

# Temporal Heterogeneity in the Study of African Land Use

## Interdisciplinary Collaboration between Anthropology, Human Geography and Remote Sensing

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**Abstract** This paper introduces a set of four collaborative papers exploring temporal heterogeneity in the analysis of African land use over a decadal time period, from 10 to 50 years, in the second half of the twentieth century. The four

cases were chosen amongst the seven teams of anthropologists, human geographers and remote sensing specialists who had carried out long-term research and who met to discuss their findings at a workshop in 2003. All seven teams' work and the

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collective discussion—on Casamance (Senegal), Brong Ahafo (Ghana), Southern Niger/Northern Cote d'Ivoire, Oyo State (Nigeria), Maasai Mara (Kenya and Tanzania), Gwembe (Zambia), and Malawi—inform this introduction. We identify several temporal processes in all the cases, each operating on its own temporal frame: population growth and, above all, mobility; livelihood change through crop and occupational change; tenure ambiguity; powerful though “punctuated” interventions by state policy; and climate change. Conceptual and methodological implications are discussed.

**Key words** African land use · temporal heterogeneity · anthropology · long term studies · remote sensing

## Introduction

The interdisciplinary studies presented in this special issue and the collective discussion to which they contribute focus attention on community-level processes of African land use change within a time frame covering the last half of the twentieth century and the first decade of the twenty-first. They originate from anthropologists' accumulation of long-term data on the economies of specific places and peoples, starting from a period around the 1960s when economy and ecology were realized to be important but relatively neglected topics in our discipline, and continuing up to the present. Seven studies were directly included in our discussions.<sup>1</sup> All

<sup>1</sup> Amanor (anthropology), well known for his work on *The New Frontier* (1994) later collaborated with Pabi (remote sensing) in a study of agricultural succession in central Ghana.

Colson, Scudder and Cliggett, all anthropologists working on the famous Gwembe Tonga study initiated by Scudder and Colson in the 1950s (Colson 1960; Scudder 1962), were joined by remote sensing specialist Lambin (Petit *et al.*, 2001), then geographer Unruh and remote sensing specialist Hay for a new round of field study.

Guyer (anthropology) had worked with Lambin in the late 1980s and early 1990s on intensification in the rural hinterland of Ibadan, Nigeria (Guyer and Lambin 1993; Lambin and Guyer 1994), remained in intermittent discussion over the decade and planned the regrouping of the participants.

Homewood (anthropology) and Lambin (remote sensing) collaborated after the 1995 conference in a major study of the Maasai across the Kenya/Tanzania border.

Linares (anthropology) and Lambin (remote sensing) developed a joint project at the 1995 conference devoted to aspects of a three-decade drought in Casamance, Senegal.

Peters (long-term anthropologist colleague of several other participants) and Walker (geography) worked together on livelihood changes in Malawi.

Turner and Bassett (human geography) had worked separately on pastoral change in West Africa (Niger and Cote d'Ivoire respectively) and collaborated on this paper after the 2003 workshop.

We have also been inspired by the work of anthropologists Glenn and Priscilla Stone in their restudy picking up on the seminal work of Netting (1968) on the Jos Plateau in Nigeria (Stone, 1996). And at an early stage the crucially important anthropological work of Paul Richards, and Melissa Leach and James Fairhead in Liberia and Sierra Leone has been a point of reference. Richards cosponsored the 1995 conference. We have kept in mind throughout the Machakos restudy (Tiffen *et al.*, 1994), and the work of French researchers in historical anthropology and human geography.

seven inform this introduction; four were selected to be full-fledged papers here because others had already been published. (Wherever reference to any of the authors is made without a date, it refers to their paper in the present collection; published works from the same studies and other studies in the network are cited as usual.)

The studies that started between 1950 and 1970 (Colson and Scudder, Linares, Guyer; also Netting, 1968) were initiated under theoretical questions about the relationship between social forms and material life, with a focus also on new state policies. They were sustained as longitudinal studies and added to by a new generation of anthropologists (Peters, Homewood, Amanor; also G. and M. P. Stone (Netting *et al.*, 1993)), by anthropology's increasingly close relationship to history (including environmental history. See Zeleza 1996) and human geography (Bassett and Turner). From the mid-1970s there was a rising crescendo of interest in historical dynamics of varied situations: the changing hinterland of cities for rapidly expanding urban food supply (Guyer, 1987, 1997a, b); the effects of the 1970s drought and other changes on pastoral movements (Bassett and Turner); the ever-moving frontier of “booms and busts” in African commercial agriculture (Cliggett *et al.*; Amanor); interventions in land law (Peters, 1994); and the sheer continuing concern with rural livelihoods (Linares; Walker and Peters) over shifting vicissitudes including agricultural policy shifts and civil strife. But the cases also share certain conditions: rapid population growth, changes in agricultural markets, apparently increasing climate instability, decline in African commodity prices on world markets, and a continuing propensity of Africans for mobility in search of a living.

The question we pose is whether there are substantive and methodological convergences amongst the widely dispersed cases. In particular, whether the specifically *social* aspect of these studies—communities, local institutions and conditions of livelihood—brings insights about which dimensions of the human side of human ecology appear recurrently and compellingly in our findings about land use and ecological dynamics in modern Africa. The range of theory which the authors have brought to their work has been extended over the years by debate of the seminal theoretical intervention by Boserup in 1965, linking population growth to agricultural intensification; the expanded study of cognitive systems under the rubric of indigenous technical knowledge; and the deepening of political economic research. Specifically social questions, however, have continued to inspire their empirical research: social difference and its basis in resource tenure (Peters, 1994); the social organizations that operate between the household (a concept taken up by economics) and the larger society (taken up by political economy) such as lineages, associations, migrant labor groups, credit institutions (e.g.,

Guyer, 1997a); localized interfaces between farmers and formal institutions in the market and the state (Amanor, 1994, 1999); intergenerational relations (Cliggett, 2001, 2005), ethnic relations (Stone, 1997); adjudication institutions (Bassett and Turner), religious groups and productive coordination (Linares, 1992).

