, water harvesting systems, and anthropogenic soils, are neither unambiguous Nature nor fully Culture. In fact, the idea of the organic machine and the world's Palenques large and small suggest that the categories of Culture and Nature respectively have little or no practical or theoretical meaning.

The concept of environmental infrastructure acknowledges humans as environmental actors, as "architects," working with Nature: "architects of Nature." Nature, or rather the environment, not only provides the medium for the architects, but it also has its own dynamics and agency, and moreover, the architects are its product. Conceptualizing, analyzing, and narrating environmental change through the lens of "environmental infrastructure" and human actors as "architects of Nature" permits the limitations imposed by the Nature-Culture dichotomous paradigm to be transcended. Within this framework, "non-western" present-day or past cultivated landscapes, fruit trees, water holes, anthropogenic soils are no longer the domain of Nature, and "western" urban and rural landscapes, and canalized or dammed rivers are no longer the uncontested domain of Culture.

Although the presence of on-farm fruit trees and off-farm mopane bush figure prominently in colonial and postcolonial descriptions of Ovamboland's vegetation, colonial officials and experts and their postcolonial successors interpreted the fruit trees and bush as wild relics of a natural forest vegetation and thus as evidence of deforestation and degradation. Ovamboland's mopane bushlands are not, however, the outcome of overexploitation as a result of a lack of management; to the contrary, their appearance and composition reflect a historic and on-going process of intensive coppice management. This interpretation challenges the deforestation-reforestation dichotomy that lies at the heart of the debate between supporters of the declinist and inclinist paradigms because the existence of the mopane bushlands as carefully managed coppice woodlands constitutes neither unambiguous deforestation nor unambiguous reforestation.

Mopane coppice management relied on (asexual) vegetative reproduction properties and thus sits uncomfortably with a western seed paradigm that is fixated on and privileges seed-based sexual reproduction. The very definition of domesticates has a clear bias in favor of sexual reproduction and evolution-as-progress: because Ovamboland's mopane vegetation was and is not included in this definition, the extent to which it is a acculturated plant has not been fully appreciated. Moreover, foresters conventionally prefer single stemmed (timber) trees capable of reproduction (and, in the case of fruit trees, production) and regard their bushy form as unproductive and a sub-climax (or sub-optimum) form of woody vegetation. Thus, if coppice management reduces mopane from a tree to a bushy form, the process of change could be defined as a form of deforestation. At the same time, however, the creation of a coppice bushland can be regarded as a form of reforestation in the sense that the environment continued to be dominated by woody vegetation. The species composition of the pre-coppice vegetation may have been more diverse, but continued coppice management – even in the absence of deliberate species selection – would have favored mopane and other coppice-vigorous species. Still, it may be more useful to move beyond a deforestation-reforestation dichotomy and, for example, focus on assessing the extent to which the new vegetation cover mimics the environmental characteristics of the pre-existing vegetation.[5]

[5] A.B. Henkemans, G.A. Persoon, and K.F. Wiersum, "Landscape Transformations of Pioneer Shifting Cultivators at the Forest Fringe," Wiersum, Tropical Forest Resource Dynamics, pp. 53-69; K.F. Wiersum, "Use and Conservation of Biodiversity in East African Forested Landscapes," P.A. Zuidema,

The history of mopane coppice in Ovamboland underlines the limits of the three paradigms' outcome-oriented bias. The paradigms analytically privilege the outcome over the process of environmental change and select only those elements of the process that it presumes are responsible for a specific outcome. Just as oak tree dominance in the northeastern United States, however, mopane bush dominance in Ovamboland, is not simply a final and static outcome of a completed process of environmental change, it is also a representation of environmental changes in process.

Human settlement ruins in pristine nature, wild plants that have been planted, deforestation and reforestation, and deforestation and soil improvement, constitute contradictions only if environmental change is conceived as a unilinear, irreversible, and singular process with a singular outcome within the framework of a nature-culture dichotomy that has nature as the point of departure. If, by contrast, environmental change is imagined as a series of subprocesses that can be asymmetric and dissynchronous, the contradictions become what they are, paradoxes. Differentiating the process of environmental change requires a more open-ended research question (i.e., "assess environmental change(s)" rather than "measure deforestation or reforestation") and more empirical research (given the constraints that are imposed by the mutually exclusive paradigms). Moreover, a combination of levels of analysis is critical. Although micro-level studies facilitate the identification of agency, motivation, and incremental change at the day-to-day level of the process of environmental change, they are often highly particular. The significance of these micro-level processes, however, is difficult to evaluate unless the data is explicitly incorporated into the overall analysis of environmental change at meso- and macro-level processes.

Rejecting "Nature" in its various incarnations of pristine Nature, relic Nature, (biological) climax, and biodiversity, as a useful benchmark to study environmental change does not entail an esthetic rejection of Nature. It also does not mean the death of Nature. And, it does not mean that everything is Culture in the sense that humanity dominates Nature and that previously natural environments have been irreversibly polluted (in a declinist perspective) or improved (in a modernization perspective). The history of environmental change in Ovamboland supports interpretations that suggest that an alternative perspective lies beyond a static Nature-Culture dichotomy. Central to this perspective is the idea that (more or less) Natural and Cultural components co-exist in a wider mosaic environment, and/or they are merged within a single hybrid organic machine form. The mosaic model conceptually allows for the co-existence of discrete hybridized forms. The concept of organic machine emanates from the co-evolution of the biological and engineering sciences, especially the fields of bionics and cybernetics. Indeed, it may be theoretically liberating to study the human-environment relationships in the last 10,000 years or so in terms of the creation of a new bionic phase in world history, rather than seeing it as a history of the human conquest of Nature and the triumph of Culture (in a modernization narrative) or the rape or the death of Nature (in a declinist valuation).

But if (pristine) Nature no longer exists and everything is Culture, or at best Bionic or Cybernetic, then what is the purpose of conserving Nature (as in Nature Reserves, Biodiversity Reserves), of Environmentalism as a movement, and, indeed, of environmental preoccupations in general? After all, everything that was ever pristine – as in pre-dating the advent of the human species – has been physically and mentally changed by human action and thought.

Even if Nature is Culture, or rather if ecosystems at all levels are bionic and/or cybernetic systems rather than Nature or Culture, in terms of their inputs and outputs, composition, and biodiversity they are all not only interrelated but also unique in place and time. As such, they may be not only esthetically and historically valuable, but also critically important in a more utilitarian way. Evolution is an on-going process that is fueled by dynamics internal to a gene, organism, species, or ecosystem, and influenced by interactions with a wider environment, i.e., be it through genetic sequencing, sexual or a-sexual reproduction, parasitizing, grazing, or coppicing. At no level are systems independent of their environments. As highlighted by humankind's preoccupation with the extraterrestrial origins of life and death, not even ecosystem earth is a closed system.

If ecosystems are not closed and independent systems, ecosystem change can not be framed in terms of an exclusive Zero-Sum Game where one organism's gain is by definition another's loss because total resources within the system are finite. External dynamics are therefore as critical in evolutionary terms as internal dynamics.

