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Author(s): Jane Guyer and Paul Richards

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THE INVENTION OF BIODIVERSITY: SOCIAL PERSPECTIVES ON THE MANAGEMENT OF BIOLOGICAL VARIETY IN AFRICA

Jane Guyer and Paul Richards

THE CONCEPT

Biodiversity means, in its broadest sense, the variety of life. More specifically it can refer to the number of species, genetic diversity or the variety of environments in which species or genes are to be found. The concept is in some ways an odd one, since biodiversity is quantitative without necessarily being quantifiable. As an object of study biodiversity is a bit like an iceberg—most of it is hidden from view, and (like the underwater portion of an iceberg) indefinite in shape and extent. The notion of global species biodiversity is often expressed in the form (estimates vary): 1.5 million species known to science, 5 million (or 30 million) yet remaining to be discovered (Primack, 1993). The rider to this surprising formulation is that most of the unknown species are probably insects in the tropical rain forest.

To talk about the unknown portion of the iceberg of biodiversity in this way is not entirely ludicrous. The eighteenth-century German philosopher Kant argued that the significance of advancing from the concept of the earth's surface as a 'plain, indefinitely extended' to that of a globe was that it put bounds on human ignorance (Richards, 1974). Adding to the idea that the earth was a sphere of a certain size, information on the known (landward) portions of the globe meant that the extent of the unknown oceans could be estimated. Columbus had the arithmetic wrong, which is why he arrived in the Americas and not (as he supposed) the Indies, but the right geometrical idea.

Biologists make use of an extended version of this argument when they talk, in quantitative terms, about the biodiversity yet to be discovered, since they have a general idea of the extent of the world's main ecozones and habitats, knowledge about how well or thinly each zone has been explored, and the rate at which new species (insects, for example) are encountered when exploring little-known habitats (when, for example, the crowns of rain forest trees are fogged with insecticide). Predictions about variations in species richness can also be made on the basis of, for example, the theory of island biogeography. The concept of biodiversity is, thus, intimately bound up with theories and information about ecozones and habitat. This introduces us to the first point of legitimate disputation about biodiversity.

An orthodox view in biology, linked with neo-Malthusian ideas in demography, is that habitats can be grouped in two great classes—those that are modified (and generally simplified) by human involvement (e.g. an area of forest partially or largely cleared for cultivation) and those that are still in some pristine state, untouched by human activity. Increase in human population numbers, causing loss of natural habitat, is seen as the greatest single threat to species diversity in the modern world, and rigorous exclusion

of human activity in the remaining pristine areas as the key to the defence of biodiversity.

But a rather different perspective, alluded to extensively in the articles in this volume, emerges from the work of those scholars and scientists who explore the history and sociology of the environment. Here the emphasis lies not with the notion of habitat as such but with concepts of landscape (land as understood in and through the human imagination, and shaped by human managerial initiative). A landscape approach to biodiversity is justified by the frequency with which apparently pristine worlds, as yet little explored by science, prove on further examination to yield ready evidence of long-term human involvement.

There is no more striking instance than the East Usambara submontane forests in Tanzania (Hamilton and Bensted-Smith, 1989). Part of a chain of ancient island-like mountains likened to the Galapagos islands in terms of richness in endemic species, these forests epitomise the notion of 'pristine environment' in Africa. They must seem unpromising terrain for archaeologists. But, just by chance, excavation of a soil pit on an uninhabited ridge in the East Usambaras revealed surprising evidence of human occupation (*ibid*). It transpired that the Eastern Usambara range had at least some human settlement from very early in the African Iron Age (Schmidt, 1989). This history of human occupation, as yet only faintly glimpsed, now has to be figured into the picture as part of the legacy of biodiversity in the ancient eastern arc mountains of East Africa.

Bearing such surprises in mind, the present set of articles (with its specific focus on Africa) seeks both to endorse the validity of an exercise in conservation biology 'to set bounds to human ignorance' of biological phenomena and to argue the case for proper caution and scholarly and practical pluralism in the way these 'zones of ignorance' are characterised and delimited. If we take the science and practice of biodiversity where it stands now, and simply apply it to tropical forest or grassland, there is a vast danger of lumping together, both substantively and in terms of principles of study, too much of what lies within this 'ignorance zone'. The *idea* of biodiversity (like the idea of the globe for Kant) should open up the scientific agenda by defining—if not the exact space occupied by the 'ignorance zone'—at least a plausibly principled approach to its characterisation.

