# (Mis)Understanding Agro-Environmental Change in Africa: Population Growth as the Principal Source of Poverty and Environmental Degradation*

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ABSTRACT:

*This paper explicitly counters conventional policy wisdom on agro-environmental change in Africa. I show which assumptions are unfounded, under what historical conditions such assumptions were made, and what is a more precise understanding of agro-environmental change. Academics, policymakers and the public often assume that traditionally stable shifting cultivation systems have recently broken down because increasing population has reduced the amount of land which farmers can use to set aside to allow replenishment. Such notions have risen in colonial times, in the 1970s after critiques of the Green Revolution and in the late 1980s and 1990s with populism, environmentalism and promotion of biotechnology. In contrast to this dominant metanarrative, social relations at multiple levels are key in understanding change in agricultural production and environmental conditions. The incorrect emphasis on population as the primary motor of change underlies top-down strategies, inappropriate prescriptions, and ill-fated projects promoting green revolution technologies.*

Keywords: Agriculture, technology, environment, Africa, population, colonialism, Green Revolution, Farming Systems Research, populism, biotechnology, shifting cultivation, political ecology.

Is it possible that some of our understandings of international development are terribly wrong? Africa represents many different things in the minds of many different people: a heart of darkness, a heartland of traditional culture, a cesspit of anarchic chaos, a continent of exotic wildlife. For many, Africa is a land where population growth is the motor of agricultural and environmental change.

African farmers, according to 'conventional development studies and policy wisdom,' have traditionally throughout the ages practiced 'shifting cultivation.' They cultivated plots for a few years until the fragile tropical soil was exhausted, and then moved on ('shifted') to cultivate a new plot cut from wild areas, leaving the old plot alone for about ten years to then naturally regenerate its quality (fallow). As populations increased, there was less land for farmers to move on to, and hence they had to either come back to their old plots before fields were replenished or cultivate marginal forest and dry areas. The apparent result of population growth induced breakdown in shifting cultivation is poverty, hunger, and environmental degradation (e.g. Cleaver and Schreiber 1994).[1] As two major accounts describe:

> Millions of small farmers, especially in Africa, are locked into an outmoded system of shifting cultivation and related bush fallow systems … Development of practical substitutes for Africa's traditional shifting cultivation and related bush fallow systems practiced by more than 60 million farmers is the "key log in the jam" holding back increased food production. Almost one-third of the world's exploitable soil resources is farmed under these outmoded systems.

—IITA, 1977, *Decade of Progress and Promise for Tomorrow*

> It is a general rule of agricultural development that, as population density increases, there is a gradual move from extensive to more intensive forms of farming. Instead of moving the fields, the same plot is cultivated most or all of the time, and the nutrients taken out by crops are put back in the form of fertilizers, manure, crop residues, or the use of nitrogen-fixing bacteria in legumes like beans or peas…
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> Time is another luxury Africa does not possess. In other regions the shift from extensive to intensive farming took centuries. Given Africa's explosive rate of population growth, currently 3.2. per cent a year, the shift needs to take place in two or three decades …
>
> Over most of Africa, there is still enough land for it to be cheaper and easier, in the short term, for farmers to move their plots every two or three years. *Population density has not yet reached the level where intensive farming is unavoidable. But it has reached the level where massive ecological damage can occur if traditional methods go on being used*. Most of Africa is presently caught in the gap between those two critical densities …
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> [M]ost African farmers are still using the techniques of shifting cultivation increasingly under conditions that make those techniques destructive.
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> The cropped area has expanded, and the fallow period has been progressively reduced, in many areas to the point where it can no longer restore soil fertility or yield sufficient wood or grazing. Trees no longer have time to grow to maturity, sometimes not even to set seed. Nutrients and organic matter are not longer returned naturally to the topsoil, nor do farmers restore them artificially by chemical or organic fertilizers. Except in severe droughts, livestock numbers grow in parallel with human numbers. The growing herds compact the soil, stripping cropped and fallow areas of edible vegetation, chomping tree seedlings down to ground level. Fuelwood needs grow in line with population too, and press on a reduced tree stock. Crop residues and dung, so desperately needed to maintain soil fertility and structure, are increasingly burned as fuel.
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> A series of vicious spirals sets in. *All pressures push together to reduce the protective cover of vegetation, exposing the fragile soil to the battering of tropical downpours and winds*.
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> —Paul Harrison 1996, *The Greening of Africa*, emphasis original

Such frameworks are incorrect because numerous other social factors at multiple geographical levels affect production and environmental conditions, including gender relations, land tenure (and property rights regimes more generally), land distribution, direct and indirect state policies (colonial and post-colonial), agricultural development projects, conflict (local, national, international), foreign aid, national parks, underground resources (oils, diamonds, etc), and commercial timber production.

This paper forms part of an effort to counter dominant policy narratives about African population, technology, agriculture, the environment, and poverty. In some cases, such policy narratives are important material forces in the lives of people in the Third World, and emanate largely from the Consultative Group on International Agricultural Research (CGIAR). The Group's tacit acceptance and occasional explicit espousal of the conventional wisdom has often removed issues of politics and power from discussions of agro-environmental change. The uniformity and inevitability of this myth make for tediously banal reading; in positing a teleological and uniform model, a universally applicable blueprint for what is happening, the conclusions are known beforehand. However, the myth is also enraging in its blunt, uniform models that ignore specific historical and geographical processes and thereby legitimates so many development projects and hinders others. The narrative leads to an emphasis on two development programs: developing new, more productive agricultural technology and on population control measures. The myth has been conclusively—but always implicitly—disproved in case studies by academics, and has been reworked by various people in the development offices and rural countrysides, but it has not to date been explicitly charted and refuted.

The dominant narrative of African agro-environmental change began in the colonial period, took hold in the late 1970s and early 1980s, and has been revived in the late 1980s and 1990s. The

last section of the paper analyzes how agro-environmental change actually occurs through multiple processes occurring at multiple geographical scales.

## I. THE COLONIAL ERA (1800 to 1960): The Myth Begins

The broad thesis regarding African agro-environmental change began with colonial concerns about maintaining sovereignty, protecting settler interests, balancing resource extraction with social stability, and protecting nature. Colonial ideologies held that (1) farming systems were static until they were broken down by population increases (increases that were spawned by health improvements and the protection by colonial guardians from ethnic conflict); (2) farming systems were bounded, uniform, homogenous and coherent systems (Niemeijer 1996); and (3) African farmers were largely backwards, lazy and irrational (e.g. Collinson 1981: 438).

The irrational small farmers threatened to destroy scenic wildlife, and cause soil erosion and livestock problems for the empire's white settlers. Colonialists feared not only farmers' irrationality, but also the sheer number of the pesky shifting cultivators. Administrators believed that beneficial colonial health measures and protection from internecine warfare had allowed African populations to expand, thereby inadvertently causing widespread disruption in the delicate agro-environmental systems. The solution was more productive technology, but technical change would come about by targeting those 'progressive' farmers (usually wealthier, more educated, male, etc.) who had broken out of the shackles of rural traditions and had come to embrace modern science and technology.

Colonialists' fear of overpopulation drew from the work of Reverend Thomas Malthus, who had originally argued in his famous 1798 text, *An Essay on the Principle of Population*, that the divergence between the food needs of a growing population and the amount of land to grow it on would result in global catastrophe. As Grove (1998) has documented, concerns about environmental degradation began first with the imperialists' island timber reserves, which provided crucial lumber for naval batteries. With the changing ideas of the Enlightenment and Renaissance, imperial powers came to embrace the notion of saving 'Edenic' tropical paradises from the destructive races. From the islands, conservation notions were transferred to India, and then Africa. It was in India and Africa that concerns about deforestation, drought, famine, and social breakdown became linked through the work of an international circuit of professional scientists and planners. Shifting cultivators—rather than timber companies—were easy targets, as imperial control took the guise of environmental protection. Concerns over conservation also grew as France, England, the United States, and colonies experienced heightened disputes, regulations, and infractions around forest resources. Furthermore, transnational networks of colonial scientists and administrators had believed the US dustbowl to be a future for then drought ridden southern African (Anderson 1984; Beinhart 1984).

In order to protect imperial heritage from the growing legions of African farmers, colonial guardians felt compelled not only to use the 'trickle down' approach of extending technology to large wealthy farmers, but also to exercise brute coercion through fines and imprisonment of small agriculturalists deemed too irrational, ignorant, or imprudent to adopt conservation measures on their own initiative. Africans were forced to work on state or chief owned plantations, change their crop compositions, contribute to emergency food reserve silos, and practice laborious soil conservation measures, such as constructing terraces and ridges (Anderson and Grove 1987). For instance, during the 1930s and 1940s a series of acts—most notably the Zimbabwean Native Land Husbandry Act of 1951—forcibly promoted conservation through destocking (mandatory reductions

in livestock numbers) and terracing. These measures ultimately provoked considerable resentment and fed into anti-colonial independence struggles (Grove 1998: 177-223).

Colonialists thus popularized the myth of African agro-environmental change through their environmentalist concerns about the disruptive consequences of growing populations of irrational, shifting cultivators. For instance, E.P. Stebbing, a highly influential colonial forester from India who toured Africa, gave an account in 1934 that is strikingly similar to current narratives:

> In West Africa the process [the advancing Sahara] owes its commencement to the system of farming the bush or degraded type of forest which covers much of the countryside, this system being a form of shifting cultivation. With an increasing population the same areas are refarmed at shorter intervals, with a consequent more rapid deterioration of the soil constituents, until a stage is reached when the soil is no longer sufficiently productive for agriculture (Stebbing 1938:12, quoted in Swift (1996: 74)).

Stebbing called for an international effort to stem the supposed agriculture-induced desertification, enlarging the Sahara and changing the climate of the entire region. An investigative commission was sent in, but since it was a particularly rainy year their conclusions were much milder. Concerns about overpopulation remained less pronounced until they were revived in the 1970s in the midst of severe droughts, famines, and Cold War politics (Swift 1996: 75-77).

## II. FORTIFYING THE MYTH: The Rise of Farming Systems Research in the 1970s

The complexly disparaging colonial ideology and interventions were transformed in highly intricate ways by the events of the post World War II era, giving rise to a new paradigm that would fortify the myth of African agro-environmental change. From the late 1950s through the 1970s, fears of population renewed, leading to efforts to stem this threat with agricultural technology. In response to critiques of such new technologies there arose a powerful new discourse and practice—Farming Systems Research—that drew upon underlying ideas of 'systems thinking,' functionalism, and evolutionism to fortify the myth of population induced agro-environmental change. With the institutionalization of FSR, the myth has been disseminated in universities, policy circles, and research centers throughout the world.