A moment arrived in the mid-1990s when new techniques opened up new possibilities for general inference and new comparative thinking that could bring larger relevance to work already published, new interest in previously unanalyzed or unpublished data, and a demand for new critical thinking about larger questions, including the famous neo-Malthusian argument raised by Kaplan (1994). They offered the opportunity and, in a sense, the responsibility to expand the relevance of these projects and bring them together. Concerns about the direction of change on the continent had greatly intensified by then. Africans face numerous challenges to gain livelihoods and find plausible niches in the globalizing economy. Civil wars in several places, the HIV/AIDS epidemic, the turn to extractive rather than productive industries in national economic policies, the collapse of tropical commodity prices since about 1980, the national debt overhang (with some relief possibly in sight after the G8 summit in June 2005), and climate instability all continue or intensify since the mid-1990s.

Coordination of the separate projects could be done by a book-length integration of many published studies, as Raynaut (1997) compiled for his important intervention on the primarily French research on *Sahels*. Another strategy undertaken in the LUC network was to start new research on an interdisciplinary basis, as has been done in Yucatan by Turner, Geoghegan *et al.* (2004). Here we take a different tack, bringing together as a network of discussion the organizers of anthropological case studies of long-term land use dynamics where, in each case, disciplines other than anthropology have been added, allowing debates and complementary contributions around the new questions posed and the new solutions pursued. In most cases, the original researcher is still returning to the field site. In others, dedication to a field-based historical approach results in a similar enormous value being placed on the original local sources we have from the past. So we retain the substantive and methodological specificity of each case, while attempting to extract general points about both Africa and method from them.

The argument that we explore in the introduction and exemplify in the papers is perhaps paradoxical for a group whose work is based on incremental data collection over large parts of their careers. We wrestled with incremental concepts such as intensification, commercialization and population growth: finding difficulties of operationalization for case study use, discovering more deviations than

confirmations, and seeing a morass of problems when the complexities of each case were compared with others. We were entirely in sympathy with the critiques made by Fairhead and Leach that the relevant relations might be “diffuse, ... a constellation rather than a structure” (1996: 285) and Leach and Mearns that “orthodox evaluations of environmental change” (1996: 4) might be based on misleading variables. At the same time, the large questions about pasts and futures remain. Our own advantage can be the ability to unpack incremental concepts and to look closely at the temporal properties of the changes they comprise or that escape their definitional boundaries altogether. It is worth reminding ourselves that Boserup predicted “intensification” of land use to be a discontinuous process at a certain critical point, and made no strong claim to know which point and what interventions might be apposite in particular cases. We can go further and ask whether, and how, the apparently cumulative processes also comprise discontinuities that may have enormous significance for both communities and their environments. So to interrupt cumulative assumptions, it has helped to approach the African environment as if it were being *re-inhabited*, that is, to work with the idea that the processes of social composition and cultural and experiential imagination on the human side of human ecology change qualitatively even more significantly than they do quantitatively. People of different origin, with different connections to markets and states, or with different technical knowledge move in as migrants or as a formal sector presence; the new generations and different genders of the existing population develop new interests and styles of resource use; long term inhabitants acquire new technologies; and so on. Qualitative shifts in the human factor then force our attention to the spatial and temporal heterogeneities specific to each of our cases, in addition to any linear summaries and projections. The notion of re-inhabited landscapes also throws into relief precisely the local institutional complexes that have grown and changed as they mediate amongst the ambitions of current inhabitants and new arrivals and departures, whether the latter be their own children, migrants, pastoralists, laborers, elite farmers, national parks or ministerial policy makers.

While heterogeneities are an anthropologist’s conceptual stock in trade, with respect to linking society and culture to ecology and history they become far too complex to continue to address solely as individual ethnographers (see Guyer and Richards, 1996). But they also make a certain *kind* of interdisciplinary collaboration imperative (Scoones, 1999). We are not supplying variables to ecologists for calculating regressions or trends (except possibly in the future, when very specific biophysical and social dynamics could be experimentally linked). Nor are we using the remote sensing for very limited spot checks on one or another ground truth. We are working in this

instance to identify spatio-temporal patterns and their correspondence to processes on the ground and in the social life of modern Africa.

Part II expands on the concept of temporal heterogeneity which we found most productive for analyses and comparisons. Part III discusses the particular challenges of combining anthropology and remote sensing over the processes that (in Africa) are particularly powerful over a time frame of between 10 and 20 to 25 years, and concludes with critiques of our limitations. Part IV introduces the papers.

### Temporal Heterogeneity in Society and Ecology: The Decadal Time Frame

The temporal concepts of long-term cumulative change and crisis have coexisted in policy and scientific study of Africa for as long as 80 years (see Walker and Peters on Malawi; Mortimore (1998) on Northern Nigeria.). Theories of cumulative change have understandably emphasized population growth as a crucial variable; it was obviously important and also amenable to study, once national censuses were instituted. However, these views bracketed out ecological processes that were original to Africa: “misreading the landscape,” as Fairhead and Leach (1996a) put it. A decade earlier, Richards (1985) had drawn attention to the cardinal importance of indigenous knowledge about African environments (see also Bassett and Crummey, 2003; Beinart and McGregor, 2003; Mandala, 1990, 2005; McCann, 2005). The cumulative (or linear or progressive) view also downplayed the importance of the socio-political process of resource management, most strikingly through interventions of the state, corporations and international price shifts (Amanor, 1999; Peluso and Watts, 2001).