We seek to reinstate real debate about what biodiversity should and might mean, arguing that this debate has fallen victim to crisis talk in conservation circles, an occupational hazard to which conservationists are as vulnerable as relief agency personnel. The problem is that crisis talk risks short-circuiting the full and rigorously plural exploration of what it is we do not, and might seek to, know about biological and cultural variety. As has been suggested in critiques of relief assistance to Africa, there seems some danger that a crisis-oriented mode of thinking creates a discourse that ends up as a tool for the realisation of its own worst nightmares.

How can we break out of this potential vicious circle of thinking? The guiding concern in the present set of articles is to scrutinise the level of phenomenal resolution at which the notion of biodiversity currently operates. Scott Atran (1990: 33) has a nice passage about why insects are so poorly characterised by comparison with other life forms: 'Bugs simply lack

phenomenal resolution for humans . . . they are phenomenally lumped together much as the light is at the end of the color spectrum'. We can turn this on its head. It is not that conservationists are unaware of the fact that human agency intersects the 'zone of ignorance' labelled 'biodiversity' but that, currently, the human factor is 'phenomenally lumped together'. As an antidote the articles that follow all advocate systematic experimentation with different scales and dimensions of analysis the better to present the human elements in biodiversity management 'in the round'. In sum, the collection emphasises the multi-stranded character of human strategies for the management of biodiversity (as one among many types of diversity) and the multiplicity of ways in which those types of diversity are conceptualised.

There are three ways in which the collection contributes to the task of disaggregating thinking about human approaches to diversity, and to 'biological variety' (Primack, 1993) in particular.

First there is the attention paid to the landscape theme. Various contributors emphasise the importance of the choice of historical and spatial dimensions in first getting a fix on diversity. Fairhead and Leach and Nyerges explore the concept of biodiversity from the standpoint of human agents engaged in an historical project to construct a forest. Linares dresses the concept of biodiversity in city clothes. Little and Nyerges ask questions about where notions of landscape and biological variety sit in relation to the history of ecological ideas and the sociology of environmental knowledge.

Second, there is a focus on neglected possibilities in the concept of diversity itself. A number of contributors focus on a sub-set of biodiversity labelled for convenience 'agro-diversity' and elaborate an argument pioneered by Robert Netting that smallholder intensive cultivation, under conditions of population pressure, actually selects positively for high levels of diversity in cultivars and protected plants. This introduces us to a striking irony in the biodiversity debate—that we tend to neglect biological variety where it is most familiar. Agro-diversity in our own back yard may be as much an unknown quantity as rain-forest biodiversity, Netting and Stone imply. Others choose to ask what we mean (and what others mean) by the concept of 'diversity'. Reiterating the point that agro-diversity is by no means diminished by change and intensification, Guyer raises the question of ways in which notions of diversity may vary across cultures, and according to historical experience. Science itself is coloured by social context and historical circumstances, so may we not look forward to an enrichment and enlargement of the possibilities inherent in the concept of biodiversity as global science becomes more and more open to, and enriched by, varieties of local experience?

The third aspect concerns the sociology of knowledge. What kinds of knowledge claims are implicit in the use of the term biodiversity, and how can the specialist knowledge claims of biological researchers be reconciled (if at all) with the competing knowledge claims of those members of rural communities who are often the direct custodians (whatever the state and international agencies may think) of actual reserves of biodiversity? This theme is dealt with more by implication than directly in the following pages, but it is the nub and essence of why we call for a plural approach to the definition and mapping of 'zones of ignorance' in the natural world (cf.

Richards, 1993; Guyer and Eno Belinga, 1995). Given the revival of ethnobotany among biological scientists, and the urgent need to qualify some of the assumptions about 'indigenous knowledge' of ethnobotanists, this theme may prove the most useful of all the contributions social scientists might make to the advancing debate about biodiversity.

