



The Nature-Culture Trap: A Critique of Late 20th Century Global Paradigms of Environmental Change in Africa and Beyond*

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By the late 20th century, three paradigms – modernization, declinist, and inclinist – dominated how changes in the *physical* environment were analyzed and described. These paradigms were mutually exclusive in their application, global and universal in their reach, and premised on a unilinear and static Nature-Culture dichotomy. They emphasized the role of western science or indig-

enous knowledge in analyzing how people understood and managed their physical environments. The modernization paradigm emphasized the need for the scientific management of environmental resources and considered a degree of environmental degradation to be an acceptable price of progress and economic growth. In contrast, the declinist paradigm, which arose in the late 1960s, identified science and modernity itself as the main cause of environmental decline. The inclinist paradigm, which gained full strength in the 1990s, emphasized the need to embrace indigenous knowledge and resource management in order to counter environmental degradation.¹

Conceptualizing the physical environment within the framework of the modernization, declinist, or inclinist paradigms gave rise to at least two paradoxes that are defined here 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 the remnants of human settlements? Moreover, all three of the paradigms conceptualize change in terms of a singular process with a singular outcome: either environmental degradation or improvement. The environmental history of Ovamboland, Namibia, 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. In brief, none of the three paradigms alone can satisfactorily explain either the Palenque or the Ovambo paradox.

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¹ The three paradigms were and are primarily analytical categories; they were neither entirely static nor discrete. See, for example, K. Sivaramakrishna, "State Sciences and Development Histories: Encoding Local Forestry Knowledge in Bengal", in M. Doornbos, A. South, B. White (eds), *Forests: Nature, People, Power*, Blackwell, Oxford 2000, pp. 61-88.

The Modernization Paradigm

The modernization paradigm posited environmental change as a progression from a primitive state of Nature to an advanced state of Culture, resulting in a state-controlled and scientifically exploited environment.² Works employing the modernization paradigm identify western science, modern westerners, and the species they domesticated or adopted as the tools and objectives of modernization. Although its intent is to illuminate why the West colonized America, Asia, and Africa, and not to celebrate the global dominance of western modernity or western science, Diamond's analysis in his path-breaking *Guns, Germs, and Steel* lies squarely within the modernization paradigm.³ Diamond identifies the early European

² Goudsblom, for example, describes the progress of humankind through the domestication of fire, J. Goudsblom, *Fire and Civilization*, the Penguin Press, London 1992. Nash argues that scientific conservation in the US arose with the closing of the Frontier, R.F. Nash, *American Environmentalism: Readings in Conservation History*, McGraw Hill, New York 1990 [1976], pp. 69-112. But Grove traces the roots of western conservation much farther back, see R.H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism 1600-1860*, CUP, Cambridge 1997 [1995]. For critical overviews of the modernization paradigm see P. Richards, *Indigenous Agricultural Revolution: Ecology and Food Production in West Africa*, Westview Press, Boulder 1985, pp. 31-40; P. Blaikie, H. Brookfield, *Land Degradation and Society*, Methuen, London 1987, pp. xviii-xix. On modernization and/or Nature-to-Culture change, see C. Merchant, *Reinventing Eden: The Fate of Nature in Western Culture*, Routledge, New York 2003, pp. 20-186; C. Merchant, *Ecological Revolutions: Nature, Gender, and Science in New England*, The University of North Carolina Press, Chapel Hill and London 1989; K. Thomas, *Man and the Natural World: Changing Attitudes in England, 1500-1800*, OUP, Oxford 1996 [first published 1983]; T.J. Bassett, D. Crummey (eds), *African Savannas: Global Narratives and Local Knowledge of Environmental Change*, James Currey, Oxford 2003, pp. 13-15; D. Worster, *Dust Bowl: The Southern Plains in the 1930s*, OUP, Oxford 1982 [1979], pp. 182-229; J.R. Stilgoe, *Common Landscape of America, 1580-1845*, Yale University Press, New Haven 1982; R. White, *The Organic Machine: The Remaking of the Columbia River*, Hill and Wang, New York 2000 [1995], pp. 59-88; D. Arnold, *The Problem of Nature: Environment, Culture, and European Expansion*, Blackwell, Oxford 1996, pp. 1-74.

³ J. Diamond, *Guns, Germs, and Steel: The Fates of Human Societies*, W.W. Norton, New York 1999 [1997]. Diamond's emphasis on how a linear process of

adoption of domesticates from elsewhere – their dissemination facilitated by geo-environmental conditions – as ultimately providing Europeans with the technological (guns and steel) and biological (germs) cutting-edge to conquer the world.

If they raise environmental concerns at all, modernizers are confident that science and technology can remedy any problems that might arise and, moreover, judge a measure of accompanying environmental degradation to be an acceptable price for progress. For example, in Zimbabwe, the colonial-era authorities – otherwise strong proponents of game conservation – exterminated large numbers of wild animals to control tsetse-fly infestation and protect the development of white commercial cattle ranching.⁴

The main objective of conservation was to prevent the irrational and wasteful use of “natural” resources and protect wildlife and forest resources from “primitive” western and non-western farmers and pastoralists.⁵ In the 1930s, the British colonial administrations in Africa became increasingly convinced of the necessity of direct intervention in how its African subjects used the land.⁶ Colonial officials

domestication enables human domination over Nature (i.e. civilization or Culture) is similar to that of, for example Sauer and Goudsblom. See C. Sauer, *Seeds, Spades, Hearths, and Herds: The Domestication of Animals and Foodstuffs*, MIT Press, Cambridge 1972 [1952] and Goudsblom, *Fire and Civilization* cit.

⁴ R. Mutwira, “A Question of Condoning Game Slaughter: Southern Rhodesian Wildlife Policy, 1890-1953”, in *Journal of Southern African Studies* (henceforth JSAS), 15, 1989, pp. 250-262.

⁵ See J.M. MacKenzie (ed.), *Imperialism and the Natural World*, Manchester University Press, Manchester 1990; J.M. MacKenzie, *The Empire of Nature: Hunting, Conservation and British Imperialism*, Manchester University Press, Manchester 1988; D. Anderson, R. Grove (eds), *Conservation in Africa: People, Policies and Practice*, CUP, Cambridge 1987, especially pp. 1-12; Grove, *Green Imperialism* cit.; J. Carruthers, *The Kruger National Park: A Social and Political History*, University of Natal Press, Pietermaritzburg 1995.

⁶ D. Anderson, “Depression, Dust Bowl, Demography, and Drought: The Colonial State and Soil Conservation in East Africa during the 1930s”, in G. Maddox (ed.), *Colonialism and Nationalism in Africa, vol. 2: The Colonial Epoch in Africa*, Garland, New York 1993, pp. 209-231; S. Berry, *No Condition is Permanent: The Social Dynamics of Agrarian Change in Sub-Saharan Africa*, University of Wisconsin Press, Madison 1993, pp. 46-54.

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 vis-à-vis lands they did not inhabit or cultivate. This characterization legitimized the practice of alienating as state land vast expanses of fallow, pasture lands, and forests, as well as hunting-and-gathering grounds.⁷ Although colonial officials initially regarded select indigenous peoples simply as part and parcel of Nature (e.g. Stone-Age hunters-and-gatherers) and preserved them in the newly established reserves and parks, by the 1950s colonial officials had removed the last local residents from the conservation areas.⁸

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.⁹ Tropical rain forests were valuable because they were a

⁷ W. Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England*, Hill and Wang, New York 1988 [1983], p. 53. On land alienation, see M. Colchester, “Forest Peoples and Sustainability”, in M. Colchester, L. Lohmann (eds), *The Struggle for Land and the Fate of the Forests*, The World Rainforest Movement, Penang 1995 [1993], pp. 61-95. On the view of Africans as sources of disease, see J. Farley, *Bilharzia: A History of Imperial Tropical Medicine*, CUP, Cambridge 1991, pp. 13-20, 130, 137-139.

⁸ H.W. Konrad, “Tropical Forest Policy and Practice during the Mexican Porfiriato, 1876-1910”, in H.K. Steen, R.P. Tucker (eds), *Changing Tropical Forest: Historical Perspectives on Today's Challenges in Central and South America*, Forest History Society, no place 1992, pp. 123-143. On removals of indigenous people from parks, see Colchester, “Forest Peoples and Sustainability”, Colchester, Lohmann, *The Struggle for Land* cit., pp. 61-95; T. Ranger, “Whose Heritage? The Case of the Matobo National Park”, in *JSAS*, 15, 1989, pp. 217-249; E. Kreike, *Re-creating Eden: Land Use, Environment, and Society in Southern Angola and Northern Namibia*, Heinemann, Portsmouth, New Hampshire 2004, pp. 129-154; Merchant, *Reinventing Eden* cit., pp. 152-154.