New anthropological and historical work covering earlier eras and longer periods (e.g. Bassett and Crummey, 2003; Beinart and McGregor, 2003; McCann, 2005; Mandala, 2005; Mortimore, 1998; Raynaut, 1997) has been illuminating in one sense and humbling in another. Vansina’s (1990) work on Equatorial Africa, covering over a millennium, shows that population distribution and productive practice in the Congo basin—a popular culture archetype for an African “wild”—emanate from a very long history of in-migration, crop assimilation (including Asian cultigens), intensive fish raising (Harms, 1987), trade along the great rivers, complex metal production, and monetization (Kriger, 1999) and the strategies of different groups and different kinds of religious and political leaders for predatory expansion or self-defense (Dupre, 1995; for comparable originalities in West Africa, see Bassett et al., 2003; Nyerges and Green, 2000; Richards, 2001). Findings

in ecological dynamics are equally striking: El Nino and climate change over centuries (Nicholson, 1979; Davis, 2001; Pikirayi, 2003); “non-human catastrophic events” such as severe cloudbursts that set in erosion (Williams, 2003: 52); the effects of insect infestations on ground cover; the probable effect of hybrid maize cultivation, and perhaps therefore the historical introduction of New World maize, on the incidence of malaria (McCann, 2005), and so on. Formal scientific knowledge about Africa is limited. It may even have been more limited in 1981—by the deliberate simplifications in the World Bank “Berg Report” which reduced African productive practices to a few global characteristics in the interests of development policy (Guyer, 1984)—than it was in the 1930s, when colonial scientists were already arguing that in Africa “the ecological system... was neither static nor linear” (Worthington in Tilley, 2003: 127). Collective and comparative works using linear variables or static correlations, especially about population and land use, have not been particularly convincing because other things are clearly going on, especially the adoption of new crops and shifts to serving new markets (Guyer, 1997b on Turner *et al.*, 1993).

Anthropologists are cautioned by developments in their own discipline against simply moving from one conventional objectivizing temporal frame to another, since both may depart from people’s own epistemologies, which important scholars suggest may well be incommensurate with western conventions (Escobar, 1999; Povinelli, 2001; Verran, 2001). Others, however, see that key concepts may be at least potentially or partially overlapping, mutually translatable or amenable to situational mediation (Robbins, 2003a, b). It is with the possibility of some sort of scientific mediation in mind that Bassett and Crummey can encourage the view that “environmental change in Africa cannot be inferred” (from any model, *our insertion*) “it must be established and measured” (2003: 13). They imply that it *can* be measured.

Given our own temporal coverage and our concern with the social, we decided that defining the temporal framing could by itself go a long way towards bringing to the fore processes that may work out along different trajectories and over different time periods. Focusing on a period between fifteen and fifty years seemed to us to offer great potential for working at the epistemological and substantive gaps. Geographers of other areas of the world are finding the decadal time frame apposite to a more nuanced, inclusive and critical approach to human ecological interactions. At least two of the case studies in “Critical Reflections” of Turner and Taylor (2003) special issue of Human Ecology refer to decadal change: Heasley (2003), since the 1930s; Jiang (2003), the past three decades. Above all, periods of decades correspond to the human world: a period over which institutions are either cultivated or neglected (or both); in which policy implications play out on the ground

and play back into the next round of policy response; and where memory, experience and interpretation can inform and challenge scientific accounts.

The idea of temporal heterogeneity is implicit in many works and is becoming explicit and persuasive. Reversibility (Fairhead and Leach, 1996a, b), violent intervention (Peluso and Watts, 2001), the inference “that a system only perpetuates itself to the degree that it transforms itself” (Raynaut, 1997) and that “no condition is permanent” (Berry, 1993): all these invoke concepts of multiple temporal trajectories, an impression also conveyed by historian Mbembe’s (2001) theoretical inference that Africa is going in several directions at once. Bassett and Crummey (2003) recently refer to the need to unpack “master narratives,” specifically in the study of African ecology.

Even with the force of experience and argument behind it, the idea of temporal heterogeneity over decades proved not so straightforward to translate analytically across disciplines. As recently as 2003, Lambin and colleagues were questioning whether the prioritization of different temporal frames was more or less written into the approaches of different disciplines. An agent-based decision-making orientation may necessarily project over short time frames, a systems orientation over (indeterminate) long time periods, institutional analysis depends on historical narratives of change and persistence, and political economy is focused on key events and ruptures (Lambin *et al.*, 2003). Sheppard and MacMaster (2004: 16–19) advocate a complex view of spatial scale than is analogous to our exploration of time: not fixed or predetermined; not necessarily hierarchical in that the larger (longer) processes shape the smaller or shorter term ones; and not necessarily neatly divisible without remainder. Finding a concept that could open up time in a comparable way, for several disciplines, was the challenge. We reached the position that by posing the human factor in human ecology as basically a discontinuity—re-inhabitation of landscapes, rather than a temporally continuous variable such as cultural or adaptive persistence, growth, intensification and so on—the conversation necessarily becomes focused on specific processes of interest to everyone rather than veering towards the conventional level of expertise of one or other discipline.

Part of the difficulty of defining common ground, however, is not necessarily theoretical. Research constraints can put a premium on highly focused, hypothetically structured and synoptically oriented attention to specific variables and relationships rather than exploration of whole fields of potentially relevant theoretical and empirical material. Turner and Taylor (2003) see a concern that remote sensing/GIS could be so labor intensive and expensive a method that it would become the tail that wagged the whole research dog, encouraging a regression to 1960s-type quantitative spatial geography and unreflec-

tive positivism by offering “a fixity that the ambiguity of social and ecological reality may not easily supply” (Turner and Taylor, 2003: 271). One may need to struggle to maintain the inclusive vision. This idea is claimed by the LUCC-Yucatan project, under the rubric of “integrated land-change science” (Turner *et al.*, 2004: 1) but it seems lacking, perhaps by design or major focus in their own case, in close enough attention to precisely the social and cultural dynamics that anthropologists would emphasize.<sup>2</sup>

Even with this shifted optic, the pragmatic implications for research design have to be faced. Units of spatial analysis can be difficult to agree upon, in part because of disciplinary conventions. Collaborative efforts have so far focused quite narrowly at two specific levels: households and landscapes (Guyer and Lambin, 1993a; Sussman *et al.*, 1994; Entwisle *et al.*, 1998; Moran and Brondizio, 1998; Liverman *et al.*, 1998; McCracken *et al.*, 1999; Mertens *et al.*, 2000; Thompson and Homewood 2002; Fox *et al.*, 2002; Turner *et al.*, 2004). However, all these advances identify further difficulties: for example, of incorporating the macro-political level beyond the landscape (Mertens *et al.*, 2000; Klepeis and Chowdhury, 2004). Even more difficult is localizing the specific complementarities and conflicts that occur *within* communities but *beyond* the household. The appropriate levels for the collection and aggregation of evidence in the domains of social phenomena and natural environment are not self-evident (Liverman *et al.*, 1998). Studies of institutions, communities, politically indexed regions or categories of the population, and scarce resources such as groundwater, each demand aggregation at its own appropriate level.