The 1950s saw renewed fears about overpopulation, less as a threat to colonial heritage than as an destabilizing force in a world of superpower battles. Colonial concerns about overpopulation died down when the French, English and Portuguese colonial powers became preoccupied with the Great Depression and the Second World War. However, after WWII, American policy circles felt that the US should act as an international beacon of democracy and hence had to tackle the problem of overpopulation. Overpopulation, they feared, could lead to hunger, rural unrest and from there to the political disorder that would make countries susceptible to pernicious communist forces. In the early 1950s, the Rockefeller and Ford Foundation sent survey teams to Asia, which upon return expressed great alarm and prompted the establishment of research centers that translated the touchy issue of population control into depoliticized professional jargon. Nonprofessional activists came to convince businessmen and politicians that extreme population growth could be politically disruptive, lead to communism, and thereby block off access to key resources and markets (Sharpless 1997).

This renewed emphasis on population lead to the formation of agricultural research centers that would provide more productive agricultural technology that would raise farmers incomes and

provide food for all. Agricultural technology was to prevent the rural discontent that would foment communist sympathizing—an agricultural Green Revolution to preempt the social Red Revolution.

The two international agricultural research centers (IARCs) that gave rise to the Green Revolution were the Mexico based International Maize and Wheat Improvement Center (known by its Spanish acronym, CIMMYT) and the International Rice Research Institute (IRRI) in Los Banos, Philippines. The Green Revolution centers consisted of researchers developing new plant varieties via controlled breeding that, in combination with fertilizer and irrigation, would give the dramatically higher yields that were supposedly necessary to feed the growing populations of the Third World. The Green Revolution consisted of: (1) increasing aggregate production, whether through large farmers or small; (2) an emphasis on a few simple components of the farming system, with a focus on developing new crop varieties; (3) technologies that moved from the top downward, from research stations to state agencies to farmers' fields; (4) a belief that new technology rather than changes in social relations could solve hunger, resource conflicts, and political instability. The emphasis thus was on breeding by a few scientists at a research station who would then create miracle seeds that, as 'magic bullets,' would alleviate hunger and poverty by decreasing the gap between aggregate populations and aggregate food production.

At the early CIMMYT precursor in Mexico, an American scientist named Norman Borlaug worked in the 1940s and 1950s to develop new methodologies and new dwarf wheat varieties that gave greater yields under heavy fertilizer use, because their shorter stature could withstand the larger grain load. The result was station-bred seed that could be used by the large commercial farms of Northwest Mexico to increase production. In the context of radically unequal landholdings, such dramatic increases by a few large farmers did little to alleviate widespread poverty and hunger, even though the research was popularly depicted as being neutral and objective modern science bringing progress to the *entire* world over (Perkins 1997). The bias of the new technology towards upper class Mexican upper farmers was systematically excluded from consideration in the research; researchers and studies that disagreed with the breeding strategy were trivialized or dismissed by the Foundations and high-ranking institute staff (including a geographer from UC Berkeley, Carl Sauer) (Jennings 1988). In the early 1960s Borlaug also made heavily publicized visits to India to (controversially) facilitate similar breeding there that would allow higher yields via new varieties, irrigation, and heavy doses of fertilizer. By 1972-3, the area in India devoted to new varieties had risen twenty-fold to ten million hectares, with aggregate production rising as well (Perkins 1997: 232-246).

IRRI was formed through the joint efforts of the Ford and Rockefeller Foundations after the 1952-3 trips through Asia emphasizing "the fundamental physiological, biochemical and genetic problems" (Baum 1986: 2). The first major dwarf rice variety, IR 8, was released in 1966, much earlier than expected. With government promotion, the new varieties of rice and wheat soon proliferated to large farms throughout numerous countries in Asia (Baum 1986).

By 1971, the two foundations and donors, such as the UN and World Bank, had formed an international network, the Consultative Group on International Agricultural Research (CGIAR), of such research centers to replicate the Indian and Mexican experiences worldwide with numerous crops.[2] The CGIAR centers were some of the main platforms through which later analysts would espouse the conventional African agriculture narratives. However, these narratives were prompted first by the growing criticism of the Green Revolution.

Criticisms of the Green Revolution in Mexico and India mounted in the 1960s and 1970s, suggesting that the new technologies favored wealthy areas, increased unemployment and regional inequality, did not reduce poverty—and hence hunger—and in addition had negative environmental and health affects (Biggs and Farrington 1991).[3] A number of policy and academic debates soon

ensued, epitomized in an IRRI study and a UN report on 'the social and economic implications of the green revolution,' (Pearse 1980). CIMMYT and IRRI sought to appease their detractors with a reformist change in research methodologies: a new approach called Farming Systems Research (FSR), which emphasized researching and testing the new technologies directly in small farmers' fields as a means to adapt the technologies to various unique 'farming systems.'

The by now obvious discrepancies between the purported benefits and stark realities of the Green Revolution prompted the centers to shift their rhetoric and practice to FSR.[4] A crucial recognition was that poorer, marginal farmers were rational—not lazy and ignorant—in rejecting technology that was not well suited to their bio-physical and socio-economic conditions. FSR's novel methodology was about forging closer links between researchers, extensionists, and farmers so that researchers could better tailor technology to farmers' complex bio-physical and socio-economic conditions—a sort of 'participatory development' precursor. In short, the fundamental premises of FSR are (a) farmers are rational and (b) they face complex systems of constraints, which implies (c) they will adopt technology that is suited to them, and so (d) technology will have to be based on in-depth analyses and actual on-farm testing (Merril-Sands 1986). In this approach, researchers and extensionists used five key FSR procedures: diagnosis through surveys and tabulation, planning, on-farm testing, assessment of new options, and extension of the chosen package (Tripp et al. 1990: 387).

However, FSR actually took a form that was severely limited and was used only to appease critics with superficial attempts to 'aim agricultural research at the needs of farmers' (Winkleman and Moscardi 1982). Initial FSR proponents emphasized both the 'upstream' factor of inappropriate R&D (such as corn husks that were too short), and the 'downstream' factor of political and socio-economic conditions (such as poor prices for crops, or labor civil war). However, the accumulated biases at CIMMYT confined research to a microscopic focus on 'upstream' R&D. The new CIMMYT director, Haldore Hanson, took office in 1970 determined to keep discussion confined to technical matters and basic research and, in 1972, scrapped a controversial Mexican project. Some researchers recognized early on that FSR focused only on small adjustments and 'technical fixes' and did not address broader constraints, which were treated as fixed parameters.

The 'technocratic' limitations stemmed partly from the fact that FSR arose out of the Economics Department at CIMMYT, which was formally started in 1969 and staffed by a lone economist, Donald Winkleman, only in order to ward off criticisms of the social and economic effects of green revolution technology (CIMMYT 1992). Center staff—mainly breeders and agronomists—were indifferent, and sometimes hostile, to the idea of more social science because they viewed it as making their own work just too complicated to be effective. As a consequence, Winkleman was hired in order to deter, rather than investigate, critical reviews—which kept the scope of research limited. Winkleman remained the director of the Economics Department until 1985, when he became Director General of CIMMYT itself (and later served as CGIAR chairman until 1999) (CIMMYT 1992). Perhaps partly as a result of Winkleman's influence, research remained focused on technical germplasm issues, albeit supplemented with attention to the complex micro-dynamics of farming systems. However, there was little analysis of the wide array of broader socio-economic and political processes and structures shaping land use (which I discuss in the final section), let alone any connection or linkages between geographical scales (Norman and Baker 1986: 37, 38, 54).[5]

While the farming systems research indeed offered a different way of conducting research and extension, it was also a product of underlying ideological currents of 'systems thinking,' functionalism, and evolutionism, and these concepts lie at the root of FSR's perpetuation of the dominant myth of African agro-environmental change. In systems thinking, the first influential

ideological current of the 1960s and 1970s, structured networks worked through elaborate feedback mechanisms to maintain a balanced equilibrium. Such thinking prevailed in academic and popular writing and in development policy as well. Ecological anthropologists emphasized, for instance, what they thought were isolated societies in static equilibrium with their environment (Vayda 1969). Popular influences included early fumbling with computer programming and such popular texts as James Lovelock's (1979) book about the earth as a single, complex living whole, '*Gaia*,' a superorganism with various balanced channels of positive and negative feedback. The systems view was also prevalent in the numerous *Integrated* Rural Development Projects, which focused on developing all aspects of rural life at once since all aspects were seen to be interconnected. While systems thinking did emphasize the importance of connections, it suffered from a focus on bounded, coherent, and parsimonious systems—giving a misleading caricature of the settings of rural life.

More important than the general inclination towards systems thinking was the functionalism inherent in FSR, which grew out of an excessively microscopic focus on risk in farming systems. Functionalism is the notion that existence is explained not by historical development, but by present function. The functional explanation of shifting cultivation is that it exists because it functions to allow delicate tropical soils a period in which nature can restore their structures and nutrient content. Functionalism is, however, built upon two fundamental flaws: (1) if one explains form from need rather than historical context, one is unable to explain change in forms through time; and (2) functionalism cannot explain differences between forms in similar situations. Functionalism cannot therefore explain why peasants might have changed farming systems over time, nor how different farmers (men vs. women, for example) have come to practice different forms of cultivation.[6]

Functional frameworks use the notion of risk as a means to explain the apparent absence of change: poor farmers do not want to take risks because they are so close to the margin of life or death that a chance failure would be catastrophic. Since it is risky to try out new options, (it was literally dangerous to experiment), farmers are unable to develop new, more productive, technologies:

> The African farmer is interested first and foremost in yield stability. He prefers a safe but modest yield to an erratic high one. The chief threats to stable yields come from diseases and pests, which flourish in conditions of higher temperature and high humidity (IITA 1977: 7)

Thus, IITA advertised its work as increasing productivity by developing and introducing varieties that reduced risk because they were less susceptible to the vagaries of disease and pests. The widely accepted wisdom is thus that the poorer a farmer is, the more risk they face, and the higher they require the returns on a risky investment in order try it out—in short, the poorer they are, the more conservative they are.

Functionalist accounts of peasant agriculture were even more appealing because they seemed to explain not only agronomic stagnation but also conservative social traditions: the notion of risk at the farm level was superimposed with conceptions of the evolution of traditional *social* institutions. Farmers who face both risk and poverty will develop an attitude, even a shared social value, that change (cultural, technological, social, etc.) is potentially risky and ought to be avoided. Conservative social systems automatically evolve that function to reduce risk. A prime example is the redistributive mechanism, whereby a leading figure (a chief or feudal lord) in a community would accrue a small portion of each farmer's production and store it, so that should a mishap occur, this surplus would be available to bail out the victim. The headperson was restrained from personally benefiting from this exercise through social sanctions (such as gossip), which necessitated that they redistribute excess surplus, often done in elaborate feasts. Further, external relations were viewed as a threat both to the headpersons authority, and to the stability of the community. What evolves, then, in functionalist accounts, is a bounded community with farmers using old, rudimentary technology,

and a coherent, harmonious social system which has evolved and continues to exist only in order to reduce risk (Scott 1972; Migdal 1974).