⁹ For conventional forestry see F. Wiersum, *Social Forestry: Changing Perspectives in Forest Science or Practice?*, Wageningen Agricultural University, Wageningen 1999, pp. 27-36, 54-60; M. Williams, *Deforesting the Earth: From Prehistory to Global Crisis*, University of Chicago Press, Chicago 2003, pp. 145-168, 242-275, 383-419; R. Guha, *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya*, University of California Press, Berkeley 1989, pp. 35-61; N. L.

source of timber hardwoods.¹⁰ In contrast, other woodlands that did not contain desirable timber stands were typically 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.¹¹ In practice, however, colonial and postcolonial states frequently lacked the capacity, the coherence, or the will to enforce their own conservation regulations or to rationally exploit the forest and other environmental resources, especially when they were met by fierce resistance from populations relying heavily on forest access.¹²

The Declinist Paradigm

The declinist paradigm construed human interference in pristine Nature as a disturbance typically resulting in a downward spiraling process of environmental degradation that might ultimately lead to the destruction of ecosystem Earth.¹³ Some authors have empha-

Peluso, *Rich Forests, Poor People: Resource Control and Resistance in Java*, University of California Press, Berkeley 1994 [1992], pp. 44-160.

¹⁰ P.B. Tomlinson, M. H. Zimmermann (eds), *Tropical Trees as Living Systems*, CUP, Cambridge 1978, focuses on the tropical rain forest.

¹¹ See G. Budowski, "Perceptions of Deforestation in Tropical America: The Last 50 Years", in Steen, Tucker, *Changing Tropical Forest* cit., p. 1; R.P. Tucker, "The Depletion of India's Forests under British Imperialism: Planters, Foresters and Peasants in Assam and Kerala", in Worster, *The Ends of the Earth*, cit., pp. 118-140; 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 Agricultural University Tropical Resource Management Papers, Wageningen 1994, p. 10.

¹² See D. Anderson, "Managing the Forest: The Conservation History of Lembus, Kenya, 1904-63", Anderson, Grove, *Conservation in Africa* cit., pp. 249-268; Guha, *The Unquiet Woods* cit.; Peluso, *Rich Forests* cit.; J.M. MacKenzie, "Experts and Amateurs: Tsetse, Nagana and Sleeping Sickness in East and Central Africa", in MacKenzie, *Imperialism and the Natural World* cit., pp. 187-213.

¹³ A seminal book was R. Carson, *Silent Spring*, Houghton Mifflin, New York 1994 [1962]. Also very influential was D. Worster, *Dust Bowl: The Southern Plains in the 1930s*, OUP, Oxford 1982 [1979]. For global perspectives, see, for example, J. Westoby, *Introduction to World Forestry*, Basil Blackwell, Oxford and New York 1989;

sized the continuity between the modernist and declinist paradigms: both highlight the danger of environmental decline.¹⁴ The declinist paradigm, however, differs fundamentally from the modernization paradigm in that it identifies (western) modernity itself as the major cause of environmental decline.¹⁵ 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.¹⁶ Many historians focusing on environmental and/or agricultural change in the non-western world have written from a declinist perspective. Often, declinists explicitly or implicitly portray pre-contact non-western environments as suspended in a state of (pristine) Nature, and pre-contact societies as living in harmony with Nature. Declinists argue that the modern western economy (including capitalism, market forces, commodification of environmental resources and labor) caused overexploitation (of timber or such game animals as elephant, tiger, beaver, or bison) or the diversion of precious land and labor away from food production and local resource management, resulting in environmental and general collapse.¹⁷ The introduction of commercial crops or livestock also led

S.C. Chew, *World Ecological Degradation: Accumulation, Urbanization, and Deforestation, 3,000 BC-AD 2000*, Alatomira Press, Walnut Creek 2001; Williams, *Deforesting the Earth* cit.; N. Myers, *Deforestation Rates in Tropical Forests and their Climatic Implications*, Friends of the Earth Trust, London, 1991 [1989]; C. J. Jepma, *Tropical Deforestation: A Socio-Economic Approach*, Earthscan, London 1995. For a history of the declinist paradigm, see Merchant, *Reinventing Eden* cit., pp. 187-203.

¹⁴ J. Fairhead, M. Leach, *Reframing Deforestation: Global Analysis and Local Realities: Studies in West Africa*, Routledge, London and New York 1998, pp. 172-173; Peluso, *Rich Forests* cit., pp. 44-160.

¹⁵ See, for example, D. Worster, "Introduction", in Worster, *Ends of the Earth* cit., pp. 4-5; S. Pyne, *World Fire: The Culture of Fire on Earth*, University of Washington Press, Seattle, Washington 1997 [1995].

¹⁶ T.R. Malthus, *An Essay on the Principle of Population*, D. Winch (ed.), CUP, Cambridge 1992; P. Ehrlich, *The Population Bomb*, Ballantine, New York 1968; P. Ehrlich, A.H. Ehrlich, *The Population Explosion*, Simon and Schuster, New York 1990.

¹⁷ See, for example, R. Palmer, N. Parsons (eds), *The Roots of Rural Poverty in*

to the clearing of forest and bush land. Some of the crops, such as coffee and cotton, caused soil erosion.¹⁸ Colonizers also introduced modern agriculture in the form of large-scale commercial plantations for crops and trees, and, where lands were suitable for European settlement, through the immigration of white farmers. Colonial administrations typically allocated prime agricultural lands to white settlers or metropolitan companies, transforming the local populations into squatters or removing them to marginal lands.¹⁹ A related argument stresses structural imbalances in access to land and other resources as the underlying cause for deforestation: a small elite that controlled the arable land pushed poor, landless farmers into the forest wildernesses.²⁰

A political ecology focus within the declinist perspective emphasized how the modern colonial and postcolonial states sought to control – especially through conservation – not only Nature but also how

Central and Southern Africa, University of California Press, Berkeley 1977; S. Pyne, *Vestal Fire: An Environmental History Told through Fire of Europe and Europe's Encounter with the World*, University of Washington Press, Seattle, Washington 1997; R. Marks, *Tigers, Rice, and Salt: Environment and Economy in Late Imperial South China*, CUP, Cambridge 1998, pp. 38-40; B.L. Walker, *The Conquest of Ainu Lands: Ecology and Culture in Japanese Expansion, 1590-1800*, University of California Press, Berkeley 2001; W. Dean, *With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest*, University of California Press, Berkeley 1997 [1995].

¹⁸ See, for example, C. Geertz, *Agricultural Involvement: The Processes of Environmental Change in Indonesia*, University of California Press, Berkeley 1963; S. Stein, *Vassouras: A Brazilian Coffee County, 1850-1900: The Roles of Planter and Slave in a Plantation Society*, PUP, Princeton, New Jersey 1985; A. Isaacman, R. Roberts (eds), *Cotton, Colonialism, and Social History in Sub-Saharan Africa*, Heinemann, Portsmouth, New Hampshire 1995.

¹⁹ See, for example, W. Beinart, P. Delius, S. Trapido (eds), *Putting a Plough to the Ground: Accumulation and Dispossession in Rural South Africa, 1850-1930*, Ravan Press, Johannesburg 1986; C. Bundy, *Rise and Fall of the South African Peasantry*, Heinemann, London 1979; Arnold, *The Problem of Nature* cit., pp. 119-168; T. Dunlap, *Nature and the English Diaspora: Environment and History in the United States, Canada, Australia, and New Zealand*, CUP, Cambridge 1999.

²⁰ See Colchester, Lohmann, *The Struggle for Land* cit., pp. 1-60, 99-163. On land conflict, see, for example, W. Durham, *Scarcity and Survival in Central America: Ecological Origins of the Soccer War*, Stanford University Press, Stanford 1979.

the local indigenous population used and managed environmental resources. Colonial administrators turned forests into reserves to facilitate their scientific exploitation; gazetted game reserves and national parks to protect wildlife; brought upper water catchments under government stewardship; and imposed draconian punishment to suppress indigenous burning regimes.²¹ Although these measures proved difficult to enforce, especially in combination with seeking to destroy or modify indigenous administrative institutions and environmental management practices, they nevertheless restricted local populations' access to important environmental resources (e.g., game meat, forest products, forages and grazing) and led to the erosion of indigenous environmental resource management, including practices that had previously contained the spread and impact of the trypanosomiasis-carrying tsetse fly in Africa.²² For example, during the 1930s, fearing the collapse of African food production systems under the strain of environmental change and population pressure – which, incidentally, was largely caused by economic, political, and conservation colonial policies – the colonial state introduced soil conservation projects (terracing and contour ploughing) throughout rural Africa. These projects, however, often exacerbated matters given the required extra labor investment, although the full weight of such policies was only felt after World War II.²³

²¹ See Anderson, Grove, *Conservation in Africa* cit., pp. 1-39; Grove, *Green Imperialism* cit.; W. Beinart, "Soil Erosion, Conservationism, and Ideas about Development: A Southern African Exploration, 1900-1960", in *JSAS*, 11, 1984, pp. 52-83; Pyne, *Vestal Fire* cit.; Guha, *The Unquiet Woods* cit.; Peluso, *Rich Forests* cit..