Let us look a little more closely at what is at stake. Biologists are not the only group to claim to know something about unknown portions of the biological realm. The Mende of Sierra Leone have two succinct claims that would be echoed around rural Africa: 'the bush is big' (life and nature are full of surprises) and the true indigene 'knows leaf' (economic botany, and the taxonomic understandings that make economic botany possible, are essential elements of local life). If we look at landscapes as creations at the intersection of social history and biological/climatological process, a special place must be accorded to these kinds of knowledge claims, referred to be Geertz (1983) as 'local knowledge'. Local knowledge figures in at least three ways: as part of the local ecosystem, as a source of scientific information about its components and their interaction, and as a basis for all negotiations among the interested parties in policy matters. Here we must enter a caveat—the classic anthropological meanings of 'local' need to be reworked for the purpose of environmental studies, in concert with ecologists and other biological scientists, and this is very much 'work in progress', as will be apparent in the following pages. The topic of 'knowledge', meanwhile, has been developed in several directions in anthropology, all of them implicitly or explicitly invoked in the articles of the present collection.

One of these directions concerns the forms in which thought that does not regularly refer to the touchstone of writing is acquired, stored, elaborated and mobilised. As far as research shows, there are some basic similarities alongside great variation. A difference between lay knowledge and science that emerged in the eighteenth century appears to be that only the latter seeks levels and terms of analysis that will—increasingly systematically and parsimoniously—comprise wider ranges of phenomena within the same explanatory framework. Classically, this has entailed decomposing natural attributes and positing others that are not amenable to direct experience (Atran, 1990). Without necessarily drawing stark contrasts, Atran suggests that lay knowledge is likely to be systematised differentially and in discrete domains, where 'it is an entirely empirical question whether or not . . . principles cross domains, and if they do, which domains they cross . . . [M]eaning should be assumed as motley, not a monolith' (Atran, 1990: 49, 57).

Some domains of knowledge may therefore 'work' kinetically (Hardin, 1993), through routines rather than through discourse, without being any the less rich or powerful for that. Some critical categories of thought may well even be 'empty', in the sense that not even specialists give definitions that go beyond the context of a singular event. Contradictions do not necessarily indicate a muddle but, rather, may inhere in and be dealt with by techniques specific to that domain (Boyer, 1990). Specialists operate within domains, often with their own characteristic intellectual techniques which may or may not operate in other specialist domains, but which—by definition—are different in some way from those of the general population, in the 'culture at

large'. Non-specialists access them through a social relationship rather than through learning, and hence in a context where interests are at play. And finally the capacity of 'events' to be the crucible of changing conceptions is likely to vary according to the cognitive and social characteristics of the particular domain.

The emphasis in all this work is that there are some common principles that can guide careful research on local knowledge: it may not work by an integrated set of deterministic principles applicable to all domains (ethnobotanists, beware!); it may be socially dispersed in particular ways; the difference between expertise and culture needs to be maintained. The empirical content of any particular scheme, however, is contingent and historically changing. Efforts to link local and scientific systematisation therefore need, in the first place, to exercise sophistication with respect to attributes of local knowledge that have already been described, then to be patient in their analysis. The relationship between the science of ecology and the lay knowledge that creates an anthropogenic landscape does not necessarily lend itself to direct translation. At the most extreme the opposition between the proponents of these two simply become adversarial.

One of our further aims in these articles, then, is not only to draw on anthropological work with respect to local knowledge and its works but also to anticipate the translation process, which may well require both 'languages' to change. If in the fullness of time some of our attempts to hybridise hitherto distinct discourses are judged, by biologists and a concerned laity alike, to be helpfully suggestive, if as yet only imperfectly realised, they will have served their intended purpose of enlarging the conceptual range of the diversity debate and allowing more shades of opinion and modes of existence to find a meaningful reflection therein.

This brings us naturally enough to the world outside the academy, and to a consideration of some of the *political* implications of the biodiversity debate, for Africa in particular.

THE POLITICS OF THE CONCEPT

The term 'biodiversity' came into general use through the work of the distinguished American biologist E. O. Wilson. From the outset the term was political as well as biological. Wilson himself has explained that it was his attempt to try and protect a specific academic interest (in whole organisms) from the radical reductionist currents in molecular biology then threatening to rule the roost.