These socially functionalist ideas, which formed the favorable context for FSR, came to the fore from the 1950s through the 1970s as the result of a few key factors. First were the functionalist trends in anthropology, spawned by A.R. Radcliffe-Brown, who was heavily influenced by the father of functionalism, the French sociologist Emile Durkheim. A.R. Radcliffe-Brown (1950; 1952) and his British cohorts held a backlash against the earlier anti-functional historicism of Franz Boas in the US, and spawned a whole series of functionalist texts as well as a generation of scholars from the UK composing functionalist accounts of African societies (including Meyer Fortes (1940; 1952), E.E. Evans-Pritchard, C.D. Forde, and others). Secondly, Talcott Parsons, as the major figure of US sociology, promoted functionalist views. Thirdly, in the 1970s interest grew about the causes of rural based revolutions (as in Asia and Latin America) in what were though to be stable, functional societies (Wolf 1969; Migdal 1974; Paige 1975). A debate ensued over whether farmers 'averted risk' and followed moral sanctions (Scott 1976), or whether they individually took risks in order to take advantage of market opportunities (Popkin 1979).

Social functionalism, however, contained the same difficulties as agronomic functionalism: it ignored history and geography and could not therefore explain change through time or diversity between and within forms. In fact, the British functional anthropologists had neglected to factor into their studies of African kinship and political systems the massive disruption caused by two hundred years of global slave trade and half a century of colonial 'pacification' and rule. Functionalist accounts often rely on stereotypical representations, abstracted from historical and geographical specificity.[7] Note in the quote from IITA above that the farmer is a bland, stereotypical, subsistence-oriented male farmer, and we are given no context at all—is this peasant actually a small woman farmer growing coffee destined for Europe on land she is renting from her cousin so that she can pay the medical bills of her son who was injured in a nearby mine that produces gold for semiconductor production in Singapore? Inattention to context lead to notions of farming systems as stable and internally homogenous (Berry 1993: 6):

> the premise of the FSR approach is that farming households *are endowed* with different characteristics … One of the first activities in FSR is to identify the groups of households within a target region that are 'relatively homogeneous' in their characteristics, on the assumption that they will respond to new technology in a similar way. (McMillan 1987: 295, emphasis added)

The untenable assumption of homogenous farming systems has met sharp criticism from scholars of women in particular (Moock 1986; Poats et al. 1988). Nevertheless, agronomic and social functionalism provided the context in the 1970s and early 1980s in which the new micro-focused FSR frameworks flourished. Farmers' aversion to taking risks explained why they did not develop new technology, and risk thus thwarted technical change in agriculture, leading to stable 'farming systems' and the accompanying traditional, bounded social systems.

In addition to systems thinking and ahistorical functionalism, FSR also involved a great deal of evolutionism. Farming Systems Research was heavily based in earlier anthropological ideas of a single, linear path along which all societies evolve, with industrialized England, naturally, at the forefront. James Ferguson (1997: 154) distinguishes three characteristics of such classic cultural evolutionism. First, the idea of evolution uses metaphors of human maturation: primitive societies and/or developing nations were like children, while civilized, developed nations were adults, as following Herbert Spencer, the infamous 19th Century Victorian cultural evolutionist. As Akhil Gupta (1998: 41) describes, "Nations are 'newly born,' their economies take time to 'grow,' and their markets and political systems finally 'mature' when they are fully developed." Second,

developing nations are supposed to be at a latter stage of the same singular path towards development. Hence some analysts note the 'mimicry' in development discourse: "To learn, follow, replicate, repeat, improve—these are the incitements of development discourse" (Gupta 1998: 40; Bhaba 1984), while others note the 'displacement' of the third world into the past of the first (termed "allochronism" by Fabian (1983) ). Third, classic cultural evolutionism orders differing people according to which stage they fit into in the grand hierarchy of humanity (deriving from earlier notions of the 'great chain of being'). Armchair anthropologists used the comparative method of speculating about societies around the world, and, based on their level of development, correlating their progress to a given stage; geography equaled cultural difference, and in the different locales and cultures one could see the stages of history.[8]

These classic cultural evolutionist ideas were translated almost exactly into agricultural terms through Farming Systems Research, with different stages of agriculture representing different rungs on the ladder to Western, modern, industrialized agriculture, epitomized by the hi-tech corn belts of Iowa. A formative evolutionist work on agriculture was Ester Boserup (1965) groundbreaking text, *The Conditions of Agricultural Growth*, in which she argued that population density was itself a prerequisite for agricultural intensification:[9]

> Radical changes in the relation between human and natural resources occur in areas in which population multiplies. Shrinking supplies of land and other natural resources would provide motivation to invent better means of utilizing scarce resources or to discover substitutes for them (Boserup 1983: 5).[10]

For Boserup, low population densities make labor the most limiting factor of production, while high population densities mean that land is the most limiting factor. As population density increases, agriculturists move from extensive shifting cultivation, to bush-fallow, and then to increasingly sedentary and intensive methods. Thus, the growth of populations throughout history could be tracked by corresponding changes in agricultural technology—in short, population growth drives change, and hence drives history. Boserup proved tremendously influential in debates an agricultural change in Africa (Boserup 1999), but her more optimistic forecast was subordinated to the crisis scenarios presented above. The strong evolutionism inherent in her work proved constraining on many scholars (Bryceson 1995), but has inspired substantially many more works, including such key cross-sectional pieces as Pingali et al's (1987) *Mechanization and the Evolution of Farming Systems in East Africa* (of which one author is now head of agricultural development in Africa at the World Bank), as well as work by McIntire et al (1992) and Bourn (1994).[11] A strong line of evolutionism pervades many texts on African agro-environmental change. In fact, one CIMMYT Annual Report even included a fill-in-the-blank narrative of this exact scenario. The notion of a single ladder of change has prompted programs to offer the technology of the next 'rung'—essentially an African Green Revolution (Borlaug and Dowswell 1995). There is, however, a long history of critiques of evolutionism, from anthropologists and those in development studies, who emphasized the importance of historical, empirical investigation in contrast to theoretical inferences from scattered case studies and shaky statistics.[12]

The sedimented ideologies of systems thinking, functionalism and evolutionism in which FSR took hold also had a peculiarly African character.[13] The three ideological bedrocks upon which FSR flourished arose from the specific colonial discourses on African tradition and tribal society. Farming Systems Research contributed to a myth that was particularly *African* in two ways: socially and ecologically. Firstly, FSR's more general narrative of agro-environmental change appeared to be especially accurate when applied to Africa because there one could clearly identify the exact social systems that had evolved with a risk reducing function: the typical African tribe. The average tribe was believed to be isolated and insulated by clear ethnic and territorial boundaries,

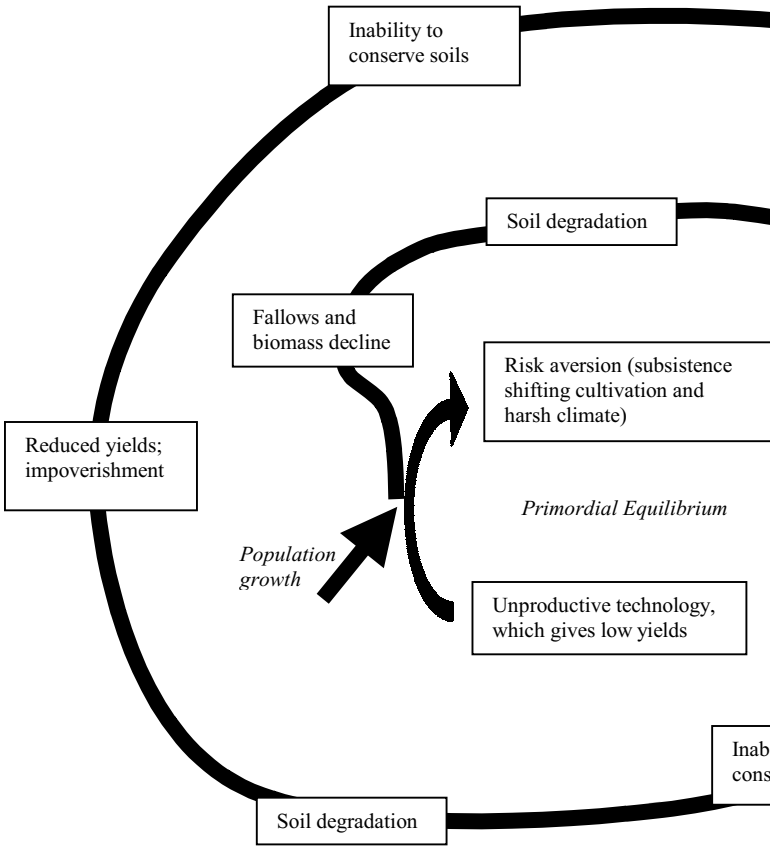
to have a chiefly leader, and to have evolved with their environment and in one place for millennia (Malki 1997).

Although we are accustomed to images of isolated tribes, unchanged throughout the centuries, stubbornly holding onto traditional shared systems of belief and action, in contrast, African societies and traditions were deeply infused with multileveled power, inequality, politics, and above all, change and contestation (e.g.Wilmsen 1989). Mamdani (1996) has perhaps given the most elaborate exposition of how tradition was perceived, constructed and contested in Africa under terrain of unequal power inherent in indirect colonial rule. In order to balance the objectives of minimal administrative costs and maximum resource extraction and still maintain socio-political control, colonial powers sought to rule through what they believed were preexisting socio-political structures. Britain brought in its functionalist anthropologists to help codify and classify tribes and their customs.[14] Administrators and anthropologists alike perceived the unit or 'container' of traditional social organization to be 'the tribe,' which was 'rooted' in a communally owned, bounded geographic area and headed by a chief (Mamdani 1996: 49-55, 107-170; Malki 1997; Vail 1988; Bryceson 1995; Bassett and Crummey 1992). Indirect rule through the stable, functional socio-political systems therefore allowed 'colonialism on the cheap,' or, as Berry (1993), puts it, 'hegemony on a shoestring': "By this dual process, part salvage and part sculpting, they crystallized a range of usually district level Native Authorities, each armed with a whip and protected by the halo of custom" (Mamdani 1996: 49). In so doing, however, colonial administrators began making claims upon resources and meanings, thereby intensifying struggles and prompting increased investment in the social means of retaining access to land, trade and labor resources: "Administrators sought information on traditional social structures and identities in order to know how to apply customary rules in governing colonial peoples, while African colonial subjects *renegotiated* rules and social identities in order to cope with or take advantage of colonial rule and commercialization" (Berry 1993: 34). What colonial powers and popular anthropologists produced in the colonial period was thus not only a set of ideas about agriculture and the environment, but more importantly, an corresponding set of ideas about social organization in Africa that found new light in the 1970s with the rise of the emerging Farming Systems Research paradigm (see also Ranger 1983; Moore 1994; Vail 1988).

