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-
igenous 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.  

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.

1 I am grateful to Marius Wessel and Freerk Wiersum (Wageningen University) and the three anonymous readers commissioned by Global Environment for their insightful comments and suggestions.

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. 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. Diamond identifies the early European


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.


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. 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.

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. Tropical rain forests were valuable because they were a

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source of timber hardwoods. 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. 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.

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. Some authors have empha-
sized the continuity between the modernist and declinist paradigms: both highlight the danger of environmental decline. The declinist paradigm, however, differs fundamentally from the modernization paradigm in that it identifies (western) 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. 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. The introduction of commercial crops or livestock also led


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. 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. 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.

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

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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. 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 trypanosomiases-carrying tsetse fly in Africa. 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.


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 lungsickness 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. Often, as in the modernization paradigm, declinists depict the scenario in terms of a pre-contact ecological balance.


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. 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.

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-

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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 increased 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 *Leucaena 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,


and community forestry, was partly driven by forestry imperialism legitimated in the name of conservation and rural development.\footnote{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.}

**The Inclinist 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.\footnote{Bassett, Crumme, 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.} 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.\footnote{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.} 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.\footnote{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-

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digienous management and use of forest resources takes center stage as a point of departure for research and intervention. 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. Inclinists consider indigenous populations not as an environmental threat, but as a critical part of the solution. 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. 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. Haggar 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.


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.\textsuperscript{41}

\textbf{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.\textsuperscript{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.\textsuperscript{43}


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

\textsuperscript{43} G.A. Bradshaw, P.A. Marquet, “Introduction”, in Bradshaw, Marquet, \textit{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, \textit{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), \textit{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


\(^{45}\) 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.

the species and the subspecies, rather than the individual.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{50}

\textsuperscript{47} The exception is pets, which are considered individuals, K. Thomas, \textit{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, \textit{Green Imperialism} cit.

\textsuperscript{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, \textit{Green Imperialism} cit., pp. xii-xiii.


\textsuperscript{50} See Blaikie, Brookfield, \textit{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. 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”. 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.


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.


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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{57} That archaeological 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.\textsuperscript{58} 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 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.\footnote{59}

Even before the 20\textsuperscript{th} 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 17\textsuperscript{th} and 18\textsuperscript{th} 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 Srwjaya, which thrived from the 6\textsuperscript{th} to the 14\textsuperscript{th} century AD. The forest “wilderness” of southeastern Borneo in the 17\textsuperscript{th} and 18\textsuperscript{th} century was not only extensively used for shifting cultivation and permanent agriculture, but also for commercial agriculture.\footnote{60} Likewise, Africa’s “wild”


\footnote{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


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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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-


\textsuperscript{63} Guha, \textit{The Unquiet Woods} cit., and Peluso, \textit{Rich Forests} cit.


\textsuperscript{65} On the use of La Selva data, see Longman, Jeník, \textit{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). 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 herdsmen 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. Processes of afforestation that do not directly

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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.\textsuperscript{68}

\textbf{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 20\textsuperscript{th} 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


inhabitants; around 1900, there had been a few thousand inhabitants at most. 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.

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 descendents. 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”. Yet, the marula and birdplum trees were overwhelmingly found in the villages and on-farm.

Deforestation and reforestation, however, consisted of many indi-

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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.
individual 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 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

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

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. 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. Twentieth century Bangladeshi farmers planted trees on homestead mounds but simultaneously cleared trees in the surrounding floodplain to make fields. 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

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

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”. 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. 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.

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

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

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. 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.

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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 multidirectional 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.