Biologists may be uneasy with the use of the word 'political' in such contexts because it suggests the crude hi-jacking of science for non-political ends, as in the adamant Larmarckianism of the biologist Lysenko in the Soviet Union under Stalin. Modern social studies of science tend to focus on less dramatic instances, and to regard scientific politics (e.g. the defence of potentially valuable but unfashionable lines of enquiry through alliance-building and suitable dramatisation of concepts) as a perfectly respectable, and indeed necessary, part of the scientific enterprise (cf. Latour, 1988; Fujimura, 1992). But this politicisation may have unintended consequences

when allies exploit the dramatic potential of an idea like biodiversity for their own ends, or when the idea shifts continents (Juma, 1989).

In this respect we have already mentioned, in passing, an affinity between the conventional view of biodiversity and neo-Malthusian perspectives in demography. These neo-Malthusian ideas are often closely bound up with a wider package of conservative and neo-liberal ideas for dealing with the problems of developing countries (control population increase, reduce the power of the state, extend the reach of the market), and therefore require a larger critical contextualisation, especially in Africa—a continent combining some of the world's poorest countries and richest biomes. We draw attention below to the urgent need for the social sciences *in Africa* to be equipped and resourced to take up this task with respect to environment and development.

The conventional argument on biodiversity tends to play out as follows. Pristine environments are naturally rich in biodiversity, and unknown biodiversity tends to a maximum in such localities. Unknown biodiversity is potentially valuable. Applying the precautionary principle (restrain human agency where intervention is not demonstrably safe), these natural environments of exceptional potential richness in biodiversity should be protected from further human interference at least until fully assayed. In practical terms, this leads to sets of strict policy prescriptions to exclude humans from protected areas and to strengthen the capacity of state elites to enforce those exclusions. As Little's article in this collection shows directly (and other contributors show by implication) if an area has long been fully incorporated into the human sphere one of the first results of human exclusion may be environmental degradation, threatening a reduction in levels of *known* biodiversity. A further implication is that strengthening the hand of central government in the name of bio-security may be distinctly anti-democratic in impact, and foster the seeds of future dissent in local political communities (cf. Ellis, 1994).

Thus it seems very important to bring into perspective the relative merits of two kinds of argument at this point. Is it better to enhance the maintenance of known levels of biodiversity, through encouraging the best established local practices, or to bank on the unknown through rigorous exclusionary tactics? Much depends on how the unknown portion of the iceberg of biodiversity is regarded. One powerful practical argument for strict protection is the idea that rare and unknown plants and insects, especially in the more remote tropical forest reaches, are important sources of natural molecules with potential applications as medicines. Technologists will one day be able to synthesise most of these molecules, but building them from scratch is altogether a more mind-stretching exercise. Studying a natural toxin in a forest insect, and how it has evolved, is seen therefore as a major potential prop to the human technological imagination. A contrary argument suggests that many parallel life forms may have evolved within the especially favourable tropical rain-forest environment, and that keeping all these forms afloat may one day prove to have been an expensive and politically harmful exercise in redundancy at the expense of concentrating on what is already known and cherished.

A reasonable position, by implication advocated in several of the following articles, is to seek an approach which combines some elements

of both arguments. Perhaps strict reservation should be applied only in a minimum of special cases, and most attention should be paid to building a constituency of local support for conservation, by researching and then emphasising ways in which human action has already, in some circumstances, served to enhance biodiversity, either by direct protection of valued resources or through triggering ecological processes that have advantageous outcomes.

In Africa this constituency-building exercise requires action on a number of fronts. First of all, there is a need to rethink the concept of biodiversity in terms more suited to present and future political concerns within the continent, especially in the rural sector (cf. Juma, 1989). Neo-Malthusian policy prescriptions are often largely foreign conceptualisations of the African development dilemma. Much African sentiment (reflecting a long history of *under*population, infertility and high infant mortality, triggered by externally induced events, e.g. the slave trade and patterns of colonial expropriation) remains strongly pro-natalist, especially among the rural communities most well endowed in biodiversity resources.