FSR, in addition to building off of social theory that had particular connections to Africa, also had an ecological focus that too was specific to Africa. The specifically African ecological portion of the myth—that Africans practice(d) shifting cultivation—was fortified through work at another CGIAR research center, this one in Ibadan, Nigeria: the International Institute for Tropical Agriculture (IITA). IITA began explicitly as a reformist program, with Haldore Hanson arriving in 1971 straight from his position as the embroiled director of CIMMYT ready to make the Institute's mandate and scope broader—more regions, more crops, more R&D techniques. The broader form of farming systems research for Africa was embodied in IITA's 'dual mandate,' which consisted of increasing food production on the one hand, and maintaining a healthy natural resource base on the other—essentially, eliminating what many perceived to be a destructive system of shifting cultivation. As the 25th anniversary review describes,

> In writing a dual mandate for IITA—one that embraced the genetic improvement of major commodities as well as a search for viable alternatives to shifting cultivation—the Institute's founders showed a clear awareness that improving agriculture in the humid and subhumid tropics of Africa would require a somewhat different strategy from the one that had yielded such dramatic results elsewhere … What Asian agriculture had then, to a large extent, was a basically sound engine that badly needed a more potent kind of fuel … This sound engine was precisely what the humid and subhumid tropics of Africa lacked for the most part. [The difference is one of] making fundamental changes in farming systems, as opposed to merely injecting new technological components into them. (IITA 1992: 25-26)

**The Vicious Cycle of Population Growth-Induced Pover**



In contrast to the new varieties used in Asia and Mexico, Africa would need a complete overhaul. IITA's major approach was to find an environmentally sound way to sedentarize Africans—to get them to stop having to move around and cultivate new land. One (unsuccessful) method developed was alley cropping, wherein farmers would plant their crops in rows between rows of leguminous shrubs—shrubs that would provide nitrogen to the soil, and would provide biomass for mulch, fodder for livestock, and for burning as household woodfuel.[15] Through IITA, FSR took on a specifically African ecological aspect, in addition to the specific socially functional, evolutionary and systems ideas. The result is a fortified conventional narrative of African agricultural change: uniform, internally harmonious and externally bounded African tribes previously existed in a static ecological balance with nature using the only slowly changing rudimentary practices of shifting cultivation, and being governed by social norms to maintain this balance. Population growth was brought about by Western advances in health and colonial protection from internecine conflict and has unfortunately led to environmental, agricultural, and social crises spiraling out of control (see diagram on following page).

This notion of agro-environmental change was disseminated the world over by donors, governments and researchers as FSR became institutionalized in academic expertise, policy practice, and public common sense around the globe:

> FSR quickly progressed from a rough amalgam of ideas regarding technology development to become a dominant concept in the 1980s in both the literature of agricultural development and the organization of agricultural research and extension systems (Tripp et al. 1990: 384).

The FSR methodology used to closely investigate why small farmers had not benefited from agricultural technology became increasingly utilized in Africa after the devastating famines of the 1970s and 1980s. Anthropologists were hired *en masse* to disseminate the new FSR practices to development projects (cf. Escobar 1991; cf. Little and Painter 1995). CIMMYT staff in the Economics Department carried out many of the initial FSR Projects in the 1970s with African governments agencies (mainly in Kenya, Zambia, Tanzania, Zimbabwe, and Ghana) (Collinson 1982).[16]

FSR also proliferated throughout books, journals, and conferences. The CGIAR Secretariat published a key report on FSR in 1978 (TAC 1978), while Westview Press published a series of half a dozen texts on farming systems and agricultural research. In the early 1980s, a number of key FSR papers were put out by a USAID funded FSR program at Michigan State University and the Economics program at CIMMYT.[17] USAID also funded annual FSR conferences at Kansas State University from 1981 to 1986, and an immense collaborative program with the University of Florida.[18] Many journals began featuring pieces on FSR, and some devoted part, or all, of their issues to FSR—including, *Human Organization* and *Agricultural Administration* (later *Agricultural Systems*). From 1986 to 1991, *Experimental Agriculture*, a journal used by many IARC staff, featured an FSR series of 34 articles. There have been a number of reports of 'the institutionalization' of FSR in agencies around the world.[19] It was in these times that Marxist theories of technical change also started appearing—focusing explicitly on technical change as a part of broader economic dynamics—but were largely sidelined by the near hegemonic hold of FSR.

## III. REVIVING THE MYTH IN THE LATE 1980s AND 1990s: Populism, Environmentalism and Biotechnology

The dominant explanation of change in African environments and agriculture—that population

growth is the primary force driving poverty and degradation through a breakdown of shifting cultivation systems—has been revived by at least three factions: populists, environmentalists, and proponents of biotechnology. Cruder varieties of populism emphasize that farmers are well stocked with a cache of indigenous knowledge that they have built up over the millennia, and hence do not need any new technology. The current emphasis on indigenous institutions and knowledge as opposed to foreign impositions perhaps comes as a response to the denigration and occlusion of African capacities during colonialism and postwar modernization theory (Amanor 1999: chapter 1; Kizza 1999). Key populist figures, whose work has commonly been mimicked, developed and distorted in many ways, include Robert Chambers and Paul Richards, with the latter authoring the landmark 1985 book, *Indigenous Agricultural Revolution.*

The crucial assumptions by populists are that Africans once lived in harmony with nature (the primordial equilibrium of shifting cultivation) and that social institutions are essentially static stores of this creative knowledge. Given the insights by Berry and Mamdani above, the origin, practice and longevity of pure, bounded, indigenous techniques are questionable (see also Bebbington 1996; Fairhead and Leach 1996). Populists overlook the colonial and post-colonial politics of custom, indirect rule, social institutions, and access to resources (Ribot 1999), recapitulating prevailing conceptions of indigenous people as evolutionary adaptations to their environments. The argument for returning to timeless traditions as a solution for current crises has likewise been used by conservatives (Ayittey 1998). Populist views differ from conventional accounts only in laying the blame for the recent breakdown, which populists put not so much on population growth as exploitative capitalist relations and poorly conceived development projects.

The dominant myth is also being reproduced, ironically, in a new brand of environmentalism. In an odd twist of history, Green Revolutionists have co-opted their environmentalist critics by now suggesting that high productivity Green Revolution technology not only solves population growth induced scarcities in food supplies, but also that by allowing more food to be produced from less land the technologies are essential to preserving Nature. By the 1970s environmental concerns had gained increasing visibility in discussions of population, after having simmered during the 1960s, with a few UN and scientific programs and committees and several popular books.[20] In 1972, a landmark UN Conference on the Human Environment was held at Stockholm, leading to the creation of the UN Environmental Program. The 1970s Sahelian famines and publicity around desertification brought concerns over resource scarcity to an even greater height. For many the OPEC cartel inspired oil price shocks and inflation of the 1970's seemed to indicate a rise in prices resulting from population induced natural resource scarcity.[21] As development institutions have been pressed to adopt environmentalism, at least rhetorically, (even at the World Bank (Wade 1997) ) the CGIAR's focuses shifted, as embodied in a key report (TAC 1988) and a significant book by Conway and Barbiers (1990), both of which focused on the environmental consequences of the overuse of Green Revolution technologies of pesticides and fertilizers on agricultural land, water sources, and directly on human health.

However, through a brand of pro-environment Green Revolution discourse, conventional wisdom about African agro-environmental change has been revived. The same rhetoric used in the Green Revolution continues, albeit now with the keyword of 'sustainability' added in, forming *The Doubly Green Revolution* (Conway 1998): high-yielding technology will save land by allowing farmers to intensify on their existing plots. Borlaug, the veritable father of the Green Revolution, has become an unofficial representative, and is summarized well here by Easterbrook (1997: 76, 78):

> By producing more food from less land, Borlaug argues, high-yielding farming will preserve Africa's wild habitats, which are now being depleted by slash-and-burn subsistence agriculture … In developing nations where population growth is surging, high-yield agriculture holds back rampant deforestation of wild areas.

Green Revolution technologies are now said to be not only consistent with, but essential to, environmental protection. Usually statistics from India are cited as proof of how hi-tech agriculture can save land in Africa:

> …if LISA [Low Input Sustainable Agriculture] food-production rather than the Green Revolution food-production model had been pursued in South Asia since the 1960s, 44 million hectares that are now under forest would instead have been plowed and cropped. This suggests that biodiversity has been enhanced in Asia by the yield-increasing and land-saving Green Revolution model. (Reardon 1998: 449)

Through these attempts to re-portray Green Revolution technology as environmentally friendly, analysts implicitly revive the dominant narrative of African agro-environmental change. That is, without new GR technology, population growth leads the ever-increasing droves of shifting cultivators to bring their ruthless practice into fragile forests and arid zones. This environmentalist co-optation has been legitimated through shaky studies of soil properties, scare tactics, and bulldogging by fertilizer industry representatives and sympathizers in the major international development institutions (Weight and Kelley 1999 , among others, even revert to comparisons with the Dustbowl; cf. Scoones and Toulmin 1999; Henao and Baanante 1999; Keeley and Sccones 2000).

In addition to crude populists and pseudo-environmentalists, the biotechnology industry and its apologists have used images of African farming systems in crisis, this time in order to assuage public concern over new agricultural biotechnologies. In response to consumer concern in Europe, transnational agro-chemical companies have recently joined together in a $50 million advertising campaign telling us that biotechnology will bring an automatic 25% gain to help beleaguered African women break out of the vicious cycle of low yields, poverty, hunger and degradation (Barboza 2000). Biotech and friends accuse anyone voicing concerns about the environmental, economic, and social cost of such technologies as spoiled and romantic Luddites, insensitive to the benefits biotech can bring to hungry shifting cultivators, and ignorant to the protection it can provide for the nature they are endangering. Perhaps the most eloquent spokesman is, once again, Norman Borlaug:

> Some of the environmental lobbyists of the Western nations are the salt of the earth, but many of them are elitists. They've never experienced the physical sensation of hunger. They do their lobbying from comfortable office suites in Washington or Brussels. If they lived just one month amid the misery of the developing world, as I have for fifty years, they'd be crying out for tractors and fertilizer and irrigation canals and be outraged that fashionable elitists back home were trying to deny them these things. (Borlaug, quoted in Easterbrook 1997: 80)

Biotech industry and research organizations flagrantly play the 'Africa card,' using decontextualized images and stories of stereotypical African farmers, in publicity reports, radio and TV commercials, newspaper and magazine ads, radio talk shows, and academic and policy papers. For example, the head of the Washington, D.C. based International Food Policy Research Institute, Per Pinstrup-Anderson (1999), writes:

> It must be hard for an African farmer to understand the debate currently raging in Europe about the use of modern biotechnological methods in agricultural research. Health and environmental risks may dominate discussions up north, but she wonders why they don't discuss the enormous possibilities that biotechnology offer … the dreams of the poor Africa farmer may not materialize [because] some European countries oppose the use of modern biotechnology for agriculture and food.

Likewise, Gordon Conway, head of the Rockefeller Foundation, uses a similarly quaint little story, this time about a stereotypical poor woman in Kenya (Conway 2000). Biotech companies have even financed genuine, authentic Africans to act as spokespersons for their continent in conferences, prestigious journals, and newspapers around the world, imploring the West to let them have access to the lifesend

biotechnology—most notable is Florence Wambugu, a Kenyan sweet potato scientist whose work as been funded by Monsanto and other industry groups.[22] Each pro-biotech statement begins by restating the conventional narrative that growing numbers of shifting cultivators have run out of land to fallow, resulting in degradation and poverty, and hence the need for productive biotechnologies. In sum, through biotechnology public relations, pseudo-environmentalist Green Revolution rhetoric, and crude populism, the dominant narrative of African agro-environmental change has been revived with vigor in the late 1980s and throughout the 1990s.