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the Dutch Association for Tropical Foresters, held in Utrecht, 2 December 2002 and 11 April 2003 (Utrecht: Utrecht University, 2003), pp. 33-39.

Energy flows are the most dramatic example: ecosystem Earth is energized by solar radiation either directly, i.e., through photosynthesis, climate and the weather, or indirectly, i.e., through fossil fuels as stored solar energy. Yet, humanity's capacity to optimally utilize the terrestrial and extraterrestrial resources available without destroying itself and the organic and inorganic forms with which it shares the earth is a product of the historical context of each point in time. Whereas the modernization paradigm inspires suicidal optimism in this respect, the declinist paradigm engenders morbid pessimism. The inclinist paradigm offers a more guarded optimism. All three paradigms, however, present the Nature-Culture struggle exclusively as a Zero-Sum game: natural resources are limited and careful stewardship is seen to be essential. In brief, in the declinist paradigm, good stewardship is seen to be totally absent (resulting in degradation); in the modernization paradigm, good stewardship is defined as (western) scientific stewardship and in the inclinist paradigm, good stewardship is as indigenous stewardship.

Evolution as a process is a product of internal and external dynamics, whereby the dynamics and the conditions that created them are time specific since they are historic (including in the wider meaning of geological time-depth) and thus by definition subject to change. That means that in every moment in time, the evolutionary process displays an array of entities and interactions between entities that cannot only be seen as (fleeting) outcomes of the process, and the genetic and behavioral precursors of the next phase of the product, but that are also unique to that moment in time (most finally if the entity or behavior were to become extinct).

If the environmental context of evolution and its product at each moment in time have unique features, each historical moment is marked by a particular biodiversity. This means that even if no (pristine) Nature is left, each moment in history presents a biological richness (even if it is not pristine Nature but bionic) that is valuable not only in purely historical terms but also in terms of biodiversity and genetic diversity. Thus, historicizing Nature and Culture highlights the need to preserve the earth's bionic inheritance not only for its esthetic and historical significance, but also because preserving a variety of historical landscapes, ecosystems, and organisms gives access to historical bio-diversity and gene pools. Moreover, there is no convincing evidence that biodiversity was significantly higher in a state of Nature (if it ever existed) than it is today; rather, evolutionary theory and genetics suggest the opposite: organisms and genes became more diverse over time.

Yet, even if the former were true and bio-and genetic diversity have narrowed between an hypothetical state of Nature and the present, the cumulative bio- and genetic diversity produced throughout history would be infinitely larger than that of any single moment in time, whether it be the state of pristine Nature or today. Even if much of the sum of history's bio- and genetic diversity has probably been lost, today's ecosystem earth and its bio- and genetic diversity are not the static outcome of one genealogical line of evolution; rather ecosystem earth at all its levels reflects a huge variety of more or less related processes of environmental changes that are sometimes synchronized, and sometimes not. In fact, in the context of evolution-as-history, a static outcome may result in an evolutionary dead-end and extinction.

This does not mean that concern about the state of the environment is unwarranted, to the contrary. What is being preserved because it is thought to represent Nature or the (more) natural is not less pleasing esthetically because it is not as pristine as it was presumed to be. Moreover, environments that have been rejected as worthy of careful management and preservation because they were seen to be all Culture, or, worse, as neither Culture nor Nature, may need to be integrated in bio-preservation. Environments that are seen to be fully Culture are frequently singled out to be preserved as cultural heritage, but environments that are not seen to be Nature and that are not considered to be fully culture may require the most urgent environmental attention. These in-between environments that are neither Natural heritage nor Cultural heritage are neglected, even though they have their own unique bio- and genetic diversity richness. How to preserve their bio- and genetic diversity is a challenge: applying conventional conservation packages that severely limit human use and management of these environments is socially, politically, economically, and logistically impossible. Moreover, eliminating or proscribing the actions of one set of human agents (and substituting them by another: the conservation staff) from those environments would change the dynamics, and cause environmental change as a result of the very intervention that is meant to preserve the environment.

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APPENDIX 1
Selected Trees and Bushes by Ovambo-English-Latin Names

Ovambo name	Ovambo name	Latin name	English	Afrikaans
efindapya		Nidorella resedifolia		
enghono	omumangandjaba	Acacia ataxacantha	Flame Thorn	Vlamdoring
enyanga ??		Scilla rautanenii		
ofufe	omutsanguta	Baphia massaiensis	Sand Camwood	Sandkamhout
okadilanghono		Acacia mellifera	Black Thorn	Swarthaak
okalimufita		Monechma divaricatum		
okalyadi	okalyanzi	Catophractes alexandri		Skaapbos
okambadanga		Indigofera astragalina	Indigo Bush	
okamutaka		Acacia tortilis	Umbrella Thorn	
okanangola		Sida hoepfneri		
okapembe		Polycarpaea corymbosa		
omangandjaba		Acacia fleckii	Plate Thorn	Bladdoring
omanyanga		Nerium duparquetiana Nerium Oleander? (X942)		
ombango	ombango omubango omumakani omumbango	Croton gratissimus gratissimus	Lavender Fever-berry	Laventelkoorsbessie Vaalbos
ombango	omumakani??	Croton gratissimus subgratissimus	Hairy Lavender Fever-berry	Harige Laventelkoorsbessie Vaalbos*
omboo		Commiphora (Generic)	Corkwood Trees	Kanniedoodbome
omholyo	omukuyumba omungholyo* omukuyumbwa omuholyo	Ficus glumosa		
omudengambwa		Cassine transvaalensis	Transvaal Saffron	Transvaalsaffraan
omudiku	omutiwongobe	Securidaca longipedunculata	Violet Tree	Krinkhout
omudime	omudhime	Euclea divinorum	Magic Guarri	Ghwarrie
omufimba	omuthimba	Dialium englerianum	Kalahari Podberry	Kalaharipeulbessie
omufyaati	omusaati omusati omufyati	Colophospermum mopane	Mopane	Mopanie
omuhaloweyo		Acacia nebrownii	Water Thorn	Waterdoring
omuhama	omunghama	Terminalia prunioides	Lowveld Cluster-leaf	Deurmekaar
omuhandwa	okanakamuma	Fagara ovatifoliolata	Ovambo Knobwood	Ovamboperdepram
omuhonga	omundjebele	Grewia tenax		
omuhonga ehonga	omushe	Grewia (Generic)	Wildraisin Bushes	Kruisbessie Rosyntjiebos