African scholars and scientists writing on conservation topics—as in a recently published major review of the state of the environment in southern Africa (SARDC/IUCN, 1994)—will tend to emphasise the central importance, to any conservation strategy, of beginning with issues of rural poverty alleviation, and the education and welfare of mothers and children, in stark contrast to a raw neo-Malthusian emphasis on population limitation as the bedrock of conservation strategy still often found in external literature.

Thus we see very well one way in which thinking about biodiversity will have to move if the concept is to enjoy a new life as a notion congenial to the popular imagination within rural Africa. This in turn will need to be supported by substantive research consistent with some of the approaches advocated in the present collection, as a support for participatory resource management initiatives. The importance of, for example, the study of forest creation by farming communities on the forest–savanna transition in Guinea by Fairhead and Leach in this volume is that it suggests ways in which humans become, potentially, part of the solution to, rather than simply the cause of, the problem of biodiversity depletion in Africa.

But political domestication of the concept of biodiversity, and a full working through of its implications in an African *social* context, run up against some serious practical difficulties of constituency formation. Biodiversity, in Joan Fujimura's (1992) terms, is a good example of a 'boundary object' in science. It embodies deliberate and useful vagueness that makes it susceptible to a number of legitimate and potentially beneficial interpretations and reapplications. But exploiting this potential in African conditions requires active brokerage between scientific and political communities. The problem is how that brokerage (reinterpretation, adaptation to local political usage, technical redefinition) will be achieved against a background of chronic resource shortages in African universities and research institutes.

Local funding to support major new research efforts linking social science and biological perspectives on biodiversity hardly exists in Africa. Biodiversity research will remain a field in which external donors play a

major part. But this carries with it a danger—addressed by Reginald Cline-Cole in his concluding article—that whereas Africans may undertake more tasks in the field of biodiversity research the overall agenda for biodiversity conservation, from which those research tasks derive, will continue to be shaped by outside perceptions and priorities. The recent report of the task force on African biodiversity published by WWF and IUCN is a serious attempt to articulate *some* African perspectives on biodiversity, but the practical feasibility of representing a full range of regions and social and biological science disciplines through a small (seven-person) expert committee is less than self-evident, despite the manifest good sense of much that the committee has to say (Biodiversity Support Program, 1993).

One of the points at issue is that political and financial support for externally funded biodiversity research and action comes from constituencies for whom African biomes have assumed a mythical status quite at odds with reality ‘on the ground’. As victims of rural insurgency in a number of Africa’s biodiverse regions have discovered to their cost, the rain forest, far from being an evolutionary Eden, is a dangerous, bandit-ridden place, perhaps as violent as any inner city in the West (Richards, 1995). Social and biological scientists need to collaborate on biodiversity issues for substantive reasons, but the contribution of the social sciences to the biodiversity debate is urgently needed also to help establish with the agencies, and their constituencies of supporters in the industrialised world, an on-the-ground sense of realism about what, in socio-political terms, many of these frontier regions are actually like.

The Red Data Book (Collar and Stuart, 1985) lists the threatened bird species of the Gola forest on the Liberia–Sierra Leone border but not the gangs of diamond diggers (and more recently the three armies) camped alongside (Richards, 1995). A representative of a leading international conservation agency, focusing on biodiversity, could not say how many of the world’s several thousand protected areas harbour insurgency movements like the Khmer Rouge in Cambodia or the Revolutionary United Front in Sierra Leone. There is an urgent need to fill this gap in knowledge, and to take account of new social realities in these supposedly ‘pristine’ environments, where automatic weapons and crack cocaine may be as common as on the streets of Liverpool or Detroit. It is for this reason, if for no other, that the agenda-building task is something that must happen within Africa, in a climate of political realism, reflecting the priorities and concerns of the immediate custodians of the continent’s biodiversity resources.