## IV. POLITICAL ECOLOGY: Towards a Multi-factoral, Multi-level Explanation of Agro-Environmental Change

After this account of conventional wisdom, I am obviously left to give my own explanation of changes in agricultural production and environmental conditions in Africa.[23] A single explanation or a neat typology for the continent is both impossible and inaccurate, so what follows next is an extremely partial list of some factors that can influence agro-environmental change—the particular combination and form of the factors will vary according with each historical and geographical context.[24] The two key theoretical points to draw from this preliminary cataloguing are that (1) history, power and agency matter; and (2) agricultural production and environmental degradation/preservation are not driven by ecology and demography alone, but are fundamentally social processes:

> In production, men not only act on nature but also on one another. They produce only by co-operating in a certain way and mutually exchanging their activities. In order to produce, they enter into definite connections and relations with one another and only within these social connections and relations does their action on nature, does production, take place (Marx 1847).

I have roughly grouped the factors into twelve groups: armed conflict, economic policy, gender relations, inter-generational relations, land distribution and tenure, foreign aid, mineral resource extraction, timber harvesting and production, rural development projects, migration, national parks, and settlement schemes.

### 1. Armed Conflict

War has probably the starkest impact on agro-environmental conditions. War—before, during, and after colonialism—has not been driven by tribal animosities nor by overpopulation induced food and resource shortages, but rather for specific historical, political and economic reasons. At the turn of the century, massive displacement and depopulation was caused by colonization related wars and resulted both the clearing of new plots and the re-growth of forests on abandoned lands. War can affect agriculture indirectly by causing insecurity—insecurity over whether farmers will be able to reap the rewards of what they have sown or whether they will be able to keep their land, etc. More than a million people in Rwanda were killed in a matter of months, and hundreds of thousands were displaced into neighboring Burundi, Congo, Tanzania, and Uganda (Gourevitch 1999; Des Forges 1999; Malki 1995). The Angolan civil war, between the oil-financed government and diamond-financed rebels, caused massive food shortages as recently as 1999.

War can also impact agricultural production directly. Armies can use production and food as a military weapon, as in Ethiopia (de Waal 1997). The seemingly barbaric amputations by Sierra Leoneon rebels had logic: since one needs all ones' limbs for farming, amputation is an effective threat to join the bands of rebel diamond traders (Richards 1996). Food aid can be channeled to different warring factions—as the U.S. and the U.S.S.R. knew all too well in the heydays of the Cold War. The Somalian

warlords controlling food aid profoundly shaped agricultural production and are partially products of the two Cold War powers' covert military, financial, and food aid support (Maren 1997).

Military strategies (both offensive and defensive) can shape agroecology. James Fairhead and Melissa Leach (1996) describe how people in pre-colonial Guinea planted look out trees, as well as dense corridors of trees through which they channeled invading colonialists to make them prone to rifle shots. For Ghana, Fairhead and Leach (1998) show how pre-colonial and colonial trade, migration, slave trade, and wars of conquest *reduced* populations in the central forest area of Ghana from 500-725,000 to 250-375,000 during the nineteenth century. In Namibia, German colonialists killed 45-64,000 Herero in a single 1904 offensive (Boahen 1990). Colonists often used *blitzkrieg* tactics of killing Africans' cattle and destroying their homes and fields. In Tanzania and elsewhere, farmers were often driven off good land, and forced into forested hills to escape colonial impunity and/or requisition, with their plots reverting back to bush (Kjekus 1977). Amanor (1994) describes how the Krobo in southern Ghana moved from the forests to cultivate savannas and established residency on the plains as part of a strategy to extend the political control of their empire (see alsoVansina 1990). Thus, for centuries and even millennia, the direct and indirect impacts of local, regional, national, and international war substantially shaped the changing agro-ecology of Africa.

**2. Economic policies**

National economic policies, such as taxation, can induce dramatic changes in use of agricultural and environmental resources. Colonial administrators instituted property and hut taxes, and depending on colonial objectives, demanded tax in food equivalents, labor, or cash, heightening requisitions during each World War to supply imperial country soldiers. Roughly 80-100,000 people from the Volta Region in West Africa "fled to Cote d'Ivoire and Ghana to avoid compulsory cultivation schemes" (Koenig et al. 1998: 51-52). Where administrators needed labor on mines or plantations, they required payment in cash, forcing previously self-sufficient households to send a member out to earn money (Palmer 1997; Schmidt 1992; Watts 1983).

From roughly the 1960s to the 1980s, many African governments attempted to industrialize by focusing government revenues on fledgling industries, and maintaining a high exchange rate and substantial import tariffs—which, combined with sometimes pervasive corruption, made agricultural production rather unprofitable. Since the 1980s, the World Bank, IMF as well as other bilateral donors have used loans and debt rescheduling as leverage to enforce the implementation of large-scale deregulation of the economy and privatization of state-owned enterprises. The once pervasive marketing boards no longer exist to buy crops from farmers or offer them loans for new tools or emergency food purchases. More than fifty studies have charted the relationship of structural adjustment, agriculture, and the environment across Africa (see deGrassi and Rosset 2001: 62-82 for a review; see also Mosley et al. 1991; Gibbon et al. 1993; Poul Engberg-Pedersen et al. 1996; Bryceson et al. 2000). Agricultural production is affected by the need to pay back debts with foreign exchange generated by export crops.[25] Export crops include bananas (widespread), tobacco (Kenya, Zimbabwe), sugar (South Africa, others), coffee (Kenya, Cameroon, Ethiopia, and others), cocoa (Ghana, Cote d'Ivoire, Nigeria), cotton (Burkina Faso, Mali, Sudan, Zimbabwe, Egypt), tea (Kenya), oil palms (Ghana, Nigeria) maize (South Africa, Kenya, Zimbabwe), and cattle (Bukina Faso, Mali, Zimbabwe, Kenya). For instance, in Ghana, the World Bank widely promoted cocoa and timber extraction in order to pay back debt and revive the economy.

**3. Rural Development Projects**

Throughout the twentieth century, agriculture and ecology in Africa has been shaped by massive development projects, including the maize schemes of the Guinea savanna in northern Nigera (Smith et

al. 1994; Goldman 1995), the irrigated rice schemes in northern Ghana (Konings 1986), and other West African countries (Watts 1992; Magistro 1997), the massive Gezira irrigation scheme on the Nile in Sudan (Sanders et al. 1996; Craig 1991), the borehole construction projects in the Sahel and in the arid parts of southern and eastern Africa (Cole and Huntington 1997).

**4. Gender Relations**

The differences between women's and men's access to, and control over, land and resources is a key factor in agriculture and environmental management. For instance, in colonial Kenya, men collaborated with colonial administrators to (unsuccessfully) ban women from living in urban areas, and, for complex reasons, prohibited them from moving about the countryside (Kanogo 1987). Boserup (1965) attempted to provide an evolutionary account of gender relations based on population density: in low density societies (read Africa), labor was a limiting factor, so women's labor was valued and bridewealth was instituted. In contrast, in high-density societies (read Asia), women's extra labor was not valued so they actually were the ones to pay, hence dowry. Certain labor intensive crops, such as yams, were thought to be mens' crops, while petty, noncommercial crops (such as cassava and various herbs) were the domain of women. Bryceson (1995), however, explodes this myth, showing how enormously diverse are men and womens' production forms, marital relations, and that households are more *diverse* (encompassing many forms than the nuclear model with which we are familiar) and *flexible* (susceptible to change between forms).

**5. Intergenerational relations**

Not only are gender relations important in agro-environmental change, but one also has to understand the relations between people of different ages. Children, often in age sets segregated by sex, are often designated to help their parents, with weeding, protecting crops from birds, roaming animals, and other pests. While school years are timed to allow kids to go back during periods of peak labor demands (such as weeding and harvesting), education can also present new opportunities, and thereby siphon people off from the agricultural sector (Snyder 1996). As children grow up, they may migrate, inherit property or work for others to develop capital stock and social networks that they then use to build up families and acquire more resources and control (Ferguson 1990). Brideprice is often required, and so men at least have to find ways to accumulate money. In polygamous families, senior wives often hold quite different duties, responsibilities, and privileges than the junior wife or wives. In the Islamic northern regions of Ghana, for instance, access to wives, land and cattle was controlled by elders in exchange for labor by younger men (Warner et al. 1997). Hence, different dynamics for different people of different ages affects agricultural production and environmental management.

**6. Land distribution and tenure**

The distribution and forms of ownership and use of land can dramatically affect agro-environmental change. If farmers face an artificial scarcity, they may indeed degrade soils and go not be able to produce enough food to meet subsistence needs. In settler countries land ownership is widely unequal (Zimbabwe, Kenya, South Africa, Namibia are the main ones). In Zimbabwe, for instance, 6 million blacks live on arid and infertile land, while most of the farmland is controlled by 4,500 white commercial farmers who were given large grants in the 1910s through the 1950s. In Namibia, 4,000 white farmers own 75% of the best arable land. However, even in non-settler colonies, inequality can be pervasive—as between large land owners and sharecropping tenants in Ghana. Land distribution also varies within villages and within households (Sarris and Shams 1991: 46; Mdlongwa 1998; Mwaura 1998; Moyo 1995).

Not only is land distribution important, but the rules and practices about use also tremendously influence agro-environmental change. Land tenure is a highly complex issue, with various norms and histories operating. The connection between rights in trees and land is highly variable and specific (Fortmann and Bruce 1988).[26] The evolutionary theory of land rights suggests that with increasing populations and markets, Africans move from communal tenure (where everyone has equal rights to all the land) to individual tenure (where individuals have clear, exclusive rights to a land and all its products). Under this guise, property registration programs have been begun, but these can often exacerbate land pressure via speculation. Often it is chiefs who retain customary ownership in the name of the community, and when land markets develop, they can sell of land to wealthier rural or urban folk (Walker and Peters 2000). In some countries, the government owns *all* land and can promote or prohibit certain planting styles or crops. Early regimes enforced famine crops that substituted famine for malnutrition with starchy cassava (Mamdani 1996). In Sudan the government mandated certain combinations of cotton, sorghum, and peanuts in the Gezira irrigation scheme (Sanders et al. 1996). In Malawi, colonial and post-colonial governments restricted tobacco cultivation to large estate holders, while colonial Tanzanian and Kenayan governments prevented black Africans from cultivating the more profitable *Arabica* coffee, and later Tanzanian law precluded farmers from uprooting coffee, even when it was unprofitable and difficult to grow (Forester 1995). Sharecropping arrangements also shape land use decisions, as when owners provide land, inputs, or some combination, requiring labor, product in kind, or cash from the sharecropper, or mandating also certain crop varieties (food or cash, perennial or annual) (Amanor 1999; Walker and Peters 2000; Lastarria-Cornhiel and Melmed-Sanjak 1999; Bruce 1998; Schroeder 1999b; Bassett and Crummey 1992).