omuhongo	omunghongo	Spirostachys africana	Tamboti	Tambotie
omukadhikuku	omukadikuku	Combretum hereroense	Russet Bushwillow	Kierieklapper
omukekete	omusheshete	Ziziphus mucronata	Buffalo Thorn	Aruboom; Blinkblaar-wag-'n-bietjie
omukopakopa		Grewia avellana		
omukuku		Combretum imberbe	Leadwood	Hardekool
omukuku (B)?	omboo	Commiphora glaucescens	Blue-leaved Corkwood	Bloublaarkanniedood
omukwa		Adansonia digitata	Baobab	Kremetart
omukwiyu	omukuyu	Ficus sycomorus sycomorus	Common Cluster Fig; Sycamore Fig	Wildevy Wurgvy*
omulama	see omunaluko	Combretum apiculatum	Red Bushwillow	
omulavi	omulayi	Gardenia volkensii Gardenia spatulifolia	Transvaal Gardenia	Transvaalkatjie-piering
omulemba		Ficus thonningii Ficus petersii*	Common Wild Fig Strangler Fig*	Gewone Wildevy Wurgvy*
omulemba (?)		Ficus craterostoma Ficus petersii	Forest Fig Strangler Fig	Bosvy Wurgvy
omulunga		Hyphaene petersiana Hyphaene ventricosa	Real Fan Palm	Makalanie-palm Waaierpalm
omumakani		Rhigozum brevispinosum	Short-thorn	Pomegranate; Kortdoringgranaat
omumbalandongo		Elephantorrhiza suffruticosa		Looiwortelbos
omumbanganyana		Mundulea sericea	Cork Bush Silver Bush	Kurkbos
omumbu	osimbu; oshimbu	Vangueria infausta	Wild medlar	Wildemispel
omumonga		Swartzia madagascariensis	Snakebean	Slangboom
omumwe	omweeguki	Ochna pulchra	Wild Pear	
omunaluko	omulama onaluko	Combretum apiculatum	Red Bushwillow	Rooibos
omunghete?*	onyege ongete	Dichrostachys cinerea	Sickle Bush	Sekelbos
omunghete	omunkete	Ricinodendron rautanenii	Mangetti Tree	Manketti
omungholyo*	omungholuo omunkolyo	Ficus glumosa and/or F. kiloneura and/or F. petersii (F. thonningi)		
omunghudi	omunkunzi omkuzi	Boscia albitrunca	Sheperd's Tree	Witgat
omungolwe	omungonze oshingodwe enolyomungolwe	Maytenus senegalensis	Red Spike-thorn	Pendoring Rooipendoring
omunkono		Acacia erubescens	Blue Thorn	Blouhaak
omupalala		Peltophorum africanum	Weeping Wattle/ African Wattle	Huilbos/Huilboom
omupanda		Lonchocarpus	Apple-leaf	Appelblaar

		capassa		
omupanda		Lonchocarpus nelsii	Kalahari Apple-leaf	Kalahari-appelblaar
omupapa		Baikiaea plurijuga	Rhodesian Teak	Rhodesiese Teak
omupetangobe		Hippocratea africana		
omupola	omupopola oshihamupolo	Maerua schinzii	Ringwood Tree	Kringboom Kwarda
omupombo		Rhus tenuinervis	Kalahari Currant	Kalahari Taaibos
omupopo	omuhanguti omunghanghuti	Albizia anthelmintica	Worm-bark False Thorn	Aruboom
omupundu	cf. oshipundu	Grewia deserticola		
omupupwaheke	omupuaheke omupupaheke	Combretum mechowianum	Rhodesian Bushwillow	Rhodesiese Boswilg
omupwaka		Strychnos pungens	Bushman Orange	Steekblaarklapper
omushadi	oshadi	Ehretia rigida	Puzzle Bush	Deurmekaarbos
omushe	omwushe?	Grewia flavescens flavesceni	Sandpaper Raisin	Skurwerosyntjie
omusheshe		Albizia versicolor	Large-leaved False Thorn	Grootblaarvalsdoring Sandkiaat
omusheshe	omushendje	Combretum zeyheri	Large-fruited Bushwillow	Raasblaar
omushii	omusii	Guibourtia coleosperma	Cobalwood	Bastermopanie
omutaka?	okamutaka omutoka omushu	Acacia tortilis	Umbrella Thorn	Haak-en-steek
omutaku		Entandrophragma spicatum	Ovambo Mahogany	Ovambomahonie
omutiwongobe	omudiku; omudhiku	Securidaca longipedunculata	Violet Tree; Fibre Tree	Krinkhout
omutulu		Elephantorrhiza elephantina	Sumach Bean	Elandsboontjie
omutundungu		Burkea africana	Wild Seringa	Sandsering
omutwanghuta	omutanghuta omutsanguta*	Bauhinia petersiana Bauhinia macrantha	Coffee Neat's Foot	Koffiebeesklou Koffiebos
omutyuula*	omuyele* omunyele* omutsuula* omuyele	Acacia sieberiana	Paperbark Thorn	Papierbasdoring
omutyuula*	omutsuula*	Acacia refisciens	Red Umbrella Thorn	Rooihaak-en-steek
omutyuula*	omutokano omutsuula	Acacia hebeclada	Candle Thorn	Trassiedoring
omuuni	omuguni; omuhuni?*	Strychnos cocculoides (also Strychnos spinosa?)	Corky Monkey Orange; Kaffir Orange	Suurklapper
omuuva	omuva; omuguya; omunguya; omuuwa	Pterocarpus angolensis	Transvaal Teak; Wild Teak	Dolf; Kiaat
omuve	omuye	Berchemia discolor	Birdplum	Voelpruim Wildedadel
omuwe	omweeguki omumwe	Ochna pulchra	Wild Pear	Lekkerbreek
omuye	see omuve			
omuyele		Acacia albida		

omuyele*	omunyele	Acacia nilotica	Scented Thorn	Lekkerruikpeul
omuyele		Acacia sieberiana	Paperbark Thorn	
omwandi		Diospyros mespiliformis	Transvaal Ebony African Ebony Jackalberry	Jakkalsbessie
omwila	omwiila	Grewia falcistipula		
omwoolo	omwolo; omugolo	Terminalia sericea	Silver Cluster leaf	Vaalboom; (Sand)Geelhout
omwoonde	omuthiya omumbonde	Acacia erioloba	Camel Thorn	Kameeldoring
omwoongo	omwongo; omugongo	Sclerocarya birrea	Marula	Maroela
onghudi	see omunghudi			
onyege	ongete	Dichrostachys cinerea	Sickle Bush	Sekelbos
oshilunda	oilunda; iilunda	Tapinanthus olaefolius		
oshinanganamwali	elangelamwali	Kleinia longiflora		
oshipeke	okakukupeke	Ximenia americana	Sourplum; Wild Plum/	Suurpruim
oshipeke*	oshimbyupeke	Ximenia caffra	Sourplum*; Wild Plum*	Kaffersuurpruim
oshipundu		Grewia retinervis		