THEMES AND ARGUMENTS

The title of this collection has been chosen deliberately to invoke the spirit of a book famous among anthropologists and historians, *The Invention of Tradition* (Hobsbawm and Ranger, 1983). That set of essays points out that far from being rooted in ancient history many active traditions are modern inventions. Hobsbawm and Ranger’s aim was not to expose tradition as a fraud but to direct attention to the social purposes that give tradition life. Historical positivism alone is insufficient to explain how and why the quasi-feudal traditions associated with the British monarchy should have taken on

a life of their own, in the press and in popular imagination, in the late twentieth century. Colonial rulers in Africa shamelessly invented 'traditional' political institutions and associated procedures and rituals, some of which (notably 'chieftaincy') have tenaciously survived the transition to independence. Where tradition 'survives' such a radical displacement it is often especially clear that history is of little account; the explanation must lie in the new or revived social purposes that the traditions serve.

The ruling conceptions in science have a similar 'invented' quality. Science is a collective undertaking. When sociologists of science refer to 'the social construction of scientific concepts' their intention, again, is to suggest not that in some way scientists are engaged in intellectual fraud but that concepts are communication devices.

Since biologists, perhaps in particular, seem to find the idea of social construction of scientific concepts especially aggravating (Wolpert, 1992), Mary Douglas (1995) has proposed substituting the less provocative word 'construal'. Concepts must be construable by the social group engaged in scientific activity. But to be meaningful across a social grouping in this way concepts (whatever they entail at a cognitive level) must also be 'collective representations'. The point being made by the sociologists of science is that collective representations have a life and longevity of their own, depending on the social dynamics of the group sustaining them, and that this may influence the rate at which new facts are discovered and absorbed within science.

Sometimes a concept is taken up by a new social constituency for altogether unanticipated purposes. To take but one example, the Green Revolution rice plant ideotype, originally an important conceptual resource for focusing the activities of plant breeders during the 1960s, introduced a number of rigidities into the way breeders subsequently looked at the requirements and opportunities of 'low resource' rice-growing environments when the ideotype 'leaked' (via journalistic promotion) into the wider political consciousness, where the semi-dwarf plant ideotype soon metamorphosed into 'miracle seed'. But since breeders themselves first chose to conceptualise their activities through the notion of plant ideotypes (Donald, 1968) it is perhaps hardly surprising that their ideas were subject to wider imaginative reworking, and then exposed to ideological critique. This ideological critique, though primarily socio-political in tone, has now fed back into science usefully to open up 'alternative' breeding options (cf. de Boef *et al.*, 1992).

This kind of 'cross-over' (and 'cross-back') effect is broadly similar, it seems to us, to the still lively invented and displaced political traditions sometimes found in ex-colonial countries. It simply means an established concept has found a new social constituency. The consequences may be obstructive to the further empirical advance of the science in question (as may have been the case, initially, in the plant-breeding example just given). But, equally, a new and enlarged social constituency may breathe life into an older and perhaps flagging area of scientific enquiry.

This second possibility is, in effect, what we argue can (and should) be aimed for in 'domesticating' the concept of biodiversity in Africa. At present it is the collective representation of perhaps too narrow and alien a group. To

achieve 'take-off' the idea of biodiversity may need to be adopted by new constituencies willing to make it their own. Ideally one such constituency should comprise (as we have argued) professional scientists in Africa *together with* the wider rural community close to the sources of biodiversity. The possibility envisaged is that biodiversity may then become a leading idea in an African 'people's science', with beneficial empirical consequences both for science and for practical conservation.

Bruno Latour (1988) points out that the acceptance of Pasteur's germ theory of medicine and hygiene required not only scientific discovery but also a profound social change (aptly summarised in the phrase 'the Pasteurisation of France'). That social change did not just happen by chance—it was worked for by the Pasteurians. This is a central point underlying many of the contributions in the present collection.

The first article, by Fairhead and Leach, sets up the argument in suitably dramatic terms. Outsiders conceived the humid zone in Western Africa to be a continuous and stable primeval forest formation, nibbled away at the margins in modern times by destructive farmers. But environmental history provides little support for this picture. The forest has long been advancing and retreating owing to climatic change. In this changeable, and gappy, world, human intervention has had a constructive as well as a destructive impact. Forest-margin farmers at times coax the forest back into being, or create new synthetic forest islands around their settlements that spread and coalesce when abandoned.