There is also another imperative to spatial experimentation in anthropology if we are continue to work in longitudinal studies at all. Our older studies were framed in community and social systemic terms in which our discipline (and we ourselves) see real limitations. In fact, we have contributed to the critique by multisite studies within an area (Peters, Linares (1992) and Amanor), following migrant and other mobile populations across the landscape (Cliggett *et al.*, Bassett and Turner), orientating interpretation increasingly to regional issues such as urban demand on the hinterland (Guyer) or different political interventions on two sides of a national border (Homewood). Anthropological strategies for theorizing locations (Gupta and Ferguson, 1997) are becoming more varied, although still very much in debate. Many are concentrating on

<sup>2</sup> For example, the full implications of usufruct tenure for ejido land use are not clear, in particular, the ejidatarios’ use of their own forest resources which—by recalculation—appear to be up to 60% of landholdings, and which are increasingly being preserved from deforestation by the use of secondary succession for fields. There is a configuration of conditions and practices here which is not pulled together.

unconventional locations, such as projects (Ferguson, 1990; Tsing, 2005) where power dynamics are focused on one event or nexus. Others are looking at “margins,” both sociological and geographical (Das and Poole, 2004).

Comparable critical attention to fieldwork techniques is demanded. In fieldwork “translation problems can lead to significant misunderstandings about land-use dynamics”; interviews yielded a more static picture of cropping patterns than either observations or remote sensing, thanks to specific wording of the questions (Turner). Some issues are simply intractable to verbal, conceptual representation: “Herding itineraries change every day and therefore the only response that a herder can make... is vague” (Turner). Even those that might seem to lend themselves to logical inference cannot be relied on: “One cannot predict the timing or pattern of herd mobility based on the type of land cover or the presence of water sources” (Bassett). One finds similar acknowledgement of complexity in several other works that try to take a synoptic view: in Yucatan “the abrupt shifts in regional development initiatives over the past half century moved land change in different directions” (Klepeis and Chowdhury, 2004: 165; See also Desanker *et al.*, 1997 on the difficulty of combining micro-studies with regional and historical studies for the *miombo* woodland ecosystems of Central Africa.)

There is a growing sense, however, that the stakes are too high for easy solutions, especially to turn away from scientific collaborations. The fact that conceptualization has so far been inapposite or neglected for (for example) study of selective impoverishment through differential commodity price declines, or farmer-herder conflict, or chieftaincy practices with respect to land distribution, should not mean that we give up altogether on trying to study them anthropologically at a larger scale. The play of spatial units and temporal frames corresponding to different social dynamics can at least be experimental if we can contextualize and extend the case material in an empirically-based manner rather than being backed into making weak versions of circumstantial arguments about the locus of causations and the aggregation of effects. How to move yet further in experimental directions while still optimizing the strengths of the old approach to “the local” and the archive of evidence about it is a challenge for which new techniques of remote sensing can be part of the solution.

So threaded through the skepticism there emerged some agreement on the importance of five non-teleological processes over the several decades of the case studies that echo the findings of Berry (1993) in her landmark study primarily focused on the prior decades of the colonial period up to the mid-century. Although the micro-processes and how to study them were open to much debate, certain overall shifts were less controversial as drivers of African land use change and therefore as imperative components of

research on sustainable human ecologies. Everywhere there had been, severally and in combination:

- (1) Major changes in the crop repertoire and other natural resources (animals, fisheries, artisanal mining, exploitation of “wild” resources) that supply people’s livelihoods, either directly through self-provisioning or through markets. So comprehensive have been the shifts in cropping (or perhaps in the attention devoted to different crops by science and government) that a recent series of publications has shone a spotlight on the many and varied *Lost Crops of Africa* (National Academies Press; see also Kreike, 2003). In our discussions as well, there was skepticism that crop change could be glossed as “diversification” because in some cases the range of opportunities had clearly declined, and neither had it been accompanied by classic signs of resource intensification. People’s realistic choices had been both changed and reduced at the same time (particularly in Ghana and Zambia). Over the past two decades, this kind of crop change could result from price declines for exported primary products but only Amanor and Pabi pick up on the price question explicitly. Crop change in general, however, has been a classic means for land use and livelihood change in Africa for centuries, resulting in a crop repertoire which is largely imported (Dommen, 1988). Crop shifts have also been associated with change in several aspects of social organization over time: the gender division of labor (Guyer, 1987), farm household and community organization (Hill, 1963; Okali, 1983) and the religious underpinning of skilled knowledge and forms of collaboration (Linares, 1992). So crop shifts are both ecological and social changes in Africa; it is not the same unit that grows yams and cacao.
- (2) Population change, above all very high levels and innovative kinds of mobility into new spaces. Whereas population growth has dominated theoretical work on the human-environment inter-relationship, in our own cases absolute population growth was less clear a driver of either social or land use change than migration. And even when generational replacement was from within a community, through its children and grandchildren, their styles of living, working and relating to their elders were different enough to make any numerical increase less striking than the generational shift. Guyer’s study in Nigeria in 1988 suggests that the overall population can be rising while the numbers directly involved in smallholder farming in a particular area stay pretty stable. Many children leave for cities and elsewhere; those who move in are not

necessarily farmers. Africa's populations are still very much on the move in ways that all of these studies grappled with. Landscapes seem to be patchworks for a variety of reasons, including mixes of ethnic, generational and class-based groups with differing styles of relating to the land. Ethnic succession and the classic founder-follower relationship of African history have been greatly complicated as the basis of social and productive relations by two significant types of movement: inter-regional migration of all kinds (for hired labor, for pasture, for access to new land, for escape from civil disorder), which can create mosaics of land use style; and inter-generational succession, where the youth who do stay in the rural areas develop different modes of land use from their seniors. We may be reticent to call the resulting landscapes "fragmented" or "disturbed," as those terms are used in geography. Uniformity of style could result from rigidly authoritarian monopoly of resources whereas mosaics could indicate diverse approaches to struggling to make do. The ecological mosaic reflects some aspects of the social mosaic, although which ones—gender, early and late comer, social status, ethnic origin—need empirical definition.