**7. Foreign Aid**

For a long period, official development aid from countries such as the US, Canada, Germany and others was 'tied,' that is, aid was premised upon a contract that the receiving country would in turn import certain goods from the giving country. Often industrialists in the donor countries would secure lucrative contracts with development agencies, using foreign aid as an outlet for surplus tractors, used tires, old fertilizer, and banned pesticides (Morrison 1998).

The most notable example of tied aid was the dumping of excess grains from Canada, the US and Europe onto Third World markets (although it also encompasses fertilizers and machinery). Governments in these industrialized countries faced political pressure to keep grain prices high, and in order to do so, they bought any unsold surpluses from large farmers—then shipping this grain (wheat and corn mostly) to political allies or emergencies in the third world. Dumping of excess grains can cause artificially low prices that make investment in farming relatively less attractive, increase imports, and artificially skew consumer preferences. Nigerians thereby developed a notorious taste for imported wheat, while the capital cities of many West African countries were flooded with imported rice (Friedmann 1990).

**8. Mineral resources**

African nations contain a number of precious resources that have greatly influenced agricultural and economic trajectories, including, oil (Nigeria, Chad, Cameroon, Libya, Algeria, Angola), diamonds (DR Congo, Sierra Leone, Angola, Liberia, Namibia), gold (Ghana, South Africa, Zimbabwe), uranium and platinum (DR Congo, Burkina Faso) (Palmer 1977).

Mineral resource exploitation has multiple direct and indirect effects. For instance, the oil spills in the Niger Delta of Nigeria directly contaminated soils, ruining both agriculture and environment. Right now, the World Bank has met massive protest, led by human rights and environmental organizations, for its involvement in an oil pipeline project across the central African rainforest. Indirect affects

include macro-economic distortions, and secondary affects, such as shifts to labor, industry and import markets. In Nigeria, the sky-rocketing oil profits brought in enormous amounts of US dollars, inflating the exchange rate and thereby making imports more attractive and exports less attractive ('Dutch Disease'). As a result, Badru (1998) reports, cultivated acreage *dropped* by nearly half from 1960 to 1980. Millions of people migrated to urban centers, where they found government jobs or engaged in trading, consuming large amounts of imported wheat, leaving rural areas with labor shortages and no markets for their crops (Watts 1987; 1992; 2000)

**9. Timber extraction**

In several instances, forest degradation stems not from increasing populations, but from private or state timber companies. Ghana privatized timber industries in the 1980s under pressure from donors, and exports increased when the government reduced duties and devalued the exchange rate. Corruption and violation of basic logging standards were rampant. Here, international resource flows, state law, and mega-profits by national and multinational firms and bureaucrats led to destruction. Often timber extraction involves a specific type of tree that requires loggers to tramp through large sections of forests to find, cut and retrieve it. Amanor (1999) reports that farmers even took to cutting down these trees as preventative measures to halt the invasion of their land by rapacious firms. In Madagascar, forest destruction resulted from timber companies, and more recently a railway line, rather than from increasing populations of shifting cultivators (Jarosz 1996; Angelsen and Kaimowitz 1999).

**10. Migration**

The notion of stable farming systems breaking down under population growth completely ignores the complex impacts of human mobility. People migrate in relation to the other factors listed here, being pushed out from one region or pulled towards another, and contributing or robbing areas of income, ideas, labor and technologies. Migrants may have varying different degrees and types of access to land, market, and state resources and can be young or old, male of female, farmers or pastoralists, Muslim or Christian, permanent or temporary, rich or poor, and so on. All of these factors are key, and complicate any notion of stable, bounded, homogeneous farming systems.

In many countries, nearly half the populace now lives in urban areas—so much of the growth in population has not even occurred on cultivated land. Roughly two million Ghanians left their country in the 1970s because of corruption and a deteriorating economy, with many going to Nigeria which was then in the midst of an oil boom. In 1983, however, Nigeria's economy soured and it expelled 1.2 million migrants back to Ghana. Ghana itself had previously deported all Nigerians in 1969. Agriculture in the small labor reserve southern African countries of Lesotho and Swaziland is determined by mining labor arrangements (Rauniyar and Goode 1996). Farmers from Zimbabwe, Zambia, Mozambique, Botswana, and Namibia migrate seasonally to mines in South Africa or to plantations elsewhere. Rural to urban migration has grown, partly because of the push of lack of opportunity in rural areas and the pull of new opportunities in large towns. There is also substantial migration of pastoralists (e.g. Fulani) south from the Sahel during the dry season, where their livestock feed on stubble in farmers fields, returning north in the rainy season (Abdulai 1999; Afikorah-Danquah 1997; Howorth and O'Keefe 1999; McDonald 1999; Cordell et al. 1996; Black and Sessay 1997; Piot 1999; Twumasi-Ankrah 1995; Kliot 1995).

**11. Parks and Reserves**

National parks as well as game and forest reserves constitute an important part of the landscape in a number of countries, including Tanzania (25%), Botswana (18%), Malawi, Namibia, Rwanada, Senegal and Togo (11-14%) and Zambia, Zimbabwe and Kenya (6-8%). Many were begun by colonial

administrators who believed that irrational farmers were destroying the 'Edenic' natural heritage of their Empire. Alternatively, game reserves were established for the leisure of white settlers, colonial administrators, and tourists, and they continue to be so used today. The reserves had the affect of squeezing displaced populations onto marginal land, and disrupting seasonal movements of human, livestock, and wildlife populations. Recent attempts have sought to shift from the fortress style reserves surrounded by fences and patrolled by soldiers armed with guns and fines, to devolving to local communities control over management and revenues—but these have been fraught with difficulties (Anderson and Grove 1987; Neuman 1997; 1998; Carruthers 1995; Schroeder 1999a).

**12. Irrigation and (Re)Settlement schemes**

Settlement and resettlement campaigns have been instituted across Africa throughout the twentieth century for a variety of reasons and can often lead to massive unintended social, agricultural, and environmental consequences (Scudder, Colson, and Scudder 1982; Colson 1971; Morgan and Colson 1987; Cernea 1991). Throughout the colonial era, populations were removed from certain areas apportioned to parks or white settlers and forced to live elsewhere. Resettlement has also occurred during the post-independence period, more for political and development objectives. Lands have often been appropriated for contract farming schemes—which frequently produce export crops such as green peas, melons, cut flowers, chilies, oil palms or tea—either directly or indirectly (Little 1994). Irrigation schemes shape agro-environmental management, as in the major rice schemes of Senegal and the Gambia, the hundreds of thousands of rice farmers at Office du Niger in Mali. At the Sudanese Gezira irrigation scheme on the Nile, land is owned and leased out by state, with tenancies as large as 8,000-10,000 ha run by roughly 5,000 entrepreneurs. These farms use turbine harvesters, 100,000 wage earning employees and nearly one million seasonal labors from the western Sudan and neighboring countries brought in on trucks for several months of thinning, weeding, harvesting and threshing (Sanders et al. 1996: 129, 119).

Dams can require resettlement and can dramatically change upriver and downriver ecology (Thomas 1996; Adams 1992). As Koenig and Diarra (1998: 34) write, regarding the Manatali dam on the Senegal River in Mali that displaced 10,000 people,

> Reservoirs created by dams often flood some of the most productive alluvial lands, including rich flood plains with good agricultural land, lush forests and rich animal habitats … Farmers lose the land that they had used to make their living, and rarely is replacement land sufficient to continue the kind of agricultural system that existed prior to resettlement.

Likewise, nearly 50,000 people were resettled to make way for Lake Volta in Ghana, whose primary purpose was to provide electricity for an aluminum smelting plant.

Leaders in socialist Tanzania implemented massive villagization ('ujamma') policies that disrupted agricultural systems by forcing farmers to move from land in which they had invested labor and materials. Instead of being inter-dispersed throughout their fields, farmers had to trek long distances from the new degraded village centers to their plots (Kikula 1997; Scott 1998; Coulson 1982). In Ethiopia, land redistribution sought to break the grip of the feudal landlords, and establish neat, ordered, modern grid-like layouts which could be easily serviced and controlled (Lorgen 1999; McCann 1995; Scott 1998; Marcus 1994). In apartheid South Africa, an estimated 3.5 million blacks were forcibly moved between 1960 and 1983 from urban areas to rural ghettos, 'bantustans' (Worden 1995). Occasionally, land redistribution projects have been undertaken, as in the limited reforms in Zimbabwe and Malawi (Walker and Peters 2000). Massive settlement schemes have taken places in river valley bottoms with the eradication campaigns against Onchocerciasis or 'river blindness' (McMillan 1995; Koenig et al. 1998).

Based on Hardin's (1968) classic on common property, which suggested that no individual would take stewardship of communally owned lands, numerous registration and land privatization projects were begun to encourage individual responsibility. These projects, however, overlooked preexisting tenure and political economy and ended up exacerbating inequality, disrupting mobility, and furthering environmental degradation. In the numerous settlement schemes throughout Africa, then, we can see how material and mental social forces operating at multiple scales influenced agro-environmental change (Peters 1994; Turner 1999b; Koenig and Diarra 1998; Little 1992; Chatty 1996; Roe 1998; Scoones 1994).

In sum, particular combinations of specific social, historical factors—from armed conflict to settlement schemes—have shaped land use. Farmers fallow their land and use different types of technology according to the vagaries of their historical and geographical contexts. I am certainly not contending that population growth is not a significant factor in some areas; rather, its never the only factor, infrequently the primary factor, and takes place in a context of multi-layered forces operating at multiple spatial and temporal scales. Population growth, therefore, has *not* directly caused a breakdown in the fallow system of static, bounded, isolated, homogenous, egalitarian and internally coherent farming systems with an evolved risk reducing function.

The complex configurations of multi-leveled social forces make the actual pattern of agro-environmental practices much more heterogeneous than suggested by the conventional narrative of now dysfunctional shifting cultivation (Silberfein 1998). The myth homogenizes production systems by reading macro-processes of change (i.e. degradation and poverty) merely as the aggregate result of choices that are individually rational at the micro-level but cumulatively destructive (continued shifting cultivation under overpopulation).[27]

The conventional myth thus pays no attention to the actual *distribution* of population. Population is not spread evenly across the land, but the specific pattern is shaped by a combination of bio-physical and socio-economic-political factors, again, at regional, national, district and local levels.[28] Urbanization is quite common, with nearly half the population living in urban areas. Nigeria and Ethiopia themselves make up 29% of the total population of sub-Saharan Africa (FAO statistical database). Hence much of the population growth has occurred in urban, and not rural, areas.[29]

Secondly, the myth implicitly contains an artificial dichotomy of urban and rural. Such tidy categories cannot deal the specific situated complexities and connections that give rise to such oxymoronic phenomena such as urban agriculture and rural industrialization (Egziabher 1994; Obudho and Foeken 1999; Hart 1997). This tendency to treat rural and urban as blunt categories is symptomatic of a broader tendency to homogenize production systems.