²² H. Kjekhus, *Ecology Control and Economic Development in East African History: The Case of Tanganyika, 1850-1950*, Heinemann, London 1977; J. L. Giblin, "The Precolonial Politics of Disease Control in the Lowlands of Northeastern Tanzania", in G. Maddox, J. Giblin, I.N. Kimambo, *Custodians of the Land: Ecology and Culture in the History of Tanzania*, James Currey, London 1996, pp. 127-151. On the limits of colonial policies, see also R. Grove, "Colonial Conservation, Ecological Hegemony and Popular Resistance: Towards a Global Synthesis", in MacKenzie, *Imperialism and the Natural World* cit., pp. 15-50.

²³ W. Beinart, C. Bundy, *Hidden Struggles in Rural South Africa: Politics and Popular Movements in the Transkei and the Eastern Cape, 1890-1930*, James Currey, London 1987; K. B. Showers, *Imperial Gullies: Soil Erosion and Conservation*

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, and sheep in the Americas, rinderpest and lung sickness in Africa, and rabbits in Australia. Some authors have emphasized that colonialism or, more recently, globalization multiplied the impact of both invading and indigenous microbes because it weakened or destroyed pre-existing environmental-management arrangements.²⁴ Often, as in the modernization paradigm, declinists depict the scenario in terms of a pre-contact ecological balance.²⁵

in Lesotho, Ohio University Press, Athens 2005; *Journal of Southern African Studies*, 15, 1989, Special Issue on Conservation in southern Africa.

²⁴ See A. Crosby, *Ecological Imperialism and the Biological Expansion of Europe, 900-1900*, CUP, Cambridge 2000 [1986]; D. Grinde, B. Johansen, *Ecocide of Native America: Environmental Destruction of Indian Lands and Peoples*, Clear Light, Santa Fe, New Mexico, 1995; E. Fenn, *Pox Americana: The Great Smallpox Epidemic of 1775-1782*, Hill and Wang, New York 2001; E. Melville, *Plague of Sheep*, CUP, Cambridge 1997 [1994]; Kjekhus, *Ecology Control* cit.; J. Giblin, “Trypanosomiasis Control in African History: An Evaded Issue?”, in *Journal of African History*, 31, 1990, pp. 59-80; M. Lyons, *The Colonial Disease: A Social History of Sleeping Sickness in Northern Zaire, 1900-1940*, CUP, Cambridge 1992; E. Rolls, *They All Ran Wild: The Animals and Plants that Plague Australia*, Angus and Robertson, London 1984 [1969].

²⁵ R. Headrick, *Colonialism, Health and Illness in French Equatorial Africa, 1885-1932*, edited by D.R. Headrick, ASA Press, Atlanta, Georgia 1994. Kjekhus attributes epidemic sleeping sickness to “ecological imbalances” associated with colonialism, Kjekhus, *Ecology Control* cit., p. 166. Brook, Webb, Johnson and Anderson, and Mandala show that desiccation, drought, and famine also occurred in pre-colonial Africa, implying that a general ecological balance did not exist. See D.H. Johnson, D.M. Anderson (eds), *The Ecology of Survival: Case Studies from Northeast African History*, Lester Crook Academic Publishing, London 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; G.E. Brooks, *Landlords and Strangers: Ecology, Society, and Trade in West Africa*, Westview Press, Boulder, Colorado 1993; J.L.A. Webb, *Desert Frontier: Ecological and Economic Change along the Western Sabel, 1600-1850*, University of Wisconsin Press, Madison, Wisconsin 1995; E.C. Mandala, *Work and Control in a Peasant Economy: A History of the Lower Tchiri Valley in Malawi, 1859-1960*, University of Wisconsin Press, Madison, Wisconsin 1990, pp. 15-97.

Although declinist analysis identified modernity as the main culprit of environmental destruction, the practice of conservationist intervention often meant that officials urged or even forced indigenous communities to change their environmental management and use strategies. Declinists sometimes admired indigenous knowledge and technology, but regarded it as traditional and static, and thus unable to cope with the new challenges brought by the modern economy and population growth.²⁶ A series of devastating droughts in Africa in the 1970s and 1980s, and the notion that the tropical rain forests of Africa, Latin America, and Southeast Asia constituted the last and most prized remnants of pristine Nature, added a sense of urgency paving the way for radical interventions.²⁷

To counter deforestation, western experts introduced agroforestry and social forestry projects in Africa, Asia and Latin America. The goal of these projects was the afforestation of lands outside the protected forests. Attention to people and their social networks, and to forests and trees outside the formally declared forests, however, was instrumental. Because the practice of protecting existing for-

²⁶ Richards noted that colonial officials discovered indigenous knowledge before World War II; during the war, however, the paradigm shifted to state-led scientific approaches, Richards, *Indigenous Agricultural Revolution* cit., 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", in Colchester, Lohmann, *The Struggle for Land* cit., pp. 61-95. On the view that indigenous knowledge is outdated, see H.N. Le Houérou, *The Grazing Land Ecosystems of the African Sahel*, Springer-Verlag, Berlin and New York 1989, p. 63; H.N. Le Houérou (ed.), *Browse in Africa: The Current State of Knowledge*, ICLA, Addis Ababa 1980, pp. 485-486; L. Núñez, M. Grosjean, "Biodiversity and Human Impact During the Last 11,000 Years in North-Central Chile", in G.A. Bradshaw, P.A. Marquet (eds), *How Landscapes Change: Human Disturbance and Ecosystem Fragmentation in the Americas*, Springer Verlag, Berlin 2003, pp. 7-17.

²⁷ On desertification, see Bassett, Crumme, *African Savannas* cit., pp. 15-17, and J. Swift, "Desertification: Narratives, Winners & Losers", in M. Leach, R. Mearns (eds), *The Lie of the Land: Challenging Received Wisdom on the African Environment*, IAI & James Currey, Oxford 1996, pp. 73-90. On shifting cultivators as deforesters, see Myers, *Deforestation Rates* cit., pp. 4-5, 30, 45-48, and Jepma, *Tropical Deforestation* cit., pp. 17-21, 104-109.

ests from human intrusion was considered to be a failure, foresters sought to grow new forests in order to provide an alternative source for fuel wood and other products that local populations had previously gathered in the native forests.²⁸

In Africa, the communal woodlot approach met with little success, an outcome that in the late 1970s and early 1980s contributed to increase attention to the role of on-farm trees and farmers in agroforestry and social-forestry research and projects. This micro focus, however, was short-lived. After farm-level projects appeared to favor men over women and the wealthy over the poor, the pendulum swung back to a macro level of analysis in the 1980s and the early 1990s. Moreover, fuel wood did not emerge as a key issue for farmers.²⁹ Instead, multi-purpose trees took center stage in agroforestry and social forestry, with an emphasis on the ability of trees, especially “miracle trees” such as *Leucanea leucocephala*, to enhance and maintain soil fertility and agricultural production.³⁰ The interest of the state, particularly forestry departments’ interventions in extra-forest agroforestry, social forestry,

²⁸ On agroforestry and social forestry, see K.F.S. King, “The History of Agroforestry”, and P.K.R. Nair, “Agroforestry Defined”, in P.K.R. Nair (ed.), *Agroforestry Systems in the Tropics*, Kluwer, Dordrecht 1989, pp. 3-11 and 14-18, respectively; M. Hobley, *Participatory Forestry: The Process of Change in India and Nepal*, ODI, London 1996, pp. 56, 66-81; and Wiersum, *Social Forestry* cit., pp. 54-81, 166-170.

²⁹ Wiersum, *Social Forestry* cit., pp. 1, 3, 62-67; K.F. Wiersum, G.A. Persoon, “Research on Conservation and Management of Tropical Forests: Contributions from Social Sciences in the Netherlands”, in K.F. Wiersum (ed.), *Tropical Forest Resource Dynamics and Conservation: From Local to Global Issues*, Wageningen Agricultural University, Wageningen 2000, pp. 3-4; G. Leach, R. Mearns, *Beyond the Fuelwood Crisis: People, Land, and Trees in Africa*, Earthscan, London 1988, pp. 23-40; R.A. Schroeder, “Shady Practice: Gender and the Political Ecology of Resource Stabilization in the Gambian Garden/Orchards”, in *Economic Geography*, 69, 1993, pp. 349-365. On the failure of communal woodlots, see Leach, Mearns, *Beyond the Fuelwood Crisis* cit., pp. 66-67, and P. Kerckhof, *Agroforestry in Africa: A Survey of Project Experience*, The Panos Institute, London 1990, pp. 87-111.