Forests, therefore, are a product of social 'work'. But there are two kinds of social work going on. First there is the straightforward work of Guinean peasants (largely unseen, or disregarded by outsiders) in banding together to make their forest islands, as a consequence of the way they make their settlements and farms. Guyer, Linares, Netting and Stone, Kandeh and Richards, and Nyerges extend the thought, by citing instances of the way in which diversity (especially crop genetic biodiversity) can result from other kinds of landscape-transforming activity. In effect, they argue that farming can have biodiversity benefits, as well as costs, even in conditions of rapid, and perhaps adverse, social and economic change. Linares develops an especially useful thought, that, since urban gardening is one of the ways the poor stay alive in difficult circumstances, it is perfectly possible to envisage such activity as a framework for the recovery and protection of rare plants. The small city farm or backyard plot is where Granny, perhaps unable to contribute to household survival in any other way, already carefully cherishes rare herbs and medicinal plants. Might urban agro-diversity be the point at which to try and engage popular interest in the topic of biodiversity protection more generally? Guyer and Netting and Stone remind us that smallholder farming practices are rich in complexity and subtlety and that we should not conclude too quickly that apparent simplifications, under the stimulus of commoditification, are necessarily permanent and irreversible. Kandeh and Richards argue that in some circumstances population pressure and an increasingly adverse environment may serve to valorise, and thus to conserve, hitherto relatively neglected crop plant genetic resources. Nyerges (comparing some of Fairhead and Leach's findings with data of his own, and setting both in a wider historical and environmental context) reminds us how

little we know with any great certainty about the way in which fragile and complex environments in Africa actually respond to farming, and human landscape management activities themselves change in response to environmental, social and economic trends. Peter Little stresses that according to newer non-equilibrium theories of tropical ecological dynamics, shorn of lingering notions of 'climax' formation or any assumption that ecological systems 'seek' stability, an appearance of landscape degradation may be deceptive. Degradation may be a natural process and not human-induced at all. With this in mind, emergency intervention to stabilise the landscape may inhibit spontaneous recovery. Little is confident that pastoralists have been wrongly accused of degrading biodiversity-rich grassland environments in East Africa.

Fairhead and Leach, Nyerges and Little also introduce us to a second kind of social work shaping biodiversity—the work of several generations of outside agencies in sustaining a vision of a changeless tropical *urwald* in Western Africa and pristine biodiverse grasslands in East Africa. Fairhead and Leach imply that this vision, persistent despite the lack of evidence, is a collective representation of a social group comprising colonial administrators and their successors in the development agencies. Peter Little's article is even more explicit about the identity of the social interests sustaining the belief that local pastoralists are primarily to blame for damage to Kenyan rangelands. Nyerges writes about the misleading impact of the Amazonian model applied to African forests (cf. P. W. Richards, 1973), finding more useful guidance for understanding the West African Guinea savanna woodlands in the history of coppiced woodlands in medieval England. Kandeh and Richards remind us of the importance of local collective representations, describing the case of two rare birds in the Gola forest, where one figures large as an element in the local moral universe and the other does not, with divergent implications for their fate as threatened species.

But none of the articles in this collection goes so far as to attempt a thorough analysis of the social interests underpinning the contested 'virtual realities' of African biodiversity, or to suggest how the actor-network base might be enlarged to constitute a mass movement for a 'people's science' of biodiversity in Africa. That is a major next step, perhaps making explicit use of the idea of Latour and others that it is the business of the sociology of science to 'follow scientists out of the laboratory into society'. This implies major sociological analysis of the networks and institutions funded and active in promoting the biodiversity concept in Africa, and poses the question 'How might the concept, and its practical applications, change if the social composition of these networks and institutions were changed?' (by, for example, the deliberate inclusion of more local professional and political interests). Such is the theme addressed by Cline-Cole in a short concluding article. The basic facts are challenging. Only about 15 per cent of local contributions to the country surveys in a major recent review of African biodiversity, it seems, came from African scientists (Stuart *et al.*, 1990). The professional standpoint from which African biodiversity is viewed is still predominantly expatriate. It is appropriate that the present collection, devoted to enlarging the range and scope of the debate about biological

variety, should conclude with a comment on the changes in institutional capacity and culture required if biodiversity issues are to become part of the wider African debate about social change and sustainable futures.

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