- (3) Resource tenure ambiguity and related conflicts (possibly increasing). Land law in Africa is slowly shifting towards more private tenure, but it is still quite unusual to hold freehold title, especially in the peasant areas. People's rights are nested in the institutions of customary law, which varies from place to place and has become more contested as newcomers and new generations claim access (see Berry, 2001). Making contested resource tenure a central characteristic seemed a more accurate and generalizable way of thinking about differentiation in all the sites than simply referring to social class. The grounds for differentiation have fluctuated within any given area. For example in Brong Ahafo in Ghana, the large farms were once state farms and then elite plantations, eventually broken out into smallholder farms and farm styles that retain some of the management styles of their predecessors. Some of the effects of large holdings may be the same whether the land is taken by the state for a national park or for the farms of the elite (both in Kenya and Malawi). The footprint on the land, and particularly on styles of forest use, depends on the vigilance of policing and on localized exceptions made to the rules.
- (4) Intensely powerful though intermittent political intervention: what the Malawi paper, where the interventions were more frequent, calls "punctuation." Sometimes it was an abrupt intervention to redefine resource access (the Maasai and Malawi

cases). In others the state's past and often failed interventions live on in their influence on the rural environment (Ghana). In Cote d'Ivoire the state intervened to define pastoral corridors, whose implications would then work out over time and through the local monitoring institutions and the herders' modes of herd management.

- (5) Climate instability. The sequences and cycles differed by area (e.g. Linares on the Senegalese drought), but climate uncertainty has marked all these livelihood systems.<sup>3</sup>

Crop change, mobility, tenure ambiguity, policy punctuation and climate instability: none of these processes is purely cumulative and incremental; all are both social and ecological; they have interacted in a temporally contingent manner; and, most awkwardly for classic anthropological method, they are not neatly localized, as we assumed ethnic adaptations to be in the past. However, we found that their social and ecological temporalities have tended to cluster (at least, within the decadal time frame covered in our studies).

#### Shorter Dynamics

The short before-and-after study covering five to ten years would lend itself best to studies of key policy moments. Results of intervention can be rapid and marked. In fact, the geographers' concept of ecological disturbance applies more appositely in Africa to political interventions than to other kinds of human action on the environment. This may be a function of the specific capacities of African governments to intervene tellingly on the landscape: more in the creation of enclaves of one kind or another and the sudden alteration of single variables in the mix, than in sustained and comprehensive legal and economic policies.

#### *Transitions in Ownership Regimes*

In almost all our cases, there had been major legal interventions during the past fifty years, sometimes of a draconian but localized nature. They were driven by several purposes: the formal sector in the commercial crop economy, alienation of land for private or state ownership, the opening of new lands for immigration, the definition of pastoral corridors. The issue arises in pastoral contexts (Niger, Cote d'Ivoire) as well as agricultural economies

<sup>3</sup> Guyer's 1988 restudy method was not exactly replicable because of the changed seasonality of rainfall since 1968 that farmers had changed crop sequences to accommodate, and the whole cycle of land clearing and therefore harvesting was almost a month later (see Guyer, 1997a, b).

(Malawi, Ghana). This is not to suggest that ownership regime transitions are discrete moments that replace one stable state with another. They bring crop and technique change; shifts in the cycles of natural reproduction; changes in the population of wild resources; and characteristic shifts in conservation and exploitation strategies (see Cooper, 1977). The rapidity of ownership change simply means that antecedents and directions may already be clear within a shorter time frame. Other changes play out over time. For example, land alienation to large holders in the Kenya case set a whole series of dynamics in process that rapidly differentiated the ecologies on each side of the Tanzanian border (Homewood *et al.*, 2001).

#### *Other Policy Interventions*

Economic policies can have marked short run effects. Democratization in Malawi conveyed the idea that authoritarian conservation laws would no longer be enforced, leading to greatly expanded use of common land by poor people (Walker and Peters). Structural adjustment policies in Cameroon led to rapidly expanding small scale timber cutting as incomes from export agriculture collapsed (Mertens *et al.*, 2000). Grain policy in Senegal affected the profitability of rice in the Casamance, in turn encouraging urban migration (Linares, 1992). Privatization of boreholes in Botswana opened up a privatization dynamic over the surrounding pastures (Peters, 1994). New infrastructures such as oilfields or goldmines undoubtedly change regional human ecologies, although there seem to be few detailed studies of the land use implications in all their complexity (see Magrin, 2001).

None of our own case studies covers outright violence or catastrophic population loss, in spite of numerous examples of wholesale evacuation and desertion in Africa over the past decades. It must be difficult-to-impossible to do ecological fieldwork in the midst of destruction. Nevertheless many present-day anthropogenic landscapes in Africa should offer themselves as examples of the kind of wilderness revival documented by Paul Richards (1996) for Sierra Leone in the past and amenable to at least some analytical techniques (remote sensing being one of them). Wars in Southern and Western Sudan, Eastern Congo, Angola, Liberia and Rwanda, and on a smaller scale the ethnic conflicts over land in Central Nigeria (see Stone, 1997) and the battles in the Niger Delta (Okonta and Douglas, 2001) must surely leave marks on the landscape.

#### *Mid-range Dynamics*

Population and cultivation dynamics seem to demand a generation to study well: 20 to 25 years.

#### *Generations: Youth Micro-politics*

Unprecedented population growth over the past half-century is faced within families as a question of generational relations about resources (including labor). Short generations and longer lives (before HIV/AIDS) mean that generational processes emerge continuously, as a moving frontier of struggle and cooperation. The expanding cohort of youth is linked to the exploitation of niches at the interstices of resources controlled by elders, many of them quite disadvantageous. They include river gardens in Malawi, charcoal in Ghana, seasonal migration in Casamance, gemstone mining in Zambia, labor needs in increasingly intricate production regimes (such as herding), gender/youth-specific farming styles in Western Nigeria. Adult mortality from HIV/AIDS will add altogether new generational dynamics that are under study (particularly by Peters).