³⁰ On the exaggerated wood fuel crisis and the association of forestry with agriculture, see Leach, Mearns, *Beyond the Fuelwood Crisis* cit., pp. 23-40. On trees and soil fertility, see A. Young, *Agroforestry for Soil Management*, CAB International, Wallingford, U.K. 1997 [1989], and P. Huxley, *Tropical Agroforestry*, Blackwell Science, Oxford 1999, p. 280.

and community forestry, was partly driven by forestry imperialism legitimated in the name of conservation and rural development.³¹

The Inclinst Paradigm

In contrast to the pessimistic outlook of the declinists, and similarly to the modernisers, the inclinists were optimistic about humans' ability to mitigate the environmental cost of environmental change.³² In the mid-1990s, 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.³³ A major departure from the modernization paradigm, however, was that the optimism derived not from a belief in western science, but from confidence in the dynamic potential of indigenous knowledge.³⁴

³¹ See, for example, J. van den Bergh, "Diverging Perceptions on the Forest: Bulu Forest Tenure and the 1994 Cameroon Forest Law", in Wiersum, *Tropical Forest Resource Dynamics* cit., pp. 25-36; Fairhead, Leach, *Reframing Deforestation* cit., p. 170. See also Guha, *The Unquiet Woods* cit., pp. 44-45. The forest services of Indonesia and Thailand control 74 percent and 40 percent respectively of the national territories, M. Colchester, "Forest Peoples and Sustainability", in Colchester, Lohmann, *The Struggle for Land* cit., p. 75.

³² Bassett, Crummey, *African Savannas* cit., pp. 1-4. Henkemann, Persoon, and Wiersum identify an emerging paradigm that stresses the human capacity for innovation, A.B. Henkemann, G.A. Persoon, F.K. Wiersum, "Landscape Transformations of Pioneer Shifting Cultivators at the Forest Fringe", in Wiersum, *Tropical Forest Resource Dynamics* cit., p. 55. See also Fairhead, Leach, *Reframing Deforestation* cit., p. 191.

³³ This argument was first made in Fairhead, Leach, *Misreading the African Landscape* cit., pp. 55-85. Fairhead and Leach extended the argument to other West African countries in their *Reframing Deforestation* cit.

³⁴ Richards, *Indigenous Agricultural Revolution* cit., pp. 12, 70-72, 84-85, 128-139, 151-152, 155; Leach, Mearns, *Beyond the Fuelwood Crisis* cit., pp. 26-40; Fairhead, Leach, *Misreading the African Landscape* cit. On the dynamism of African farmers/peasants, see also Berry, *No Condition is Permanent* cit., pp. 49-52; M. Tiffen, M. Mortimore, F. Gichuki, *More People, Less Erosion: Environmental Recovery in Kenya*, John Wiley and Sons, Chichester 1994, pp. 226-245; V. Mazzucato, D. Niemeijer, *Rethinking Soil and Water Conservation in a Changing*

An important second root of inclinist revisionism stemmed from the rejection of the declinists' alarmist claims, which were based on the use of prejudicial colonial information and contemporary data that were estimates at best. In his highly influential 1989 study *Deforestation Rates*, Myers predicted that little forest would be left by the end of the 20th century. His prediction, however, has not come true, although deforestation continues to be a major concern. Williams notes that the statistics for deforestation between 1976 and 1998 were based on only two sets of primary sources, which were themselves estimates: a FAO/UNDP analysis partly relying on satellite data, and Myers' study, which was based on Myers' and others' experience.³⁵ 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.³⁶

In the inclinist paradigm, indigenous knowledge about and in-

Society: A Case Study in Eastern Burkina Faso, Wageningen University Tropical Resource Management Papers, Wageningen 2000.

³⁵ See Leach, Mearns, *Beyond the Fuelwood Crisis* cit., pp. 1-9; Fairhead, Leach, *Misreading the African Landscape* cit., pp. 1-85, 121-136, 182-197, 237-278; J.C. McCann, *Green Land, Brown Land, Black Land: An Environmental History of Africa, 1800-1990*, Heinemann, Portsmouth 1999, pp. 79-107; Bassett, Crummey, *African Savannas* cit., pp. 4-15, 24; M.P. Lehman, "Deforestation and Changing Land Use Patterns in Costa Rica", in Steen, Tucker, *Changing Tropical Forest* cit., 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 (pp. 40-57), M.P. Lehman (pp. 58-76), E. Graham, M. Prendergast (pp. 102-109), and W. Balée (pp. 185-197). See Myers, *Deforestation Rate* cit., p. 4, and Williams, *Deforesting the Earth* cit., pp. 477-479 and 453-457.

³⁶ E. Boserup, *Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*, Aldine, New York 1965; P. Pingali, Y. Bigot, H. P. Binswanger, *Agricultural Mechanization and the Evolution of Farming Systems in Sub-Saharan Africa*, The Johns Hopkins University Press, Washington 1987. See also Leach, Mearns, *Beyond the Fuelwood Crisis* cit., pp. 1, 53; Tiffen, Mortimore, Gichuki, *More People, Less Erosion* cit.; and S.F. Siebert, "Beyond Malthus and Perverse Incentives: Economic Globalization, Forest Conversion and Habitat Fragmentation", in G.A. Bradshaw, P. A. Marquet (eds), *How Landscapes Change: Human Disturbance and Ecosystem Fragmentation in the Americas*, Springer Verlag, Berlin 2003, p. 29.

indigenous management and use of forest resources takes center stage as a point of departure for research and intervention.³⁷ The definition of what constituted “forest” was further expanded to include the dry forests (including the *miombo* expanses of Africa) and the woodlands, which support much larger populations than the rainforests.³⁸ Inclonists consider indigenous populations not as an environmental threat, but as a critical part of the solution.³⁹ Social forestry included transferring “forest” management from the state to local communities, although in practice officials and scientists overwhelmingly proved incapable or unwilling to relinquish real control over conservation areas and experiments.⁴⁰ N. Sundan, for example, was critical

³⁷ Leach, Mearns, *Beyond the Fuelwood Crisis* cit., pp. 23-40. Franzel et al. emphasize the importance of building on Indigenous Technical Knowledge (ITK), S. Franzel, P. Cooper, G.L. Denning, D. Eade (eds), *Development and Agroforestry: Scaling up the Impacts of Research*, Oxfam, Oxford 2002, see especially the contributions by G.L. Denning (pp. 1-14), J. Hagggar et al. (pp. 15-23), J.C. Weber et al. (pp. 24-34), and C. Wambugu et al. (pp. 107-166). See also W. Balée, “Indigenous History and Amazonian Biodiversity”, in Steen, Tucker, *Changing Tropical Forest* cit., pp. 185-197.

³⁸ See Westoby, *Introduction to World Forestry* cit., pp. 147, 169-170. On the *miombo* woodlands, see B. Campbell (ed.), *The Miombo in Transition: Woodlands and Welfare in Africa*, CIFOR, Bogor, Indonesia 1996.

³⁹ Several chapters in Franzel and Scherr underline the importance of on-farm participatory research with farmers but stress that the scientists need to remain in control, see S. Franzel et al., “Methods of Assessing Agroforestry Adoption Potential”, and S.J. Scherr, S. Franzel, “Promoting Agroforestry Technologies: Policy Lessons from On-Farm Research”, in S. Franzel, J. Scherr (eds), *Trees on the Farm: Assessing the Adoption Potential of Agroforestry Practices in Africa*, CABI, Wallingford, UK 2002, pp. 11-36 and 145-164, respectively.

⁴⁰ On indigenous farmers’ participation and its limits, see Leach, Mearns, *Beyond the Fuelwood Crisis* cit., pp. 230-231; G.L. Denning, “Realizing the Potential of Agroforestry: Integrating Research and Development to Achieve Greater Impact”; J. Hagggar 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 from the Peruvian Amazon”, and C. Wambugu et al., “Scaling Up the Use of Fodder Shrubs in Central Kenya”, in S. Franzel, P. Cooper, G.L. Denning, D. Eade (eds), *Development and Agroforestry: Scaling up the Impacts of Research*, Oxfam, Oxford 2002, pp. 1-14, 15-23, 24-34, and 107-116, respectively.

of joint state-local community forest management projects in India, asserting that the state continued to set the agenda and that the practice was not new; rather, it resembled colonial indirect rule, that is, forest management on the cheap.⁴¹

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-to-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 often irreversible.⁴² 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.⁴³

⁴¹ N. Sundan, "Unpacking the 'Joint' in Joint Forest Management", in Doornbos, South, White, *Forests: Nature, People, Power* cit., pp. 249-273, especially pp. 252, 258-259, 269. See also Peluso, *Rich Forests* cit., pp. 124-165; Hobley, *Participatory Forestry* cit., pp. 59-60, 80, 130, 139-157, 191-193, 244, 251, 259-260; Fairhead, Leach, *Reframing Deforestation* cit., pp. 192-193.