APPENDIX 2
Fodder Trees and Bushes by Latin-Ovambo Names

Latin name	Ovambo name(s)	A	B	C	
Acacia ataxacantha	enghono (A); omumangandjaba (D)	N			
Acacia erioloba	omwoonde	Y	Y	Y	
Acacia erubescens	omunkono	N			
Acacia fleckii	omangandjaba	N			
Acacia mellifera	okadilanghono	N			
Acacia nebrownii	muhaloweyo	Y			
Acacia nilotica	omuyele	N			
Acacia refisciens	omutyuula	N			
Acacia sieberana	omutyuula (D)				
Acacia tortilis	kamutaka (B); omutoka(D)		Y		
Adansonia digitata	omukwa			Y	
Albizia anthelmintica	omupopo; omuhanguti	N			
Albizia versicolor	omusheshe		Y		
Baekiaea plurijuga	omupapa		Y		
Baphia massaiensis	ofufe	N	Y	Y	
Bauhinia petersiana	omutwanghuta; omutsanguta	Y	Y	Y	
Berchemia discolor	omuve; omuye	N		Y	
Boscia albitrunca	omunghudi	Y			
Burkea africana	omutundungu	N			
Cassine transvaalensis	omudengambwa	N			
Catophractes alexandri	okalyadi	Y			
Colophospermum mopane	omufyaati; omusati	S	Y	Y	
Combretum apiculatum	omulama; omunaluko	Y			
Combretum hereroense	omukadhikuku	Y			
Combretum imberbe	omukuku (A)	S			
Combretum mechowianum	omupupwaheke				
Combretum zeyheri	omushendje	S			
Commiphora spp.	omboo	N			
Commiphora glaucescens	omukuku (B)?	Y			
Crotolaria podocarpa		Y			
Croton gratissimus	ombango; omumakani	S	Y	Y	
Dialium engleranum	omufimba	?			
Dichrostachys cinerea	onyege; ongete	Y		Y	
Diospyros mespiliformis	omwandi			Y	
Euclea undulata	(Herero)	S			
Euclea divinoru	omudime				
Ehretia rigida	omushadi				
Entandrophragma spicatum	omutaku				
Fagara ovatifoliolata	omuhandwa; okanakamuma				
Ficus petersii	omungholyo		Y		
Ficus sycomorus	omukwiyu		Y	Y	
Ficus thonningii	omulemba	N			
Hippocratea africana	omupetangobe				
Hyphaene ventricosa	omulunga			Y	
Gardenia spatulifolia	omulavi				
Grewia spp.	ehonga (A); omushe; omuhonga	Y			
Grewia avellana	omukopakopa				
Grewia deserticola	omupundu				
Grewia flavescens	omushe			Y	
Grewia tenax	omuhonga (B); omundjebele(D)		Y		
Guibourtia coleosperma	omushii				
Elephantorrhiza suffruticosa	omumbalandongo				

Indigofera astragalina(B)	okambadanga		Y		
Kleinia longiflora (?)	oshinanganamwali (B)		Y		
Lonchocarpus nelsii	omupanda	Y		Y	
Maerua schinzii	omupola; omupopola		Y		
Maytenus senegalensis	omungonze	N			
Monechma divaricatum	okalimufita		Y		
Mundulea sericea	omumbanganyana	N			
Nerium duparquetiana*	omanyanga		Y		
Nidorella resedifolia	efindapya		Y		
Ochna pulchra	omumwe	N			
Peltophorum africanum	omupalala	N			
Polycarpaea corymbosa	okapembe		Y		
Pterocarpus angolensis	omuuva			Y	
Rhigozum brevispinosum	omumakani				
Rhus tenuinerwis	omupombo	N			
Ricinodendron rautanenii	omunghete			Y	
Scelorcarya birrea	omwoongo; omugongo	N		Y	
Scilla rautanenii	enyanga		Y		
Scirpus muricinux	?		Y		
Securidaca longipedunculata	omudiku				
Sida hoepfneri	okanangola		Y		
Spirostachys africana	omuhongo; omunghongo	N	Y		
Strychnos cocculoides	omuuni				
Strychnos pungens	omupwaka				
Swartzia madagascariensis	omumonga		Y		
Tapinanthus olaefolius	oshilunda (parasite)		Y		
Tarchonanthus camphoratus	-	Y			
Tephrosia burchellii	?		Y		
Terminalia prunoides	omuhama; omunghama	N			
Terminalia sericea	omwoolo; omugolo	S		Y	
Vangueria infausta	omumbu; osimbu				
Ziziphus mucronata	omukekete	N		Y	

* [NB Nerium oleander, origin. from Mediterranean, poisenous. (E) p. 797]

Y=Yes; N=No; S=Sometimes. Sources: (A)=Based on Rundu Forestry, file Protected Species, List of trees with botanical names and local names (Kavango and Owambo names); B= Robert J. Rodin, The Ethnobotany of the Kwanyama Ovambos (Missouri Botanical Garden, 1985); C=Preliminary data (random sample) OMITI Survey; D=B.C.H. Turvey, W. Zimmermann, and G.B. Taapopi, Kwanyama-English Dictionary (Johannesburg: Witwatersrand University Press, 1977); E=Keith Coates Palgrave, Trees of Southern Africa (Cape Town: Struik 1990 (first published, 1977; revised and updated, 1988).

APPENDIX 3
Chronological Highlights

1897	Rinderpest epizootic
1907	Portuguese colonial conquest of the Ombadja kingdoms
1914-1918	First World War
1915	-Portuguese conquest of Oukwanyama and re-occupation of Ombadjas; -British South African conquest of German South West Africa and occupation of the southern floodplain (subsequently known as Ovamboland) -Famine, dislocation, and flight from the northern floodplain -Institution of the disputed border strip as the Neutral Zone, co-administered by a Portuguese and a South African official;
1917	Death of the last King of Oukwanyama in a battle with British South African troops
1927	The Neutral Zone is transferred to the Portuguese colony of Angola resulting in a massive southward migration into Ovamboland
1929-1931	Famine of the Dams
1940-1945	Second World War
1948	National Party wins elections in South Africa
1953	Ovamboland transferred to Native Affairs Department of the Union of South Africa
1975	Decolonisation and independence of Angola
1990	Decolonisation and independence of Namibia

Emmanuel Kreike

ARCHITECTS OF NATURE: ENVIRONMENTAL INFRASTRUCTURE AND THE NATURE-CULTURE DICHOTOMY

SUMMARY

The environment and the causes and consequences of environmental change are topics that are hotly debated by academics, development experts, policy makers, and the public at large. Yet, despite path-breaking research about local and global environmental change over the last decades, the conceptualization and analysis of environmental change remains rooted in a one-dimensional Nature-Culture dichotomy that depicts environmental change in unilinear, static, and monolithic terms that privileges the outcome of change over the process of change, obscuring agency, motivation, and the day-to-day mechanics involved as well as homogenizing the subjects and the objects of environmental change.

The Nature-Culture dichotomy defines human and non-human entities and their products exclusively as either part of Nature or of Culture. For example, plants and animals are wild (and part of Nature) or domesticated (and part of Culture). But many animals and plants do not fit neatly into this binary framework, including feral animals and "semi-domesticated" plants. The idea that westerners armed with science and technology and motivated by a modern market-oriented outlook seek and manage to overcome and destroy Nature, replacing it with a human-made construct (Culture) and in the process freeing themselves entirely from Natural bounds places the west and science unambiguously in Culture. The complementary idea that non-westerners have not liberated themselves from the yoke of Nature, and that they live by Nature and in Nature (however degraded that Nature may have become) assigns the non-west and its traditions to the realm of Nature.