#### *Crop and Cultivation Successions*

Over the past 50 years urban demand has expanded and commercial crops have changed their profile in national economies. Certain crops for the domestic market have steadily expanded: cassava in Western Nigeria (Wan, 2001), beans in Kenya (Robertson, 1997), yams in Central Nigeria (Netting *et al.*, 1993). Certain kinds of transition have been repeated in several places, or in the same place several times: unoccupied land turned over to pioneering (the Gwembe case); large commercial plantations downsized to small farming (the Brong Ahafo case); small farming contained by commercial exploitations (Malawi). One can ask whether there are some classic successions with their own internal logic here, such as Netting (1968) famously suggested for Kofyar land pioneering, where migrants optimize the value of their labor by clearing and claiming large areas and planting crops with low labor demands. The Gwembe case here suggests that pioneers have followed similar strategies of clearing and planting new land at least three times over the history of the study. The continent-wide expansion of low labor crops such as cassava appears to be favored by change and instability in general (Berry, 1993). But all the studies suggest that significant discernible change in crop and farm-type succession takes place over a couple of decades.

#### *Land Re-occupation*

All of the cases presented here involve successions of inhabitants moving in and out of the area of study. Only the Jola in Senegal (presented for the workshop by Linares) appear to have followed a continuous and sedentary pattern that we might expect from Chinese or European agricultural populations. Their irrigated agricul-

ture from the past and their political resistance in the present enable such a rare situation, and even then their children are deeply involved in urban migration. In all the other cases, the relationship between locations and peoples has been intermittently renewed throughout their history. There is, in this sense, no “baseline” situation and we have to approach the data from our earliest studies as historically specific. All landscapes were already anthropogenic. Walker and Peters describe a situation in Malawi at the beginning of colonial rule that is comparable to the interpretation of forests in West Africa that has been questioned by Richards (1997) and Fairhead and Leach (1998). What seemed to be wildernesses had been inhabited already, and either depopulated by recent wars and slave raids, or were being used in ways that were not obvious to Europeans. The history of crops and the history and social organization of the producers are intertwined in ways first pointed out by Polly Hill (1963) in her classic work on migrant cocoa farmers of southern Ghana. We have argued throughout that given the cropping-social-migratory nexus in Africa even the most sedentary of populations should be understood as being there for reasons, by social dynamics and using technologies other than the inertias of tradition (see Chalfin, 2004 on new markets for the old product of shea butter).

#### Longer Time Frames

##### *Recurrences: Frontiers*

In several of the studies, major population movements into new lands had been initiated at some time over the decadal period. We think of these as recurrences rather than singular events, not only because in the Gwembe case segments of the same population have moved at least twice but because the whole history of African land use has been cast under the “frontier” concept. The peopling of the continent in the first millennium is known as the Bantu Expansion, and Kopytoff’s (1987) book on the social organization of internal colonization of new lands in African history took the frontier idea from American Studies to conceptualize *The African Frontier*. The authors of these latter case studies explored the idea of a replicative political and cultural dynamic as techniques of cultivation allowed and adverse conditions promoted movement into new spaces. In all of our own cases, the studies trace out the long process of moving, getting established, settling, consolidating, struggling for specific niches in resource access, and providing for intergenerational transmission of assets. We gain a sense of the successions involved, but the Gwembe study offers a particularly valuable view since it can trace two generations of migration onto an extensive frontier, and therefore suggests a specific social-ecological

process. The shorter cases draw attention to pioneering into the interstices of already populated areas, where the land use dynamics may be more profoundly shaped by externally imposed restrictions that also, nevertheless, appear to play out over a mid-time frame.

##### *Trends and Cycles: Long Ecological Shifts*

Africa has experienced climate instability over the past 50 years. The 1950s, on the eve of independence, were unusually favorable for cultivation. In the 30 years between the late 1960s and the late 1990s, there have been major droughts, the rainy season has shortened and the distribution of rains has become erratic. Climate change is expected to have very strong effects in the savannas of West Africa where the climate zone transitions are very close together. In this context, phenomena such as the Casamance drought are difficult to place in a cycle or a trend (Linares, for the workshop). The temptation to search for a “normal” or a baseline has to be resisted because, even when the “cycle” resumes, life does not necessarily resolve back into any *status quo ante*. Braudel’s concept of the *longue duree* needs revisiting here for its applicability to a modern tropical context.

##### *Observed Persistences*

African ecology has always been defined as in some sense more challenging than others: more disease vectors, older soils, less controllable water, more erratic rainfall, sparser and more disease-vulnerable populations, and so on. While studies of indigenous technical knowledge suggest enormously varied ways of mitigating these effects, long-term studies do reveal some persistences over periods of even quite major social change. The most striking is the limited development of continuous cultivation types of intensification, except through tree crops. Even under population pressure, there is an absence of agricultural intensification in some environments (Zambia, coastal Kenya). Is this conservation or conservatism? (see the Miombo study, Desanker *et al.*, 1997). Agriculture has probably always been one motif in a shifting array of other sources of livelihood, which in turn may protect the land from over-use. Research in Malawi stresses the heterogeneity of livelihood strategies. Techniques with great social and symbolic significance, such as *citemene* cultivation in Zambia, have continued in practice, against many predictions (Moore and Vaughan, 1994). The amount of work men are willing to do seems to persist in some places (Guyer, 1992), women’s harvest labor in others. Such reproductive dynamics, and their assessment in terms of social and ecological conservation/conservatism, are in some sense more puzzling than the intrusive interventions characteristic of the short time frames, given the magnitude of the latter.