Dominant narratives also depend on reducing the complex and changing forms of agricultural production to the one grand sweeping category of shifting cultivation, when farmers in reality have many different practices that vary in intensity in both time and space (Okigbo 1990; Richards 1983). No group of Africans is, or has forever been *purely* shifting cultivators, farmers, pastoralists, or completely urban or rural—these tidy categories miss the detailed complexity of agricultural production, environmental management, and social life (Niemeijer 1996).

## V. CONCLUSION

Agro-environmental change in Africa has been a dynamic, diverse, flexible, and social phenomenon, but through a variety of forces, has come to be widely seen as driven by population growth alone. It is necessary at this point to say a word about four general methodologies used to

legitimate the conventional narrative. The myth is buttressed first by the use of broad, national or continental level statistics. Aggregation is highlighted more than dissaggregation. The use of statistics in Africa is fraught with logistical and political difficulties, but numbers are nonetheless summed, tabulated and manipulated with either no or frighteningly minor cautions. Second, functionalism and evolutionism depend on emphasizing cross-sectional study, rather than longitudinal study (a practice which may reflect the come and go nature of development experts and academic interests). Third is a reliance on models and quantitative equations to understand processes (either environmental or social)—a practice which probably stems from the economistic training of many analysts. The last is an emphasis on deducing the past from these statistics, surveys and models, rather than on examining the historical record (through written, material, photographic, and/or visual sources). These methodologies are not in and of themselves misleading and useless, but they have been utilized in inappropriate ways by specific people at particular historical conjunctures. They can give rise to global crisis scenarios that are quite at odds of the local realities on the ground.[30] Nonetheless, even respected agricultural economists use these methodologies. Self-assured claims abound in policy literature, generalizing for the whole region without the slightest inclination of recognizing the need to cite rigorous empirical studies.

The conventional narrative removes all considerations of politics—that is, social power—from understandings of agro-environmental change. Humans have foresight and memory and are able to communicate in sophisticated ways with each other, and thereby wield physical, social, and discursive power in their relations with one another. Agro-environmental changes are hence more accurately conceived of as a situated, political processes and practices, rather than as recent, demographically driven departures from a static ecological equilibrium.

If politics are understood as essential to historical processes, then in excluding all politics, the dominant myth essentially denies Africans' history. Boserup (1983: 3), for instance, suggests that "Human history can be viewed as a long series of technological changes." Such a unilinear, technocratic, functionalist version of history is not history at all (cf. Berry 1997), it is teleological evolution wherein population and biology determine everything, and people have no agency, no memory, no foresight, and no relation to one another. In reading out politics, analysts deny Africans their history, and ultimately, their humanity.

A better understanding would see agro-environmental change in terms of trajectories or transformations (Batterbury et al. 1997), for the same reasons that Hart suggests in arguing for using the concepts of multiple trajectories of capitalism and modernity (Hart 1996; forthcoming). A focus on "everyday politics and the exercise of power" allows one to see the "multiple, nonlinear, and divergent *trajectories*" of development (Hart 1997: 56). The key point is that "social processes are the product of interaction at multiple societal levels, they cannot simply be read off or deduced from organizational forms or relational structures" (ibid, 63). So, "Instead of asking *what* are the rules or relational structures that produce particular outcomes … the focus of the processual approach taking shape in agrarian literature is instead on *how* negotiation and contestation take place within and across multiple social arenas" (ibid, 63, 56). This approach, I think, provides a profound critique of much of the literature on agricultural technology change in Africa, and points to limitations of teleological, evolutionary, functionalist ideas more generally (Batterbury and Bebbington 1999).

In the end, when we assert that population growth—the mere asocial accumulation of increasing numbers of human beings—drives agro-environmental change, we deny the history of African's social experiences, the priveleged's own involvement in those experiences, and the capacity of all of us to change future outcomes. With the recognition of multiple sources of agency and change, one can see just how absurd is the thought that a simple development project, macro-economic policy, or population control program imposed from above could alone have its intended impact—a preposterous, naïve and extremely arrogant notion. However, once we see that it is not only a matter of devising new agricultural

and reproductive technology to combat 'the population monster,' we can begin work on a number of the social fronts listed above to make real impacts on the state of agriculture and the environment. What this real change requires first and foremost is more accountability on the part of the privileged and empowerment of those currently without a direct political voice.

## References


Abdulai, A. 1999. Internal Migration and Agricultural Development in Ghana. *Scandinavian Journal of Developing Countries* 18(1): 61-74.

Adams, W. M. 1992. Minneapolis: University of Minneapolis Pres.

———— 1995. Sustainble Development? In, Johnston, R.J., P.J. Taylor, and M.J. Watts (eds.), *Geographies of Global Change: Remapping the World in the Late Twentieth Century.* Oxford: Blackwell, 354-373.

Adamu, H. 2000. We'Ll Feed Our People As We See Fit. *Washington Post* September 11: A 23.

Afikorah-Danquah, S. 1997. Local Resource Management in the Forest-Savanna Transition Zone: The Case of Wenchi District, Ghana. *IDS Bulletin* 29(4): 36-46.

Amanor, K. S. 1994. *The New Frontier: Farmer Responses to Land Degradation, A West African Study*. London and Geneva: Zed and UNRSID.

———— 1999. *Global Restructuring and Land Rights in Ghana: Forest Food Chains, Timber and Rural Livelihoods*. Uppsala: Nordiska Afrikainstitutet.

Anderson, D. M. 1984. Depression, Dust Bowl, Demography, and Drought: the Colonial State and Soil Conservation in East Africa During the 1930's. *African Affairs* 83(332): 321-343.

Anderson, D. and R. Grove, (eds.). 1987. *Conservation in Africa: People, Policies and Practice*. Cambridge: Cambridge University Press.

Angelsen, A. and D. Kaimowitz. 1999. Rethinking the Causes of Deforestation: Lessons From Economic Models. *The World Bank Research Observer* 14(1): 73-98.

Anthony, C. G. 1988. *Mechanization and Maize: Agriculture and the Politics of Technology Transfer in East Africa*. New York: Columbia University Press.

Asad, T. 1973. *Anthropology and the Colonial Encounter*. Atlantic Highlands, N.J.: Humanities Press.

———— 1987. Are There Histories of People Without Europe. *Comparative Study in Society & History*: 594-607.

Ashton, T.H. and C.H.E. Philton, (eds.). 1985. *The Brenner Debate : Agrarian Class Structure and Economic Development in Pre-Industrial Europe*. Cambridge: Cambridge University Press.

Ayittey, G. B. N. 1998. *Africa in Chaos*. New York: St. Martins.

Badru, P. 1998. *International Banking and Rural Development: The World Bank in Sub-Saharan Africa*. Aldershot: Ashgate.

Bannock, G., R. E. Baxter, and E. Davis. 1992. *Dictionary of Economics [5th Ed.]*. London: Penguin.

Barboza, D. 2000. Industry Moves to Defend Biotechnology.(Public Relations Advertising Campaign to Ease Fears Over Genetically Altered Foods). *New York Times* April 4: C6(N), C6(L).

Bardhan, P., (ed.). 1989a. *The Economic Theory of Agrarian Institutions*. New York: Clarendon Press.

———— 1989b. The New Institutional Economics and Development Theory: A Brief Critical Assessment. *World Development* 17(9): 1389-1395.

Bassett, T. J. and D. E. Crummey, (eds.). 1992. *Land in African Agrarian Systems*. Madison, WI: The University of Wisconsin Press.

Bates, R. H. 1981. *Markets and States in Tropical Africa: the Political Basis of Agricultural Policies*. Berkeley: University of California Press.

Batterbury, S. and A.J. Bebbington. 1999. Environmental Histories, Access to Resources and Landscape Change: An Introduction. *Land Degradation & Development* 10(4): 279-289.

Batterbury, S., I.I.B.L. Turner, M. Thompson, W.M. Adams, I. Scoones, P. Woodhouse, O.T. Coomes, A. Bebbington, D. Preston, R.M. Auty, and D. Satterthwaite. 1997. Environmental Transformations in Developing Countries. *Geographical Journal* 163(2): 126-224.

Baum, W. C. 1986. The CGIAR—How It All Began. In, CGIAR (ed.), *CGIAR Annual Report 1985.* Washington, D.C.: CGIAR.

Bebbington, A. 1996. Movements, Modernizations, and Markets: Indigenous Organizations and Agrarian Strategies in Ecuador. In, R. Peet and M. J. Watts (eds.), *Liberation Ecologies: Environment, Development, Social*

*Movements.* London: Routledge, pp. 86-109.
Beinhart, W. 1984. Soil Erosion, Conservationism and Ideas About Development: a Southern African Exploration 1900-1960. *Journal of Southern African Studies* 11: 52-83.
Berry, S. 1984. The Food Crisis and Agrarian Change in Africa: A Review Essay. *African Studies Review* 27(2): 59-112.
———— 1986. Macro-Policy Implications of Research on Farming Systems and Households. In, J. Moock (ed.), *Understanding Africa's Rural Households and Farming Systems.* Boulder, CO: Westview, pp. 199-216.
———— 1993. *No Condition Is Permanent: The Social Dynamics of Agrarian Change in Sub-Saharan Africa*. Madison, WI: The University of Wisconsin Press.
———— 1997. Tomatoes, Land and Hearsay: Property and History in Asante in the Time of Structural Adjustment. *World Development* 25(8): 1225-1241.
Bhaba, H.K. 1984. Of Mimcry and Man: The Ambivalence of Colonial Discourse. *October* 28: 125-33.
Biggs, S. and J. Farrington. 1991. *Agricultural Research and the Rural Poor: A Review of Social Science Analysis*. Ottawa, Canada: International Development Research Centre.
Black, R. and M. Sessay. 1997. Forced Migration , Land-Use Change and Political Economy in the Forest Region of Guinea. *African Affairs* 95(385): 587-606.
Blalock, H.M. 1982. *Conceptualization and Measurement in the Social Sciences*. Beverly Hills: Sage Publication.
Boahen, A. A., (ed.). 1990. *Africa Under Colonial Domination: 1880-1935*. Berkeley: University of California Press.
Borlaug, N. E. and C. R. Dowswell. 1995. Mobilising Science and Technology to Get Agriculture Moving in Africa. *Development Policy Review* 13(2): 115-130.
Boserup, E. 1965. *The Conditions of Agricultural Growth: The Economics of Agrarian Change Under Population Pressure*. New York: Aldine Publishing Company.
———— 1983. *Population & Technological Change: A Study of Long-Term Trends*. Chicago: University of Chicago Press.
———— 1999. *My Professional Life and Publications 1929-1998*. Copenhagen: Museum Tusculanum Press, University of Copenhagen.
Bourn, D. and W. Wint. 1994. *Livestock, land use and agricultural intensification in sub-Saharan Africa*, London: Overseas Development Institute.
Brinkley, D. 1995. Jimmy Carter's Modest Quest for Global Peace. *Foreign Affairs* 74(6).
Bruce, J.W. 1998. *Country Profiles of Land Tenure: Africa, 1996*, Research Paper No. 130. Madison, WI: Land Tenure Center, University of Wisconsin.
Bryant, R. L. and S. Bailey, (eds.). 1997. *Third Word Political Ecology*. New York: Routledge.
Bryceson, D. and V. Jamal, (eds.). 1997. *Farewell to Farms: De-Agrarianisation and Employment in Africa*. Aldershot: Ashgate.
Bryceson, D., C. Kay, and J. Mooij. 2000. *Disappearing Peasantries? Rural Labour in Africa, Asia and Latin America*. London: Intermediate Publications.
Bryceson, D. F., (ed.). 1995. *Women Wielding the Hoe: Lessons From Rural Africa for Feminist Theory and Development Practice*. Oxford: Berg Publishers.
Byerlee, D. and M. Collinson. 1980. *Planning Technologies Appropriate to Farmers: Concepts and Procedures* . Mexico, D.F.: CIMMYT.
Byerlee, D., L. Harrington, and D. L. Winkelman. 1982. Farming Systems Research: Issues in Research Strategy and Technology Design. *American Journal of Agricultural Economics* 64(5): 897-904.
Byerlee, D. and R. Tripp. 1988. Strengthening Linkages in Agricultural Research Through a Farming Systems Perspective: The Role of Social Scientists. *Experimental Agriculture* 24: 137-151.
Carruthers, J. 1995. *The Kruger National Park: A Social and Political History*.
Carson, R. 1965. *Silent Spring*. Harmondsworth: Penguin.
Cernea, M. 1991. *Putting People First: Sociological Variables in Rural Development*. New York: Published for the World Bank by the Oxford University Press.
Chatty, D. 1996. *Mobile Pastoralists: Development Planning and Social Change*. New York: Columbia University Press.
CIMMYT. 1992. *Enduring Designs For Change: An Account of CIMMYT's Research, Its Impact, and Its Future Directions*. Mexico, D.F.: CIMMYT.
Cleaver, K.M. and G.A. Schreiber. 1994. *Reversing the spiral: the population, agriculture, and environment nexus in Sub-Saharan Africa*, Washington, D.C.: World Bank.
Cole, D. C. and R. Huntington. 1997. *Between a Swamp and a Hard Place: Development Challenges in Rural Africa*. Cambridge, MA: Harvard University Press.
Collinson, M. P. 1981. A Low Cost Approach to Understanding Small Farmers. *Agricultural Administration* 8(6): 434-