The historian Richard White has argued, however, that the Columbia River, arguably the most dammed (and thus a paragon of Culture) and damned (in terms of the destruction of its Nature) river in the technologically most advanced world power, the United States, is in fact neither Culture, nor Nature. White calls the Columbia River an "organic machine" because despite the human input in the transformation of the river, humans have failed to unravel its workings as an ecosystem. White's idea has significant implications because it problematizes the understanding of modern

(agro-) industrial rural and (sub)urban landscapes as Culture and indeed the very concept of Culture as an environmental category.

The concept of "environmental infrastructure" facilitates a focus on the twilight zone between Nature and Culture. The term "infrastructure" not only stresses the utilitarian value that humans ascribe to it (by humans), but also allows room for environmental agents to shape or re-shape it mentally as well as physically. The adjective "environmental" highlights that human control, use, and agency are neither absolute nor exclusive. Thus, unlike conventional infrastructure (i.e. bridges, roads, schools), which is controlled, designed and created by humans to support human activity, environmental infrastructure is not confined to the realm of Culture. Rather, it operates at a level below and distinct from conventional infrastructure. Environmental infrastructure may include, for example, "cultivated landscapes," landscapes created by fire regimes and/or shifting cultivation, abandoned urban and rural landscapes as well as anthropogenic soils, fruit trees and orchards, coppice woodland, localized or decentralized water-management systems (including, for example, simple water holes or wells), farms and fields, and seed stores.

Humans are "architects of Nature" because they are environmental actors. Humans, however, work <u>with</u> nature (which is at once an actor and a medium), rather than dominating nature or being dominated by nature. The "architects of nature" create, configure, maintain and remake "environmental infrastructure" in interaction with other local, regional, and global actors, factors, and processes (for example, climate change). Any change in how the architects maintain their environment has implications for the environmental infrastructure. For example, if a population abandons an area, by definition, the environment changes (and may be perceived to change) because the environmental infrastructure is no longer maintained and/or re-configured in the same way.

The dominant paradigms that are currently in use to analyze environmental change, that is, the modernization, the declinist, and the inclinist paradigms, are all premised on a unilinear Nature-Culture dichotomy. Largely mutually exclusive in their application, the three competing paradigms emphasize the role of western science or indigenous knowledge in analyzing how people understand and manage their physical environments. The modernization paradigm considers a degree of environmental degradation to be an acceptable price of progress and economic growth and emphasizes the need for the scientific management of environmental resources. In contrast, the declinist paradigm identifies science and modernity itself as the main cause of environmental decline. The emerging inclinist paradigm emphasizes the need to embrace indigenous knowledge and resource management in order to counter environmental degradation.

The paradigms give rise to at least two paradoxes that may be defined as the Palenque Paradox and the Ovambo Paradox. Because environmental change is depicted as a linear and irreversible progression from a state of Nature to a state of Culture, the presence of the ruins of Palenque and other cities in what are assumed to be the earth's last remaining wilderness environments constitutes a puzzle. How can the forests of Central America, the jungles of Southeast Asia and the wilderness expanses of Africa be pristine and natural if they are littered with urban ruins? Moreover, the paradigms frame change in terms of a singular process with a singular outcome: either environmental degradation or improvement. The history of environmental change in Ovamboland, Namibia, however, demonstrates that environmental change can be characterized by a process of environmental degradation in the form of deforestation that is simultaneously accompanied by a process of environmental recovery in the form of reforestation. None of the paradigms alone can satisfactorily explain this Ovambo paradox.

In addition, many studies of environmental change focus exclusively on a specific type of natural resource, i.e. vegetation, fauna, soil, or water. Moreover, the interactions between changes in vegetation, fauna, and hydrological conditions and how these changes are related to the quality rather than the sheer quantity of human actions, has been relatively understudied. A more open-ended approach that is not based on such a priori environmental trends as, for example, deforestation or reforestation, yields a deeper understanding of environmental change. Emphasizing relative benchmarks based on empirical historical research, rather than such "absolute" and a-historical benchmarks as, for example, vegetation climax, and differentiating sub-processes of environmental change that may even be contradictory, similarly contribute to a more nuanced analysis of environmental change. Multi-scale analysis facilitates assessing macroprocesses and their impact as well as microprocesses. Attention to the microlevel provides insight into the day-to-day dynamics of environmental change, highlighting agency and motivation (for example, whether people cut or plant trees for social, political, or environmental reasons), and reveals contradictory trajectories of environmental change that may be obscured at the aggregate meso- and maco-levels of analysis.

The study uses a comparative approach, highlighting the processes and dynamic outcomes of environmental change, especially in non-western and western pre-industrial societies in the last 2,000 years, including the pre-Columbian, colonial and post-colonial Americas, pre-colonial, colonial, and post-colonial Africa, ancient and modern Asia, and pre-modern Europe. The concept of environmental infrastructure and the notion of humans as architects of Nature serve as tools to analyze and describe processes of change. The environmental history of Ovamboland, Namibia is woven through the larger narrative to detail how select individual threads connect with one another to form the intricate web of relationships and interactions that provides the context and the medium for environmental processes and gives them form. The study contributes to a fast-growing body of literature from a wide range of fields written for academic and wider audiences that focus on the causes, effects, and nature of environmental change as well as highlighting how environmental factors have contributed to and continue to shape the human past, present, and future. Finally, the study sheds new light on the relationships between Nature and Culture, wild and domesticated, west and non-west, and science and indigenous knowledge.

Chapter 1 discusses the dominant paradigms that are used to analyze and describe environmental change. Chapter 2 identifies some of the major weaknesses of the Nature-Culture paradigms as exemplified through two paradoxes that arise from their use. Chapter 3 focuses on methodological issues and explains how the study approaches the issue of environmental change from a historical framework that focuses on the processes involved rather than emphasizing the outcome. Chapter 4 argues that the search for "absolute" benchmarks to measure environmental change by (i.e. "pristine" Nature or the state of Nature) is futile and that the mere notion of their existence is misleading and prejudices the analysis. Rather, relative benchmarks should be identified and used. Chapters 5 and 6 analyze environmental change at the macro level, focusing on arguably the most critical human-related catalysts for environmental change: population growth and human environmental management practices. The chapters stress that the relationships between the factors of "population" and "management" and environmental change are marked more by correlations than by evidence of causality. Chapter 5 demonstrates that the impact of population density on the environment is ambiguous and that population should not be regarded merely as a quantitative and biological factor, but rather as a qualitative factor that impacts on forest resources through social processes. Where and how people impacted on Ovamboland's environment was as important as how many people affected it.

Chapter 6 focuses explicitly on the effects of human agency on the environment through the management and use of livestock. It is often argued that population growth in semi-arid regions is accompanied by increases in livestock herd sizes, resulting in overgrazing. These arguments are based on the consideration that human agency in managing livestock is circumscribed by culture or tradition. For example, in the "cattle complex" model, cattle population numbers increase beyond environmental bounds because cattle is a symbol of status and wealth as opposed to a commodity. Yet, hard evidence for the existence of a livestock population bomb or serious overgrazing is lacking. Moreover, Ovamboland's cattle owners readily exported cattle before the imposition of colonial rule, a practice that contradicts the "pre-colonial" or "traditional" origins of the presumed cattle complex.