### Temporalities and Remote Sensing, with Emphasis on Institutional Processes

One can now return to the strengths and weaknesses of each disciplinary methodology. Several factors that link the natural and human worlds have not been reflected very well in remote sensing. Perhaps counterintuitively, the discernment of interventions of the politically motivated sort offers remote sensing a particularly unique purchase on land use changes that social science disciplines are not easily able to “see” and assess in their full magnitude. The very long-term changes also lend themselves to the synoptic view because it is unlikely that major cycles or recurrences or trends would fail to leave some quite striking footprint on land cover. The difficulties seem to settle over the mid-range generational changes, perhaps because this is the range over which the local institutional dynamics have such importance and there is no one-to-one predictive relationship between, for example, tenure mediation and land use. Indeed even crop change can be impossible to identify. This is the time frame that clearly needs most work. Can one identify new herd movements along pastoral corridors in Cote d’Ivoire in relation to changing farmer-herder relations? Can generational change in the claim and use of inherited land in the Nigeria case be identified in farm distribution in settlement hinterlands? Can culling of wood from private estates, under “turning a blind eye” customary agreements, be distinguished from patterns of illegal opportunistic cutting in a national park? Can the expansion of charcoal production from scrub woodland farms be identified at all? In principle many of these institutional processes should be possible to recognize, measure and interpret. We offer brief examples of specific propositions about land use processes mediated by institutions that come from other cases in our network.

(a) *Generational Succession in an Urban Hinterland (Western Nigeria)* (Guyer)

Based on studies in 1968–1969 and 1988, Guyer and Lambin concluded that as urban demand provoked economic and ecological change, two different styles of land use were developing, ahead of the land constraint: one consisted of larger farms, cleared by tractor, cultivated in less labor intensive fashion for longer periods and shorter fallows; the other was a development of the older pattern of intercropped farms on a 4-year cultivation and 8-year fallow cycle. Both were viable as livelihood strategies and some farmers combined them. By 1997, Guyer argued that two styles was actually a simplification of the emergence of several variants on livelihood styles that combined farming with other occupations, especially by youth returning from the city and by new categories of the

population (such as women) going into farming. Expansion of very small, hand cultivated farms, some in river beds, is not necessarily “fragmentation.” It reflects women’s ability to claim land under the familial tenure regime and gain entry into agriculture on their own account, to profit from the improved reliability of the transport for highly perishable products to urban markets. At the other end of the field size spectrum, one sees larger fields, with low density cropping styles, close to roads and settlements, in a style that would *not* be predicted by central place theory. One hypothesis would be that these modes of continuous cultivation are both responses to familial tenure under commercial demand: in the second case, low density planting allows a family member to retain control of a choice plot, where fallowing it would invite other kin to borrow, and perhaps make it difficult to repossess. So the dynamics of the tenure system, under the process of livelihood diversification, would seem to be crucial institutional dynamics that have traceable implications “on the ground.”

(b) *Maasai Age sets and Aspirations* (Homewood)

Maasai perceptions of time and of trajectories of land use and livelihoods change are strongly structured by ageset membership. The tenure of any one warrior ageset lasts about 14–15 years. Periods of transition overlap any one ageset for around four years, during which opposition, tensions, confrontations and ceremonies mark the build up to the opening of a new ageset. The collective identity of a male ageset is partly defined by their ability to negotiate or exact access to and control of resources, contributing to the patterns of land use and cover change detected by remote sensing (Kurimoto and Simonse, 1998). Current junior elders in Kenya Maasailand successfully challenged the gerontocracy over allocation of land titles, and won significant concessions (Thompson and Homewood, 2002). Since the end of the nineteenth century Maasai generations and agesets have shifted from being primarily ‘people of the cattle’ towards progressively greater involvement with cultivation. While periodic remotely sensed land cover data give us an overall framework of observed change structured by chronologically arranged timeslices, the timelines derived from individual histories and site specific understanding capture aspirational changes that reflect successive agesets and divergent gender dynamics.

(c) *Protection of Sacred Forests in Casamance, Senegal.* (Linares and Lambin 2003)

In areas of Lower Casamance where Islam has eroded the power of the spirit-shrines, and the cultivation of groundnuts and millet has replaced rice, sacred forests are disappearing. Also, as a result of

insufficient rain, causing a fall in the Lower Casamance water-table from 6 to 12 m in some place, many subGuinean tree species have died in the midst of untouched forests. Only in those bastions of “traditional” *awasena* religion, where wet (i.e. flooded) and transplanted rice predominates, have sacred forests not only survived but been protected from the effects of drought. The Oussouye sacred grove contains at least 17 species of trees and bushes that are characteristic of most swampy forests of West Africa. However, at least nine species in it are not found north of The Gambia. Accessibility plays a crucial role in the processes of agricultural expansion, resettlement, and yet the Samatiit-Kagnout sacred forest, which is highly accessible, has remained intact.

Infractions against the prohibitions surrounding sacred forests are punishable with illness or even death. The immediate area around each shrine in a sacred forest is cleared of weeds each year, but no other portion of the vegetation in the sacred grove can be felled or burned. Women cannot collect the dead branches of trees and use them as firewood, thus leaving the substrate covered with leaves and dead vegetation. The rainfall conserved in the sacred forest plays a crucial role in the highly intricate irrigated system of intensive, permanently cropped rice-growing and fish-raising that has continued to be practiced through the decades’ long drought.

Social research is not yet making use of the full potential of GIS/remote sensing techniques to triangulate such processes. New, very high spatial resolution sensors allow mapping and detection of finer-scale features of the landscape. Features associated with land use do become clearly detectable from space (settlements, individual fields, clumps of trees, water points). New, high temporal frequency but coarse spatial resolution satellite sensors (such as MODIS, SPOT Vegetation, Meteosat Second Generation) allow tracking of rapidly evolving ecosystem changes, related to drought, floods, fires, and phenology so unusual features of localized change can be traced more closely and accurately than is possible through ethnography or any other on-the-ground technique. We should also experiment with very recent and current changes over much shorter time frames, and work harder on the successions which might suggest principles for their aggregation and intersection with the mid- and long-term time frames. One obvious application is to landscapes marked by extraction rather than, or as well as, cultivation and herding, such as Southern Chad and the Niger Delta for oil, and central Africa for minerals that are mined close enough to the earth’s surface to leave a clear mark.