⁴² Merchant criticizes both the progressive (here: modernization) and declinist paradigms as linear and unidirectional, Merchant, *Reinventing Eden* cit., pp. 4, 6, 215. See also D.L. Pimentel, L. Westra, R.F. Noss (eds), *Ecological Integrity: Integrating Environment, Conservation, and Health*, Island Press, Washington 2000, pp. 7-8; P. Huxley, *Tropical Agroforestry* cit., p. 301.

⁴³ G.A. Bradshaw, P.A. Marquet, "Introduction", in Bradshaw, Marquet, *How Landscapes Change* cit., 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, Crummey, *African Savannas* cit., p. 5. 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", in *ibid.*, p. 51. In a declinist worldview, human environmental agency may give rise to a degree of misanthropy, E. Hargrove, "Foreword", in L. Westra, P.S. Wenz (eds), *Faces of Environmental Racism: Confronting Issues of Global Justice*, Rowman & Littlefield Publishers, Lanham, Maryland 1995, pp. x-xi.

These 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 them 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 class and gender into account.⁴⁴ The inclinist paradigm emphasizes the practices and knowledge of indigenous communities, for example ethnic groups, rather than individuals, because indigenous knowledge is seen as a collective body of knowledge.⁴⁵ 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.⁴⁶ Similarly, the fields of ecology, environmental studies, agriculture, and forestry analytically highlight ecosystems, plant communities, and taxonomic collectives; the lowest significant level of analysis comprises

⁴⁴ A. Nygren, "Development Discourses and Peasant-Forest Relations: Natural Resource Utilization as Social Process", in Doornbos, South, White, *Forests: Nature, People, Power* cit., p. 25.

⁴⁵ On the focus on collectives and collective bodies of knowledge, see, for example Wiersum, *Social Forestry* cit., 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 Agricultural University, Wageningen 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", in Wiersum, *Tropical Forest Resource Dynamics* cit., p. 38; Mazzucato, Niemeijer, *Rethinking Soil and Water Conservation* cit., 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* cit., p. xx and M. Wagner, "Environment, Community and History: 'Nature in the Mind' in Nineteenth Century and Early Twentieth Century Buha, Tanzania", in Maddox, Giblin, Kimambo, *Custodians of the Land* cit., p. 176.

⁴⁶ "Tribe" and "ethnic group" suggest primordality and homogeneity. For critiques see, L. Vail (ed.), *The Creation of Tribalism in Southern Africa*, Currey, London 1989, and R. White, *The Middle Ground: Indians, Empires, and Republics in the Great Lakes Region, 1650-1815*, CUP, Cambridge 1991, p. xiv.

the species and the subspecies, rather than the individual.⁴⁷ Moreover, traditional western science tends to atomize the collectivity, but analyses 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 as representative of a population, a tribe/ethnic group, or a race.⁴⁸ In short, individuals in human, animal, or plant families, species, and tribes are not appreciated for their unique qualities; rather, they are treated as though they constituted a core sample. Such thinking facilitates extrapolating the results of, for example, small trial plots to measure soil erosion, to larger areas, regions, or continents; a methodology that is problematic.⁴⁹

Finally, the paradigms are homogenous because they depict environmental change as a singular and undifferentiated process with a singular 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 signify reforestation to ecologists and foresters.⁵⁰

⁴⁷ The exception is pets, which are considered individuals, K. Thomas, *Man and the Natural World: Changing Attitudes in England, 1500-1800*, Oxford University Press, New York 1996 [1983], pp. 100-142. Grove stresses the non-western origins of the environmental and bio-sciences. 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* cit.

⁴⁸ Grove notes that the holistic outlook of modern environmentalism stresses the importance of the (eco)system over the individual so strongly that it may devalue the importance of a plant, an animal or a human as an individual, Grove, *Green Imperialism* cit., pp. xii-xiii.

⁴⁹ M. Stocking, "Measuring Land Degradation", in P. Blaikie, H. Brookfield, *Land Degradation and Society*, Methuen, London 1987, pp. 50-54 ; T.T. Kozlowski, P.J. Kramer, S. G. Pallardy, *The Physiological Ecology of Woody Plants*, Academic Press, San Diego 1991, pp.222, 236; and K.A. Longman, J. Jenik, *Tropical Forest and its Environment*, Longman, Burnt Mill, England 1987 [1974], p. 116.

⁵⁰ See Blaikie, Brookfield, *Land Degradation and Society* cit., pp. 4-7, 14-16. See also C.C. Gibson, M.A. McKean, E. Ostrom, "Explaining Deforestation: The Role

The Palenque Paradox

The modernization, declinist, and inclinist paradigms each offer important insights into the dynamics of environmental change. Because they are cast as being competing and mutually exclusive, however, these paradigms have created paradoxes about the process of environmental change. The first paradox is the presence of such remnants of urban settlements as, for example, the ruins of Palenque, Mexico, in pristine forest. The urban environment was and 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.⁵¹ The benchmark environment against which environmental change is assessed and measured is variously referred to as "wilderness", "Nature", "pristine Nature", "state of Nature/Natural state", "pre-contact environment" (indigenous Eden or people-Nature balances), or "vegetation climax".⁵² The defining characteristic is essentially the same: the absence of human action

of Local Institutions", in C.C. Gibson, M.A. McKean, E. Ostrom (eds), *People and Forests: Communities, Institutions, and Governance*, MIT Press, Cambridge, Massachusetts 2000, p. 2, and A. Holland, "Ecological Integrity and the Darwinian Paradigm", in Pimentel, Westra, Noss, *Ecological Integrity* cit., p. 55.

⁵¹ The classic study on the concept of wilderness is R. Nash, *Wilderness in the American Mind*, Yale University Press, New Haven 1982 [1967]. Cronon and White stress a Nature-Culture (urban-rural and wild-domesticated) continuum, see W. Cronon, *Nature's Metropolis: Chicago and the Great West*, W. W. Norton & Company, New York 1991, pp. 17-19, and R. White, *The Organic Machine: The Re-Making of the Columbia River*, Hill and Wang, New York, 2000 [1995], pp. 105-109. See also E. Kreike, "The Palenque Paradox: Bush Cities, Bushmen, and the Bush", in A.C. Isenberg (ed.), *The Nature of Cities: Culture, Landscape, and Urban Space*, University of Rochester Press, Rochester, New York 2006, pp. 159-174.

⁵² P. Blaikie and H. Brookfield, for example, posit an Edenic point of departure; see Blaikie, Brookfield, *Land Degradation and Society* cit., p. xx. On discomfort with the climax concept, see Longman, Jeník, *Tropical Forest* cit., pp. 13-14, 20-21, 25; T.T. Kozłowski, P.J. Kramer, S. G. Pallardy, *The Physiological Ecology of Woody Plants*, Academic Press, San Diego 1991, p. 100; Pimentel, Westra, Noss, *Ecological Integrity* cit., pp. 12-13, and L. Westra et al., "Ecological Integrity and the Aims of the

in shaping the environment. As humans affect 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 for the better, depending on the paradigm). For example, until recently conventional wisdom maintained that “indigenous” people who live by Nature as hunter-gatherers do not shape their environment. At the turn of the 20th century, however, the impact of indigenous peoples on the environment became hotly debated.⁵³

Indeed, the very idea of assessing and measuring environmental change along a Nature-Culture gradient with Nature as the point of departure created 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 those of the proverbial last Wilderness Continent, Africa, contain such “lost cities” such as, for example, Palenque in Mexico’s rainforest and Thulamela in South Africa’s Kruger National Park.⁵⁴

Global Integrity Project”, in *ibid.*, pp. 19-41. For a critical overview, see Fairhead, Leach, *Reframing Deforestation* *cit.*, pp. 10-11, 20, 24, 164-166.