Chapters 7 and 8 show the contradictory nature of environmental change exemplified in the Ovambo Paradox: in Ovamboland both dramatic deforestation and reforestation occurred within the time frame of a few generations. Chapter 8 differentiates environmental change to the meso- (village) and micro level (household, individuals), showing the how, when, where and by whom of day-to-day environmental change accomplished by the architects of Nature. The chapter also underscores that specific environmental considerations regarding the role of trees or forests did not necessarily provide the motivation to cut down and to propagate trees. In 20th century Ovamboland, women were responsible for much of the on-farm reforestation because tree fruit was a source of food and the raw material for the production of alcoholic beverages that could be consumed, traded, or sold.

Chapter 9 problematizes Culture as the outcome of environmental change in particular and as an analytical and descriptive category in general. Even as it caused dramatic environmental change, colonial science failed to domesticate wild Ovamboland. For example, its makeover of the region's hydraulics resulted in the creation of an "organic machine," a Nature-Culture hybrid and not Nature or Culture. Moreover, the hydraulic society that emerged at the end of colonial rule was the product not only of western science and technology but equally so of indigenous knowledge and technology. Chapter 10 introduces the concept of environmental infrastructure to analyze and describe (sub)processes of environmental change and (dynamic) “outcomes” that are located in the twilight zone between Nature and Culture or that fall beyond the purview of the Nature-Culture dichotomous model.

Chapter 11 concludes that new insights can be gained by conceiving environmental change as involving multi-directional and multi-trajectory processes with multiple, dissynchronous and at times fleeting outcomes. As in the case of Ovamboland, such an approach may detect dramatic environmental change even when a comparison of one past “state of the environment” (the 1890s) with the field research “present” (the 1990s) suggests continuity. The focus on the analysis of the processes themselves, for example, revealed that both deforestation and reforestation marked environmental change in Ovamboland during the 20th century. Vegetation changes resulted not merely from increases (or decreases) of human or animal population numbers, but from temporal and spatial redistributions of human and animal populations that were associated with, for example, violence. Moreover, the actual processes of woody vegetation changes were a product of cumulative individual human decisions and acts to cut down, burn, or uproot, or to plant, cultivate, or protect individual specimens of woody vegetation.

The study also concludes that an analytical focus solely on forest dynamics, i.e. highlighting the trees or the forest or even the relationship of forest-people may not be sufficiently inclusive. Thus the conventional disciplinary ecological focus on forests as natural ecosystems or the forestry focus on forests/trees-society interactions may impose arbitrary limits to analysis. Just as much of the volume of a tree or bush is underground, many of the processes and the factors that affect the forests/trees and the people who relate to them may occur just beyond the conventional purview of ecological and forest scientists. Forest and tree use and management are not only affected by people-tree relationships but are also subject to various people-people, people-animal, people-crops, animal-crops, animal-animal, and crop-crop interactions, resulting in counterintuitive and paradoxical outcomes in terms of the direction of vegetative change. Differentiating the process of environmental change thus requires open-ended, empirical research, and multi-level analysis.

SAMENVATTING

Het milieu en de oorzaken en gevolgen van milieuveranderingen zijn het onderwerp van intense discussies niet alleen in specialistische universitaire en ontwikkelingssamenwerkingskringen, maar ook in de politiek en de samenleving in het algemeen. Maar, ondanks de publicatie van baanbrekend onderzoek op het terrein van lokale and globale milieuveranderingen gedurende de afgelopen twee decennia, blijft de ideevorming over en de analyse van milieuverandering geankerd in een eenzijdige Natuur-Cultuur tegenstelling die milieuverandering voorstelt als lineair, statisch en monolitisch. De nadruk in deze benadering ligt ook op de uitkomst van het veranderingsproces ten koste van de zorgvuldige studie van het proces zelve met als gevolg dat er weinig of geen aandacht wordt besteed aan de details van het wie, waarom en wat in de dagelijkse werkelijkheid van milieuveranderingsprocessen. Zo worden de onderwerpen en voorwerpen in milieuveranderingsprocessen niet onderscheiden naar hun individuele uitwerking maar gehomogeniseerd.

De Natuur-Cultuur tegenstelling beschouwt mensen en niet-menselijke eenheden of als onderdeel van Natuur, of van Cultuur. Planten en dieren, bijvoorbeeld, zijn of wild (en dus onderdeel van de Natuur) of gedomesticeerd (en dus onderdeel van Cultuur). Maar veel dieren en planten zoals verwilderde dieren en "semi-gedomesticeerde" planten passen niet zo gemakkelijk in het raamwerk van de Natuur-Cultuur tegenstelling. Het idee dat "westerlingen" gewapend met wetenschap en technologie en gemotiveerd door een moderne vrije markt instelling de verovering van de Natuur nastreven om die te vervangen door een menselijk product (Cultuur) terwijl ze zich ondertussen bevrijden van de beperkingen die de Natuur hen oplegt, plaatst het Westen en de wetenschap in het kamp van Cultuur. Het aanvullende idee dat niet-westerlingen afhankelijk zijn van de Natuur, één zijn met de Natuur en dus een Natuurlijk leven lijden (zelfs als het natuurlijke milieu waarin zij leven niet langer onverpest is) plaatst het niet-westen en zijn tradities in het domein van de Natuur.

De historicus Richard White heeft benadrukt dat de Columbia rivier, mogelijk de meest gedamde (en dus een schoolvoorbeeld van Cultuur) en gedoemde (omdat de Natuur is verpest) rivier in de technologisch modernste wereldmacht de Verenigde Staten, noch Cultuur, noch Natuur is. White beschrijft de Columbia rivier als een organische machine omdat ondanks het feit dat mensen er grote veranderingen in hebben aangebracht, het menselijk begrip van hoe de rivier werkt als een ecosysteem

nog steeds beperkt is. White's idee heeft belangrijke gevolgen voor hoe we denken over milieuveranderingsprocessen want het oppert de mogelijkheid dat het moderne (agro)industriële plattelands- en stedelijke landschap wellicht niet zo eenduidig tot het domein van Cultuur behoort als algemeen wordt aangenomen. En die constatering op zijn beurt maakt het onduidelijk of het idee Cultuur wel zo nuttig is als een categorie om milieuverandering te begrijpen.

De term milieu-infrastructuur (environmental infrastructure) maakt het mogelijk om te kijken naar het niemandsland tussen Natuur en Cultuur. De keuze van het woord infrastructuur benadrukt niet alleen de (menselijke) gebruikswaarde maar laat ook toe dat het milieu fysiek of mentaal herschapen wordt door gebruikers. De specificatie "milieu" benadrukt dat menselijke controle over, en gebruik en verandering van de infrastructuur niet volledig noch exclusief is. Dus, in tegenstelling tot conventionele infrastructuur (bijvoorbeeld, bruggen, wegen, scholen) die door mensen gecontroleerd, ontworpen, en gerealiseerd wordt om hun activiteiten te ondersteunen, is milieu-infrastructuur niet uitsluitend het domein van Cultuur. Milieu-infrastructuur functioneert op een ander, lager niveau dat apart staat van dat van conventionele infrastructuur. Milieu-infrastructuur omvat bijvoorbeeld "gecultiveerde landschappen," landschappen gevormd door vuur, verlaten stads- of plattelandslandschappen, en antropogene bodems, fruitbomen en boomgaarden, hakhoutbos, lokale of gedecentraliseerde waterbeheerssystemen (inclusief eenvoudige watergaten of –bronnen), boerenbedrijven, akkers en zaadbanken.