There are some frontiers in the use of multiple methods and extrapolations that beckon. New approaches for linking household survey data with remote sensing data at the pixel level (see Fox *et al.*, 2002) may open up applications to the other social groupings we identify in the papers. Issues of design flexibility and research ethics also promote at least debate if not yet complementarity. On research design: there was some agreement that a strict hypothetical model for research can turn into a straightjacket. Temporality implies causal and interactive sequences, but it can be problematic to try to identify them unambiguously ahead of time. For example, how indicators for institutional shifts, such as changes in the enforceability of respect for public goods or legal ownership, could be differentiated in advance from the direct effects on land use of population growth or impoverishment cannot be estimated in advance. One should avoid the dangers of imputing generic causes such as “resource competition” when proximate causes for conflict, as people themselves see them, might include long histories of interpersonal battles. The challenge then is how to optimize the potentials of remote sensing and hypothetical thinking without too narrow and closed a definition of the problem and without an exclusive emphasis on the quality of visibility.

On ethics: Rendering visible raises another and different problem. The sense of scientific distance that is provided by remote sensing technology can conceal the fact that gathering evidence of this kind, at finer and finer levels, is itself an intimate political engagement (see Craig *et al.*, 2002). The technical possibility of tracing large trees one by one, and of identifying paths through fences, raises surveillance of poachers to an entirely new level. Alongside the gains in understanding, there remain the possible costs to people’s rights: not just against intrusion but against the creation of another authoritative objectivized account of their lives that does not acknowledge its own hesitations and limitations, or even the tolerant “blind eye” that allows activities that are technically illegal. Ethical concerns may be an incentive as well as a caution to research. In the context of the condition of the continent, new anthropological work is reasserting its prime responsibility for understanding the *people*, as distinct from the *landscape* or any overall *system*. Poverty is a profound concern; the presence of large state and corporate actors is another; the intricacies of food supply (see Mandala, 2005) and the religious framing of lives under pressure or in distress are others. Can the disciplinary practices work together to illuminate and ameliorate the conditions under which people make a living? While the studies do not yet go that far, they can come to strong conclusions about the times these people have lived in and the challenges they now face.

## The Papers

Each paper reflects the authors' own research, written up in light of our exchanges. We did not attempt to integrate them further, so they are not strictly comparative. Each includes both field-work and remote sensing (or experience of using these techniques in their broader research in the case of Bassett and Turner). Each engages in the authors' own ways with the idea of temporal heterogeneity: all address processes of landscape "fragmentation" and livelihood change as African rural populations re-inhabit their landscape over time. The following paragraphs offer a brief guide to the papers and begin—but by no means exhaust—the search for resonances amongst them.

Walker and Peters, writing on Malawi, take the most temporally intensive view. There is a century-long history of land appropriation and government intervention, due to the management ambitions for this desirable environment by both colonial and post-colonial governments. Against this backdrop, the authors concentrate attention around policy change since about 1983, when President Hastings Banda instituted greater land appropriation and the long and shifting history of social differentiation. Since then, there have been multiple changes in land and agricultural price policy, as well as democratization and the beginning of the HIV/AIDS epidemic. The authors take us carefully through the logics of documentation and interpretation for a case such as this, where none of the classic teleological processes has time to "play out" before another intervention intersects with it. Theirs is a particularly searching examination of what may and may not be achieved with different techniques of study.

Cliggett, Colson, Scudder, Unruh and Hay, summarize over fifty years of closely documented change among the Gwembe: in the area to which they were relocated after the building of the Zambezi Dam, and as they are now migrating to further new areas. It is with the authority of an unbroken record of social and demographic evidence that the authors can show how uncertainty has generated differentiation, but through recurrence rather than any simple progression. At each juncture people have seized the new opportunities, only to see them dissipate for one reason or another: policy change, declines in infrastructure, dry and unpredictable weather, changes in commercial opportunities, and also variable recourse to social relations. Antagonism between generations, between maternal and paternal kin, and evangelical conversion all affect the way that local institutions mediate resources and income access. Without a viable mode of intensification on their land, people's efforts at livelihood diversification have taken the form of successive migrations to new land. Each time, the pioneers have an advantage over the later-comers and there is a spurt in land clearing. But here the sociologically recurrent process shows that this progressive strategy will

surely have its limits as long as policy interventions remain so undependable and cyclic booms and busts constitute people's only experience of economic life. The authors argue that land degradation is due more to people "jumping" at chances as they pass, than to systematic soil mining as an agro-ecological approach.

Amanor and Pabi address in greater detail the crucially important processes of population mobility and ecological succession in areas where the politics of markets for both resources and commodities frame incentives and limitations. The case itself suggested to them that they look at successions in an immigrant area first of all in historical terms. This landscape was opened up by policy, so they argue that it should be understood as a "narrative," not as a "simple linear process" of "traditional" agriculture being adapted to "the market." Brong Ahafo was opened up by state farms in the 1960s, followed by subsidized inputs and large commercial production. The demise of state-sponsored intervention left its marks on the area, which then was largely rehabilitated by smaller scale farmers. These farmers' diverse trajectories follow from a niche occupational logic, as different participants find spaces and technologies that create their own presence on the land. They emphasize, however, that this is hardly a system in any strict sense. Past policies to develop the land have remaining effects into the present; current land-users are in tense relations with each other; there is gain of land cover in some areas and loss in others.

Bassett and Turner highlight the social institutional frameworks that determine the temporalities of herd mobility in Niger and northern Cote d'Ivoire over the period from the 1970s. After the great Sahelian droughts, there appears to be a historic southwards movement of the pastoral herds from the Sudanic to the Sahelian zones. They argue against a stimulus-response approach, which inevitably focuses on measurable "determinants" that can be analyzed as linear quantitative variables, such as rainfall. By detailed case analysis and comparison, the authors show the mid-term thinking that accounts for the timing and patterns of herd movement. For the pastoralists, it takes typically 10 years in each location for a herd to be prepared in terms of composition, breeding for disease resistance, negotiation of pasture access and security assurance for their owners to move to another region. The process is dense with political, social and technical challenges, leading Bassett and Turner go back to the older anthropological concept of "migratory drift" that refers to social institutions that predate the drought. Here a series of drastic experiences in the north, compounded by the draw of the meat market in the south, are resulting in the reworking of indigenous knowledge, social institutions, generational relations and relations with the state in ways that have much in common with the past modes of self-reliance.

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