⁵³ For hunting-gatherers as living 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, I. DeVore (eds), *Man the Hunter*, Aldine Pub. Co., Chicago 1968, pp. 30-43. For critiques of the concept of a pre-modern human-nature balance, see S. Krech III, *The Ecological Indian: Myth and History*, WW Norton, New York, 1999; A.C. Isenberg, *The Destruction of the Bison*, CUP, Cambridge 2000; J.D. Wingerd, “Interactions between Demographic Processes and Soil Resources”, in S.L. Fedick (ed.), *The Managed Mosaic: Ancient Maya Agriculture and Resource Use*, University of Utah Press, Salt Lake City 1996, pp. 207-235, and M.J. MacLeod, “Exploitation of Natural Resources in Colonial Central America: Indian and Spanish Approaches”, in Steen, Tucker, *Changing Tropical Forests* *cit.*, pp. 31-39.

⁵⁴ On Palenque, see G.S. Stuart, G. E. Stuart, *Lost Kingdoms of the Maya*, The Society, Washington D.C. 1993, pp. 19, 31, and V. Perera, R.D. Bruce, *The Last Lords of Palenque: The Lacandon Indians of the Mexican Rainforest*, University of California Press, Berkeley 1985 [1982], pp. 10-26. On Thulamela, see P. Davidson, “Museums and the Reshaping of Memory”, in S. Nuttall, C. Coetzee (eds), *Negotiating the Past: The Making of Memory in South Africa*, Oxford University

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.⁵⁵ In addition, Palenque, Thulamela, Great Zimbabwe and the other lost cities were not isolated anomalies in an otherwise pristine wilderness: the impact on 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.⁵⁶ 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.⁵⁷ That archeological research long has been biased towards excavating temples and palaces has resulted in a dearth of data about the daily activities of urban inhabitants, including environmental resource use and the size of the populations of the urban centers and their hinterlands.⁵⁸ The lost cities in the African, the Central and Latin American, and the

Press, Oxford 1999 (1998), pp. 150-151. On Africa as the last wilderness, see J.S. Adams, T.O. McShane, *The Myth of Wild Africa: Conservation without Illusion*, University of California Press, Berkeley 1996 [1992], chapter 1.

⁵⁵ On the Meso-American ruins, see L.V. Foster, *A Brief History of Central America*, Facts on File, New York 2000, pp. 20-21. On Great Zimbabwe, see M. Hall, *The Changing Past: Farmers, Kings, and Traders in Southern Africa, 200-1860*, D. Philip, Cape Town 1987, pp. 91-116.

⁵⁶ Hall, *The Changing Past* cit., pp. 91-116.

⁵⁷ B.J. Meggers, "Natural Versus Anthropogenic Sources of Amazonian Biodiversity: The Continuing Quest for El Dorado", in Bradshaw, Marquet, *How Landscapes Change* cit., pp. 89-107, and Cronon, *Nature's Metropolis* cit., pp. 17-19.

⁵⁸ E. Graham, D.M. Prendergast, "Maya Urbanism and Ecological Change", in Steen, Tucker, *Changing Tropical Forests* cit., pp. 102-109, and G.S. Stuart, G.E. Stuart, *Lost Kingdoms of the Maya* cit., p. 32. See also W.A. Hartland, "Maya Settlement Patterns: A Critical Review", in E. Wyllys Andrews IV et al. (eds), *Archaeological Studies in Middle America*, Middle American Research Institute, Tulane University, New Orleans

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 comprising up to 13,500 hectare. Historic Angkor Wat in Cambodia relied on distant stone quarries 20 miles away and the upkeep of just one of its many temples was the responsibility of over 3,000 villages.⁵⁹

Even before the 20th century, the primordial forest and woodland of much of the Americas, Southeast Asia, and Africa were heavily shaped by human use. The forests that hide the Maya ruins may be no more than 400 years old and 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, which 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.⁶⁰ Likewise, Africa's "wild"

1970, p. 37, and N.P. Dunning, "A Reexamination of Regional Variability in the Pre-Hispanic Agricultural Landscape", in Fedick, *The Managed Mosaic* cit., pp. 53-91.

⁵⁹ On the Maya, see E. Graham and D.M. Prendergast, "Maya Urbanism and Ecological Change", in Steen and Tucker, *Changing Tropical Forests* cit., pp. 102-109 and P.S. Dunham, "Resource Exploitation and Exchange among the Classic Maya", in Fedick, *The Managed Mosaic* cit., 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", in L.E. Sponsel, T.N. Headland, R. Baily (eds), *Tropical Deforestation: The Human Dimension*, Columbia University Press, New York 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*, CUP, Cambridge 1989, pp. 333, 339-340. On the Andean forests, see D.W. Gade, *Nature and Culture in the Andes*, University of Wisconsin Press, Madison 1999, p. 52. In general, see also P. Crabbé, "A Complex Systems Approach to Urban Ecosystem Integrity: The Benefit Side", in Pimentel, Westra, Noss, *Ecological Integrity* cit., pp. 317-333.

⁶⁰ On the Maya, see B.W. Leyden, M. Brenner, T. Whitmore, J.H. Curtis,

landscapes are arguably human creations: for example, the West African forest islands, which Fairhead and Leach studied, were human-made, and the extensive *miombo* woodlands of eastern and southern Africa have been modified by human use. Indeed, Adams and McShane assert that the whole idea of “Wild Africa” is a myth.⁶¹

National parks and reserves were often portrayed as sanctuaries of pristine wilderness; the Kruger Park, for example, was long advertised

D.R. Piperno, B.H. Dahlin, “A Record of Long – and Short – Term Variation from Northwest Yucatán: Cenote San José Culchacá”, and J.D. Wingard, “Interactions between Demographic Processes and Soil Resources in the Copán Valley, Honduras, in Fedick, *The Managed Mosaic* cit., pp. 30-49 and pp. 207-235, respectively. For similar arguments regarding Northern Mexico and the Amazon, see J.B. Alcorn, “Huastec Noncrop Resource Management: Implications for Prehistoric Rain Forest Management”, in *Human Ecology*, 9, 4, 1981, pp. 395-417, and C.D. Becker, R. Léon, “Indigenous Forest Management in the Bolivian Amazon: Lessons from the Yuracaré People”, in C.C. Gibson, M.A. McKean, E. Ostrom (eds), *People and Forests: Communities, Institutions, and Governance*, MIT Press, Cambridge, Mass. 2000, pp. 163-191. On Suriname, see P. Boomgaard, “Exploitation and Management of the Surinam Forests, 1600-1975”, in Steen, Tucker, *Changing Tropical Forest* cit., pp. 252-264. On the US, see W. J. McShea, W.M. Healy (eds), *Oak Forest Ecosystems: Ecology and Management for Wildlife*, The Johns Hopkins University Press, Baltimore 2002, pp. 4-5, 13-33, 34-45, 46-59, 60-79. On Srwijaya, see J.A. McNeely, “Foreword”, in Sponsel, Headland, Baily, *Tropical Deforestation* cit., pp. xv-xvii. On Borneo, H. Knapen, *Forests of Fortune? The Environmental History of Southeast Borneo, 1600-1880*, KITLV Press, Leiden 2001, pp. 189-281. See also S. Rietbergen (ed.), *The Reader on Tropical Forestry*, Earthscan, London: 1993, pp. 1-2; S.G. Boyce, *Landscape Forestry*, J. Wiley, New York 1995, p. vii; L.E. Sponsel, T.N. Headland, R. Baily, “Anthropological Perspectives on the Causes, Consequences, and Solutions of Deforestation”, in Sponsel, Headland, Baily, *Tropical Deforestation* cit., pp. 7-8; Longman, Jeník, *Tropical Forest and its Environment* cit., pp. 13-14, 24, and 27.

⁶¹ On Africa, see Adams, McShane, *The Myth of Wild Africa* cit., pp. 1-13; McCann, *Green Land, Brown Land* cit, p. 2; G. Sheperd, E. Shanks, M. Hopley, “Management of Tropical and Subtropical Dry Forests”, in S. Rietbergen (ed.), *The Earthscan Reader on Tropical Forestry*, Earthscan, London 1993, pp. 107 and 112; Fairhead, Leach, *Reframing Deforestation* cit.; S. Berry, *Cocoa, Custom, and Socio-Economic Change in Rural Western Nigeria*, Clarendon Press, Oxford 1975, p. 66; Webb, *Desert Frontier* cit., p. 3; Campbell, *The Miombo in Transition* cit., pp. 1-3; Kreike, *Re-creating Eden* cit., especially chapters 1-4; J. Ford, *The Role of Trypanosomiasis in African Ecology*, Clarendon Press, Oxford 1971; Kjekhus, *Ecology Control* cit..

as an African Eden. 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.⁶² This phenomenon was not confined to Africa; clearing out populations and denying them access to forest reserves and other conservation areas has been marked, especially in Asia, by fierce resistance, frequently making conservation at best precarious.⁶³

Similarly, ecological (and agricultural) research stations often turned out not to be the primordial wilderness sites they had previously been presumed to be. 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.⁶⁴ The realization that these areas do not constitute undisturbed sites approaching the state of Nature or a natural climax was critical, because much of the longer-term and in-depth 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 to extrapolate scenarios about tropical ecology in general.⁶⁵

Examples of non-unilinear environmental change, with eras of deforestation followed by reforestation, and sometimes back again, abound. The waxing and waning of forests characterized, for exam-

⁶² See Carruthers, *The Kruger Park* cit.; J. Stevinson-Hamilton, *South African Eden: The Kruger National Park, 1902-1946*, Struik, Cape Town 1993 [1937]; B. de Villiers, *Land Claims and National Parks: The Makuleke Experience*, Human Sciences Research Council, Pretoria 1999. For East Africa, see R.P. Neumann, *Imposing Wilderness: Struggles over Livelihood and Nature Preservation in Africa*, University of California Press, Berkeley 2000 [1998].