Mensen worden hier beschouwd als "architecten der Natuur" omdat zij de Natuur vormen. Maar in plaats van mensen te beschouwen als dominerend over de Natuur of de Natuur te zien als dominant over mensen, ligt hier de nadruk op hoe mensen werken met de Natuur (en er is ruimte om de Natuur zelf tevens te zien als vormgever en medium). De architecten der Natuur creëren, geven vorm aan, onderhouden en hervormen milieu-infrastructuur in samenwerking met andere lokale, regionale en globale vormgevers, aspecten en processen (klimaatverandering, bijvoorbeeld). Elke verandering in hoe de architecten hun milieu onderhouden wordt heeft gevolgen voor de stand van de milieu-infrastructuur. Bijvoorbeeld, als een bevolking haar woongebied verlaat verandert het milieu automatisch (fysiek en mentaal) omdat de milieu-infrastructuur niet langer op dezelfde wijze wordt onderhouden of/en herschapen.

De dominante paradigma's die vandaag de dag worden gebruikt om milieuverandering te bestuderen, dat wil zeggen de paradigma's van modernisering (modernization), verval (declinist), en bloei (inclinist) zijn gebaseerd op een lineaire eenrichtingsverkeersinterpretatie van de Natuur-Cultuur tegenstelling. Elk van de drie is exclusief in haar toepassing, maar ze delen een geloof in de instrumentele rol van (inheemse of wetenschappelijke) kennis voor de studie van hoe mensen hun fysische milieu begrijpen en onderhouden. Het moderniseringsparadigma beschouwt een zekere mate van milieuverslechtering als een aanvaardbare prijs voor ontwikkeling en economische groei en benadrukt het belang van een wetenschappelijk beheer van natuurlijke hulpbronnen. Het verval (declinist) wereldbeeld daarentegen beschouwt wetenschap en het moderne zelf als de hoofdoorzaak van milieuvervuiling. Het nieuwe bloei (inclinist) paradigma pleit voor het gebruik van inheemse kennis- en beheerssystemen om de huidige milieuproblemen op te lossen.

Het gebruik van deze paradigma's creëert twee paradoxen die hier de Palenque-paradox en de Ovamboparadox zijn gedoopt. Omdat milieuverandering wordt voorgesteld als een lineaire en onomkeerbare progressie van een staat van Natuur tot een staat van Cultuur is de aanwezigheid van de ruïnes van Palenque en andere steden, in wat wordt beschouwd als de laatste wildernisgebieden van onze aarde, een raadsel. Hoe kunnen de Centraal-Amerikaanse wouden, de Zuid-Oost Aziatische bossen, en de uitgestrekte Afrikaanse wildernis maagdelijk en natuurlijk zijn als ze volliggen met ruïnes van steden? De paradigma's zien verandering in de vorm van een eenduidig proces met een eenduidige uitkomst: of milieuverslechtering of milieuverbetering. De geschiedenis van milieuverandering in Ovamboland, Namibië, toont echter aan dat milieuverandering gekenmerkt kan worden door meerdere gelijktijdige processen van milieuverslechtering (door ontbossing) en milieuverbetering (door herbebossing). Geen van de paradigma's op zich kan dit verschijnsel afdoende verklaren.

Daarnaast concentreren veel studies over milieuverandering zich eenzijdig op een bepaald type van natuurlijke hulpbronnen, bijvoorbeeld flora, fauna, bodem of water. Hoe veranderingen in flora, fauna en waterhuishouding elkaar wederzijds beïnvloeden en in welke mate die veranderingen verbonden zijn met de kwaliteit van menselijke acties in plaats van met de kwantiteit alleen heeft relatief weinig aandacht gekregen. Een meer open onderzoeksstelling die niet uitgaat van vooroordelen over de te verwachten richting van milieuverandering, bijvoorbeeld ontbossing of herbebossing kan een meer evenwichtig beeld geven van milieuveranderingen. Het gebruik van relatieve uitgangspunten gebaseerd op empirisch historisch onderzoek in plaats van het accepteren van absolute en a-historische uitgangspunten zoals bijvoorbeeld climaxvegetatie en het onderscheiden van subprocessen van milieuverandering die zelfs tegenstrijdig kunnen zijn, leidt tot een meer genuanceerde analyse van milieuveranderingen. De studie van milieuverandering op verschillende schalen tegelijkertijd geeft inzicht in zowel de macro- en microprocessen en hoe ze elkaar beïnvloeden. De aandacht voor microprocessen geeft inzicht in de dagelijkse dynamiek van milieuveranderingen en benadrukt het wie, hoe en waarom (bijvoorbeeld, of mensen die bomen vellen dat doen voor sociale, politieke of milieubeweegredenen). De microschaal laat ook de identificatie toe van mogelijke tegenstrijdige trends die op een meso- of macroschaal vereffend worden.

Deze studie gebruikt een vergelijkende aanpak en benadrukt processen en dynamische uitkomsten van milieuverandering in vooral niet-westerse en westerse pre-industriële samenlevingen gedurende de laatste 2000 jaren inclusief pre-Columbiaans, koloniaal en postkoloniaal Amerika, prekoloniaal, koloniaal en postkoloniaal Afrika, klassiek en modern Azië, en premodern Europa. Het raamwerk van een milieu-infrastructuur en het idee dat mensen de architecten der Natuur zijn dienen als instrumenten voor de analyse en beschrijving van de veranderingsprocessen. De milieugeschiedenis van Ovamboland, Namibië functioneert als een rode draad die laat zien hoe geselecteerde individuele elementen met elkaar verbonden zijn in een weefsel dat de achtergrond vormt voor en het medium is waarin milieuprocessen zich voordoen. De studie levert een bijdrage aan een snelgroeiende literatuur geschreven voor een academisch- en wijder publiek uit een reeks van specialiteiten over de oorzaken, gevolgen en aard van milieuverandering en die benadrukt hoe milieuaspecten het menselijk verleden, heden en toekomst beïnvloeden. Een verdere bijdrage is dat de studie nieuw licht werpt op de interrelaties tussen Natuur en Cultuur, wild en gedomesticeerd, niet-westers en westers en inheemse kennis en wetenschap.