⁶³ Guha, *The Unquiet Woods* cit., and Peluso, *Rich Forests* cit.

⁶⁴ On Kibale, see C.A. Chapman, L.J. Chapman, "Mid-Elevation Forests: A History of Disturbance", in T.R. McClanahan, and T.P. Young (eds), *East African Ecosystems and their Conservation*, OUP, New York 1996, pp. 385-400. On Pobé, see Fairhead, Leach, *Reframing Deforestation* cit., 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", in Steen, Tucker, *Changing Tropical Forests* cit., pp. 47-48.

⁶⁵ On the use of La Selva data, see Longman, Jeník, *Tropical Forest and its Environment* cit., p. 230.

ple, Ghana (forest clearing between 1000-1600 and again in the 1900s), the Ethiopian Highlands, the *miombo* of eastern and southern Africa with expansion and contraction spanning at least the last 22,000 years, and the forests of the Midwestern and Eastern United States (where oak forests repeatedly have expanded and contracted during the last 10,000 years).⁶⁶ But it was not simply 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. Similarly, San and Ovambo hunters and herdsman during the early 1900s used fire to manage the Sandveld east of the Ovambo floodplain in northern Namibia, a proverbial last wilderness in the history of southern Africa. The result was an open landscape with the fire-resistant *Pterocarpus angolensis* (Transvaal teak) tree as one of the principal species. Fire-suppression during the 20th century, however, led to forest re-growth. In the Namibian Sandveld, the vegetation became denser. In the United States, such fire-sensitive species as red maple and sugar maple replaced oak and, moreover, forest was and is encroaching on what used to be savannah or 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 World War II, but two thirds of its mountain forests are industrial monoculture forests.⁶⁷ Processes of afforestation that do not directly

⁶⁶ On Ghana, Fairhead, Leach, *Reframing Deforestation* cit., pp. 76-77. On Ethiopia, J.C. McCann, *Green Land, Brown Land, Black Land: An Environmental History of Africa, 1800-1990*, Heinemann, Portsmouth 1999, pp. 79-107. On the miombo, see Campbell, *The Miombo in Transition* cit., pp. 5-6, and S. Misana, C. Mung'ong'o, B. Mukamuri, "Miombo Woodlands in the Wider Context: Macro-Economic and Inter-Sectoral Influences", in *ibid.*, pp. 79-83. On the US, see W.J. McShea, 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", in W.J. McShea, W.M. Healy (eds), *Oak Forest Ecosystems: Ecology and Management for Wildlife*, The John Hopkins University Press, Baltimore 2002, pp. 4-5 and 34-45, respectively. See also Williams, *Deforesting the Earth* cit., pp. 3-4, 12.

⁶⁷ On the US, see 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", in Mc-

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 abandoned lands or as the result of fire suppression, also draw attention to Nature's role as an actor rather than a victim of, or a backdrop to, human initiative.⁶⁸

The Ovambo Paradox

Whereas the Palenque Paradox problematizes unilinearity and a predominant focus on human agency because it highlights that deforestation and reforestation may occur sequentially as a result of natural or human agency, the Ovambo Paradox suggests that deforestation and reforestation may occur simultaneously. Violence marked the Portuguese conquest of the northern Ovambo floodplain (in modern southern Angola) during the first two decades of the 20th century, as well as subsequent Portuguese rule. As a result, the area experienced massive population displacement into the uninhabited wilderness area of the middle Ovambo floodplain and the Sandveld to its east (in modern northern Namibia). As the refugees settled the wilderness areas, they deforested land in order to construct farms, fields, and villages. In 1933, the new Oukwanyama district (in modern Namibia), where most of the refugees had settled, had 41,000

Shea, Healy, *Oak Forest Ecosystems* cit., 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", in Bradshaw, Marquet, *How Landscapes Change* cit., pp. 331-336. On Namibia, see Kreike, *Re-creating Eden* cit. ch. 8 and E. Kreike, "Architects of Nature: Environmental Infrastructure and the Nature-Culture Dichotomy", Wageningen Agricultural University Dr. Sc. thesis, Wageningen 2006, pp. 57-62. On central America, see B.W. Leyden, M. Brenner, T. Whitmore, J.H. Curtis, D.R. Piperno, B.H. Dahlin, "A Record of Long – and Short – Term Variation from Northwest Yucatán: Cenote San José Culchacá", in Fedick, *The Managed Mosaic* cit., pp. 30-49. On Japan, see J. Knight, "From Timber to Tourism: Re-commoditizing the Japanese Forest", Doornbos, South, White, *Forests: Nature, People, Power* cit., pp. 335-336.

⁶⁸ See for example Cronon, *Changes in the Land* cit. 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", in *International Journal of African Historical Studies*, 32, 2-3, 1999, pp. 261-280.

inhabitants; around 1900, there had been a few thousand inhabitants at most.⁶⁹ The impact of the refugee re-settlement on the woody vegetation of the area was particularly dramatic in the 1920s, as a missionary witness described:

[The] Natives are very destructive of the natural bush & their method of clearing ground is not economical.... 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.⁷⁰

Paradoxically, as the deforestation of the wilderness areas in northern Namibia progressed, a process of reforestation followed in its wake. The majestic marula (*Sclerocarya birrea*) and birdplum (*Berchemia discolor*) trees, which during the 1960s, 1970s, and 1980s shaded many a farm in the Oukwanyama district of Namibia, were propagated and often introduced by the refugee-settlers and their descendants. Women played a major role in the propagation of fruit trees, producing alcoholic beverages from the fruit. The beverages could be sold or used to lubricate social networks: money and patronage were critical means to secure and maintain women's access to land, labor, livestock, food, clothes, and other goods. Colonial officials noted the abundance of the fruit trees but regarded them as wild and wilderness trees. The agricultural officer for the area stated in the mid-1950s that "[the] natural fruit tree species... grow without any care... they really occur everywhere in the forested areas of the region".⁷¹ Yet, the marula and birdplum trees were overwhelmingly found *in* the villages and *on-farm*.⁷²

Deforestation and reforestation, however, consisted of many indi-

⁶⁹ Kreike, "Architects of Nature" cit., pp. 71-102 and 137-156.

⁷⁰ National Archives of Namibia, Native Affairs Ovamboland 26 f. 21, Report Ovamboland Cotton Prospects appendix to Alec Crosby to Bishop of Damara-land [Mss.], St. Mary's Mission, 11 January 1924.

⁷¹ National Archives of Namibia, Bantu Affairs Commissioner 133 f. HN 8/21/4/1, Agricultural Report Ovamboland 1956/1957.

⁷² Kreike, "Architects of Nature" cit., pp. 137-180; E. Kreike, "Hidden Fruits: A Social Ecology of Fruit Trees in Namibia and Angola, 1880s-1990s", in W. Beinart, J. McGregor (eds), *Social History and African Environments*, James Currey, Oxford 2003, pp. 27-42.

vidual and dissynchronous acts of, respectively, tree cutting and tree propagation. For example, a single village consisted of both older and more recently-arrived households. Some of the latter had only recently cleared their plots of woody vegetation, while some of the former had done so several decades previously and, in the meantime, had reforested their plots. Thus, overall, north-central Namibia in less than a century saw dramatic environmental changes: many areas were heavily deforested and reforested, revealing multi-trajectory and contradictory environmental changes.⁷³

Contradictions and/or ambiguities in the record of environmental change have been noted elsewhere.⁷⁴ Such acknowledgement, however, has not led to explicit questioning about the *homogeneity* of the process of environmental change itself, beyond the recognition that the outcome of the process may be evaluated differently by different stakeholders.⁷⁵ Crummey and Winter-Nelson demonstrate that both afforestation and environmental decline can be observed in Wällo in Ethiopia.⁷⁶ Bassett, Kolo Bi, and Okatarra identify a decline in wildlife (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, concluding that environmental change can occur in different directions at the same

⁷³ Kreike, "Architects of Nature" cit., pp. 137-180; Kreike, "Hidden Fruits", in Beinart, *Social History* cit.

⁷⁴ H.L. Moore, M. Vaughan, *Cutting down Trees: Gender, Nutrition, and Agricultural Change in the Northern Province of Zambia, 1890-1990*, Heinemann, Portsmouth, N.H. 1994; Fairhead, Leach, *Misreading the African Landscape* cit.; B.J. Meggers, "Natural Versus Anthropogenic Sources of Amazonian Biodiversity: The Continuing Quest for El Dorado", in Bradshaw, Marquet, *How Landscapes Change* cit., pp. 89; C.C. Gibson, M.A. McKean, E. Ostrom, "Explaining Deforestation: The Role of Local Institutions", in C.C. Gibson, M.A. McKean, E. Ostrom (eds), *People and Forests: Communities, Institutions, and Governance*, MIT Press, Cambridge, Mass. 2000, p. 2; S. Schama, *Landscape and Memory*, Alfred Knopf, New York 1995, pp. 9-10.

⁷⁵ Blaikie, Brookfield, *Land Degradation and Society* cit., pp. 4-7, 14-16.

⁷⁶ D. Crummey, A. Winter-Nelson, "Farmer Tree Planting in Wällo, Ethiopia", in Bassett, Crummey, *African Savannas* cit., p. 119. See J. McCann, *People of the Plow: An Agricultural History of Ethiopia, 1800-1990*, University of Wisconsin Press, Madison 1995.

time.⁷⁷ A baseline survey of 1800 households in a Zimbabwean afforestation project revealed that, while deforestation was strongly correlated with clearing land for crop cultivation, the non-arable land was not deforested and might have actually gained woody biomass.⁷⁸ 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".⁷⁹

Van der Haar, however, concludes that her paradoxical findings of intensification of agriculture and afforestation might 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 to illuminate the step by step processes of environmental change.⁸⁰ 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.⁸¹ Twentieth century Bangladeshi farmers planted trees on homestead mounds but simultaneously cleared trees in the surrounding floodplain to make fields.⁸² If the homestead mound gardens were the unit of analysis, the outcome of the process of environmental change would be afforestation. If, on the other hand, the actual

⁷⁷ T.J. Bassett, Z. Koli Bi, T. Okattara, "Fire in the Savanna: Environmental Change & Land Reform in Northern Côte d'Ivoire", in Bassett, Crummey, *African Savannas* cit., p. 64. See also C.C. Gibson, M.A. McKean, E. Ostrom, "Explaining Deforestation: The Role of Local Institutions", in Gibson, McKean, Ostrom, *People and Forests* cit., p. 2.

⁷⁸ Kerkhof, *Agroforestry in Africa* cit., pp. 69-73.

⁷⁹ G. van der Haar, "Peasant Control and the Greening of the Tojolabal Highlands, Mexico", in Wiersum, *Tropical Forest Resource Dynamics* cit., pp. 110-112.

⁸⁰ G. van der Haar, "Peasant Control", in Wiersum, *Tropical Forest Resource Dynamics* cit., pp. 110-112.

⁸¹ Williams, *Deforesting the Earth* cit., pp. 412-431.

⁸² W.A. Leuschner, K. Khaleque, "Homestead Agroforestry in Bangladesh", in Nair, *Agroforestry Systems* cit., pp. 197-209.

floodplain were the focus, the diagnosis would be one of deforestation. If the Bangladeshi floodplain land-use system as a whole were to be evaluated, the outcome would depend on the degree of afforestation on the mounds and the extent of deforestation in the plain. Thus, the scale of analysis may significantly influence its outcome. Multi-scale analysis may partially counter this problem; as Huxley notes, however, “research activities are nearly always confined to a single scale level”.⁸³

It is not only scale that is an issue, however, but also the focus on outcome. Huxley noted that “Ecologists often study the *outcome* of plant-plant interactions in terms of changes in species number. Unfortunately, because the *processes* involved are extremely complex, less is known about these in most cases”.⁸⁴ Huxley’s observation is equally relevant to the way environmental change as a whole was studied under the aegis of the modernization, declinist, and inclinist paradigms: late 20th century research emphasized the outcome of Human-Nature interactions (degradation, stabilization, or improvement) more than the processes themselves.⁸⁵ For example, a comparison of 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 instance, 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.⁸⁶

Such issues may be more acute in Africa than elsewhere, not only

⁸³ Huxley, *Tropical Agroforestry* cit., p. 302. On multi-scale analysis, see C.C. Gibson, M.A. McKean, E. Ostrom, “Explaining Deforestation: The Role of Local Institutions”, in Gibson, McKean, Ostrom, *People and Forests* cit. The chapters in the same volume by G. Varughese, “Population and Forest Dynamics in the Hills of Nepal: Institutional Remedies by Rural Communities”, p. 204, table 8.2, and C.C. Gibson, C.D. Becker, “A Lack of Institutional Demand: Why a Strong Local Community in West Equador Fails to Protect Its Forest”, pp. 135-161, stress the need for differentiation.

⁸⁴ Huxley, *Tropical Agroforestry* cit., p. 135.

⁸⁵ Williams, *Deforesting the Earth* cit., p. 237.

⁸⁶ Mazzucato, Niemeijer, *Rethinking Soil and Water Conservation* cit., pp. 125-127.

because deforestation data (and other environmental statistics) for the continent are questionable, but also because more of the environmental change is caused by individuals and households for their own benefit than is the case in Latin America, for example, or in Southeast Asia.⁸⁷ In Latin America, especially in the Amazon, and in Southeast Asia, in particular in Indonesia, state and commercial interests played a much more direct role in bringing about deforestation as a result of colonization schemes, timber exploitation, plantation agriculture, or ranching. State and commercial clearings were 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 produced more information about their activities because they were 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. Thus, these images cannot unambiguously distinguish rural cultural from natural landscapes, and could not identify pristine Nature or climax vegetation even if they actually existed.⁸⁸

⁸⁷ Williams, *Deforesting the Earth* cit., pp. 401-406, and C.C. Gibson, M.A. McKean, E. Ostrom, "Explaining Deforestation: The Role of Local Institutions", in Gibson, McKean, Ostrom, *People and Forests* cit., pp. 1-26, especially pp. 1-2.

⁸⁸ See Fairhead, Leach, *Reframing Deforestation* cit., pp. 8-9; W. Balée, "Indigenous History and Amazonian Biodiversity", in Steen and Tucker, *Changing Tropical Forest* cit., p. 187-188; J. Vandermeer, "The Human Niche and Rain Forest Preservation in Southern Central America", in Sponsel, Headland, Baily, *Tropical Deforestation* cit., pp. 216-229, especially p. 224; Williams, *Deforesting the Earth* cit., p. 477. On Southeast Asia and Latin America versus Africa, see M. Colchester, "Colonizing the Rainforests: The Agents and Causes of Deforestation", in Colchester, Lohmann, *The Struggle for Land* cit., pp. 5-9.

Conclusion

The process of environmental change cannot be measured solely in terms of a linear Nature-to-Culture (or wild-to-domestic) trajectory, and is not necessarily singular, homogenous, synchronous, self-contained, or even coherent. Rather, the objects and subjects of environmental change and the process of change itself need to be differentiated. The process of environmental change occurs across various scales of analysis involving multiple strands, trajectories, and sub-processes that may converge and diverge, intertwine and unwind in dissynchronous asymmetry. Research in environmental change (or rather, *changes*) thus requires more open-ended and empirical investigation across semantic fields and disciplines employing multiple models and theories, multiple scales and levels of analysis, and multiple sources. The dominant 20th-century paradigms to analyze environmental change, that is, the modernization, the declinist, and the inclinist paradigms, are mutually exclusive and do not fully capture the intricacies of environmental change resulting from Human-Nature interactions. The environmental history of Ovamboland, Namibia, for example, demonstrates that new insights can be gained by conceiving environmental change as involving multi-directional and even ambiguous outcomes: it was marked by both deforestation and reforestation in the 20th century.

Human settlement ruins in pristine Nature, and simultaneous deforestation and reforestation, constitute contradictions only if environmental change is conceived as a unilinear and irreversible singular and undifferentiated process with a singular outcome within the framework of a Nature-Culture dichotomy with nature as the point of departure and Culture as the (desired or feared) outcome. If, by contrast, environmental change is imagined as a series of sub-processes that can be asymmetric and dissynchronous, the contradictions appear for what they are: paradoxes.