Hoofdstuk 1 bespreekt de voornaamste paradigma's die in gebruik zijn om milieuverandering te analyseren en beschrijven. Hoofdstuk 2 belicht de belangrijkste zwakheden van de wereldbeelden die voortkomen uit het idee van een Natuur-Cultuur tegenstelling. Hoofdstuk 3 legt de nadruk op de methodologische aspecten en legt uit hoe en waarom de studie een empirisch-historische benadering gebruikt en de nadruk legt op de ontleding van de processen van milieuverandering zelve in plaats van op de uitkomst van de processen. Hoofdstuk 4 toont aan dat het gebruik van bijvoorbeeld een "natuurlijke staat" als een absoluut nulpunt voor het meten van milieuverandering zinloos en misleidend is. Een betere methode is het identificeren van een reeks van relatieve meetpunten. De hoofdstukken 5 en 6 richten de aandacht op twee van de voornaamste macrofactoren in milieuverandering: bevolkingsgroei/druk en milieubeheerssystemen. De hoofdstukken laten zien dat de relatie tussen "bevolking," "beheer" en milieuverandering meer gekenmerkt wordt door correlaties dan door causaliteit. Dat het effect van bevolkingsdruk op het milieu niet eenduidig is, wordt duidelijk in hoofdstuk 5. Bevolkingsdruk moet niet alleen gezien worden als een directe kwantitatieve en biologische factor maar moet voornamelijk bestudeerd worden als een kwalitatieve factor die bossen op indirecte wijze beïnvloedt via sociale processen. Waar en hoe mensen Ovamboland's milieu beïnvloeden is net zo belangrijk als hoeveel mensen dat milieu beïnvloeden.

Hoofdstuk 6 belicht hoe mensen het milieu veranderen door het gebruik en beheer van vee. Een bekend argument is dat bevolkingsgroei in de droge streken samengaat met een toename in de veebestanden en overbegrazing. Dit argument komt voort uit het idee dat beheer en gebruik van vee gedicteerd worden door tradities en Cultuur. Het cattle complex model bijvoorbeeld gaat er van uit dat rundvee niet wordt gezien als handelswaar maar uitsluitend als een symbool van status en rijkdom met als gevolg dat het milieu wordt overbelast. Maar er is geen duidelijk bewijs voor de stelling van een veebevolkingsexplosie of ernstige overbegrazing. Daarnaast is het duidelijk dat Ovamboland's veehouders rundvee exporteerden voor de koloniale bezetting en dus is het onmogelijk om vol te houden dat een cattle complex (als het al bestond) een prekoloniale of traditionele oorsprong heeft.

In de hoofdstukken 7 en 8 wordt de tegenstrijdige aard van milieuverandering naar het voorbeeld van de Ovamboparadox duidelijk gemaakt. In Ovamboland vonden zowel dramatische ontbossing en herbebossing plaats in het tijdsbestek van een paar generaties. Hoofdstuk 8 onderscheidt milieuverandering naar de meso- (dorp) en micro- (huishouden en individu) niveaus en illustreert het hoe, wanneer, waar, waarom en wie van de dagelijkse realiteit van milieuverandering teweeggebracht door de architecten der Natuur. Het wordt ook duidelijk in dit hoofdstuk dat de beslissing over het vellen of planten van bomen niet noodzakelijkerwijs altijd terug te voeren is op beweegredenen die samenhangen met de milieufuncties van bomen en bossen. Vrouwen in het 20e eeuwse Ovamboland waren verantwoordelijk voor het merendeel van de herbebossing die plaats vond op de akkers. Vruchten van bomen waren voor hen voedsel en de grondstof voor alcoholische dranken die gedronken en verhandeld werden.

Hoofdstuk 9 toont aan dat Cultuur als de uitkomst van milieuverandering in het bijzonder en als een analytische en beschrijvende categorie in het algemeen een hoogst problematische term is. Hoewel koloniale wetenschappen enorme milieuveranderingen teweegbrachten faalden ze in hun streven om wild Ovamboland te domesticeren. Koloniale wetenschappen “mechaniseerden” de lokale waterhuishouding resulterende in een organische machine, een mengeling van Natuur en Cultuur die noch puur Natuur, noch puur Cultuur was. Daarenboven was de waterhuishoudkundige samenleving die tegen het einde van het koloniale tijdperk was gevormd niet alleen een produkt van westerse wetenschap en techniek maar evenzeer van inheemse kennis en techniek. Hoofdstuk 10 introduceert het begrip milieu-infrastructuur (environmental infrastructure) voor de analisering en beschrijving van (sub)processen van milieuverandering (en hun dynamische “uitkomsten”) die of plaatshebben in de schemerzone tussen Natuur en Cultuur of die buiten de reikwijdte van het model van de Natuur-Cultuurtegenstelling vallen.

Hoofdstuk 11 concludeert dat nieuwe inzichten verworven kunnen worden door milieuverandering voor te stellen als meerrichtings (i.p.v. eenrichtings) en meersporige (i.p.v. eensporige) processen met meerdere, ongelijktijdige en soms heel tijdelijke uitkomsten. Zulk een benadering kan dramatische milieuveranderingen ontdekken zelfs wanneer, zoals het geval was in Ovamboland, een vergelijking van een staat van het milieu in het verleden (in het laatste decennium van de 19e eeuw) met het veldonderzoeks “heden” (een eeuw later) op het eerste gezicht continuïteit suggereert. Het leggen van de nadruk in de analyse op de processen zelve bijvoorbeeld onthulde dat milieuverandering in het 20e eeuwse Ovamboland gekenmerkt werd door zowel ontbossing als herbebossing. Veranderingen in plantengroei waren niet alleen het gevolg van een toe- of afname van de menselijke en dierlijke bevolking maar ook van de herverdeling van mens- en dierpopulaties in tijd en ruimte, bijvoorbeeld ten gevolge van geweldddaden. Ook waren de feitelijke processen die de houtige vegetatie veranderden het gevolg van de accumulatie van individuele menselijke beslissingen en daden om individuele planten te vellen, verbranden en te ontwortelen, of om ze te planten, cultiveren en te beschermen.

Verder concludeert deze studie dat een analytische focus op de dynamiek van bossen, d.w.z. het de aandacht richten op de bomen of de bossen en de relatie tussen bomen en mensen, wellicht niet voldoende omvattend is. De conventionele disciplinaire ecologische focus op bossen als natuurlijke ecosystemen of de gerichtheid van de bosbouw op de interacties tussen bossen, bomen en de samenleving perkt de analyse op willekeurige wijze in. Net zoals veel van het volume van een boom of struik ondergronds en dus aan het zicht onttrokken is, moet er rekening mee gehouden worden dat veel van de processen en factoren die de relaties tussen bossen, bomen en mensen betreffen zich buiten het traditionele gezichtsveld van milieuwetenschappers en bosbouwers kunnen afspelen. Het gebruik en beheer van bossen en bomen wordt niet alleen beïnvloed door mens-boom relaties, maar ook door relaties tussen mensen en mensen, mensen en dieren, mensen en gewassen, dieren en gewassen, dieren en dieren, en gewassen en gewassen, met als gevolg onverwachte en paradoxale uitkomsten voor de richting van vegetatieverandering. Het differentiëren van het milieuveranderingsproces vereist dus een meer open-eindig, empirisch onderzoek en aandacht voor meerdere analyse niveaus tegelijkertijd.

BIOGRAPHY

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1978-1986	Studie Geschiedenis, Universiteit van Amsterdam Bijvakken: Internationale Betrekkingen en Volkenrecht; Geschiedenis van de Oorlog en Oorlogsrecht
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1998-2001	LaPorte ’28 Preceptor in Regional Studies, Princeton University
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