50.
———— 1982. *Farming Systems Research in Eastern Africa: The Experience of CIMMYT and Some National Agricultural Research Services, 1976-1981*. East Lansing, MI: Michigan State University, Department of Agricultural Economics.
Colson, E. 1971. *The Social Consequences of Resettlement: The Impact of the Kariba Resettlement Upon the Gwembe Tonga*. Manchester: Published on behalf of the Institute for African Studies, University of Zambia by Manchester University Press.
Conway, G. 1998. *The Doubly Green Revolution: Food for All in the 21st Century*. Ithaca, NY: Cornell University Press.
———— 2000. USDA Millennium Lecture. http://www.ocav.usda.gov:8080/ramgen/secy/ml.rm.
Conway, G. and S. Sechler. 2000. Helping Africa Feed Itself. *Science* 289(5485): 1685.
Conway, G. R. and E. B. Barbier. 1990. *After the Green Revolution: Sustainable Agriculture for Development*. London: Earthscan.
Cordell, D.D., J.W. Gregory, and V. Piche. 1996. *Hoe and Wage: A Social History of Circular Migration Systems in West Africa*. Boulder: Westview Press.
Coulson, A. 1982. *Tanzania: A Political Economy*. Oxford: Clarendon Press.
Craig, G. M., (ed.). 1991. *The Agriculture of the Sudan*. Oxford: Oxford University Press.
Crawford, E. W. 1982. *A Simulation Study of Constraints on Traditional Farming Systems in Northern Nigeria*. East Lansing: Michigan State University, Department of Agricultural Economics.
Crehan, K. 1997. *The Fractured Community: Landscapes of Power and Gender in Rural Zambia*. Berkeley: University of California Press.
de Waal, A. 1997. *Famine Crimes: Politics and the Disaster Relief Industry in Africa*. Oxford: Africa Rights & The International African Institute, in association with James Currey.
Degrande, A. and B. Duguma. 2000. *Adoption potential of rotational hedgerow intercropping in the humid lowlands of Cameroon*, London: Overseas Development Institute.
deGrassi, A. 2000. *Development struggles: The multiple politics of a green revolution project in Africa*, Senior Honors Thesis, International and Area Studies Department, UC Berkeley.
deGrassi, A. and P. Rosset. Forthcoming 2001. *The Green Revolution in Africa: Past Experiences, Current Issues, and Future Prosepects*. Oakland: Institute for Food and Development Policy.
Des Forges, A.L. 1999. *"Leave None to Tell the Story": Genocide in Rwanda*. New York: Human Rights Watch.
Easterbrook, G. 1997. Forgotten Benefactor of Humanity. *The Atlantic Monthly* 279(1): 75-82.
Egziabher, A.G. 1994. *Cities Feeding People: An Examination of Urban Agriculture in East Africa*. Ottawa: International Development Research Centre.
Ehrlich, P. 1968. *The Population Bomb*. New York: Ballantine.
Eicher, C. K. and D. C. Baker. 1982. *Research on Agricultural Development in Sub-Saharan Africa: A Critical Survey*. East Lansing, MI: Michigan State University, Department of Agricultural Economics.
Escobar, A. 1991. Anthropology and the Development Encounter: the Making and Marketing of Development Anthropology. *American Ethnologist* 18: 658-682.
Fabian, J. 1983. *Time and the Other: How Anthropology Makes Its Object*. New York: Columbia University Press.
Fairhead, J. and M. Leach. 1996. *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic*. Cambridge: Cambridge University Press.
———— 1998. *Reframing Deforestation: Global Analyses and Local Realities; Studies in West Africa*. London: Routledge.
Ferguson, J. 1990. *The Anti-Politics Machine: "Development," Depoliticization, and Bureaucratic Power in Lesotho*. Minneapolis: University of Minnesota Press.
———— 1997. Anthropology and Its Evil Twin: "Development" in the Constitution of a Discipline. In, F. Cooper and R. Packard (ed.), *International Development and the Social Sciences: Essays on the History and Politics of Knowledge.* Berkeley: University of California Press, pp. 150-175.
———— 1999. *Expectations of Modernity: Myths and Meanings of Urban Life on the Zambian Copperbelt*. University of California Press: Berkeley.
Forester, P. G. M. S., (eds.). 1995. *The Tanzanian Peasantry: Further Studies*. Avebury: Brookfield.
Fortes, M. and E.E. Evans-Pritchard, (eds.). 1940. *African Political Systems*. London: Oxford University Press for the International Institute of African Languages and Cultures.
Fortmann, L. and J. W. Bruce, (eds.). 1988. *Whose Trees? Proprietary Dimensions of Forestry*. Boulder: Westview.
Friedmann, H. 1990. The Origins of Third World Food Dependence. In, H. Bernstein, B. Crow, M. Mackintosh, and C. Martin (eds.), *The Food Question: People Versus Profits.* New York: Monthly Review Press, pp. 13-32.
Gibbon, P., K. J. Havnevik, and K. Hermele. 1993. *A Blighted Harvest: The World Bank and African Agriculture in the*

*1980s*. Trenton, NJ: Africa World Press.
Gilbert, E.H.G., D.W. Norman, and F.E. Winch. 1980. *Farming systems research: a critical appraisal*, MSU rural development paper No. 6. East Lansing, Mich: Dept. of Agricultural Economics, Michigan State University.
Goldman, A. a. J. S. 1995. Agricultural Transformations in India and Northern Nigeria: Exploring the Nature of Green Revolutions. *World Development* 23(2): 243-264.
Gourevitch, P. 1999. *We Wish to Inform You That Tomorrow We Will Be Killed With Our Families: Stories From Rwanda*. New York: Farrar, Straus and Giroux.
Gray, L. 1999. Is Land Being Degraded? A Multi-Scale Investigation of Landscape Change in Southwestern Burkina Faso. *Land Degradation & Development* 10(4): 329-343.
Gressel, J. 1996. Plant Biotechnology Can Quickly Offer Solutions to Hunger in Africa. *Scientist* 10(19): 10-13.
Griffin, K. 1974. *The Political Economy of Agrarian Change: An Essay on the Green Revolution*. London: MacMillan.
Griffin, K. and J. James. 1981. *Transition to Egalitarian Development: Economic Policies for Structurla Change in the Third World*. New York: St. Martin's Press.
Grove, R. H. 1998. *Ecology, Climate and Empire: Colonialism and Global Environmental History, 1400-1940*. The White Horse Press.
Gupta, A. 1998. *Post-Colonial Developments: Agriculture in the Making of Modern India*. Durham: Duke University Press.
Guyer, J. 1997. *An African Niche Economy: Farming to Feed Ibadan, 1968-88*. London: Edinburgh University Press for the International African Institute.
Hansen, A. and D. McMillan, (eds.). 1986. *Food in Sub-Saharan Africa*. Boulder, CO: Lynne Rienner.
Hardin, G. 1968. The Tradgedy of the Commons. *Science* 162(3859): 1243-1248.
Harrison, P. 1996. *The Greening of Africa: Breaking Through in the Battle for Land and Food*. Nairobi, Kenya: Academy Science Publishers.
Harriss, J., J. Hunter, and C. M. Lewis. 1995. *The New Institutional Economics and Third World Development*. London: Routledge.
Hart, G. 1996. The Agrarian Question and Industrial Dispersal in South Africa: Agro-Industrial Linkages Through Asian Lenses. *Journal of Peasant Studies* 23(2-3): 245-277.
———— 1997. Multiple Trajectories of Rural Industrialisation: An Agrarian Critique of Industrial Restructuring and the New Institutionalism. In, D. Goodman and M. J. Watts (eds.), *Globalising Food: Agrarian Questions and Global Restructuring.* London: Routledge, pp. 56-78.
———— forthcoming. *Disabling Globalization: Tales of Two Towns in South Africa*. Berkeley: University of California Press.
Hayami, Y. and V. W. Ruttan. 1971. *Agricultural Development: An International Perspective*. Baltimore: The Johns Hopkins University Press.
Henao, J. and C. Baanante. 1999. Nutrient Depletion in the Agricultural Soils of Africa. *IFPRI 2020 Vision* 62.
Howorth, C. and P. O'Keefe. 1999. Farmers Do It Better: Local Management of Change in Southern Burkina Faso. *Land Degradation & Development* 10(2): 93-109.
IITA, (by William B. Ward). 1977. *Decade of Progress and Promise for Tomorrow: 10th Anniversary, International Institute of Tropical Agriculture*. Ibadan, Nigeria: International Institute of Tropical Agriculture.
———— 1992. *Sustainable Food Production in Sub-Saharan Africa: IITA's Contribution*. Ibadan, Nigeria: IITA.
Jarosz, L. 1996. Defining Deforestatio in Madagascar. In, R. Peet and M. J. Watts (eds.), *Liberation Ecologies: Environment, Development, Social Movements.* London: Routledge, pp. 148-164.
Jennings, B. H. 1988. *Foundations of International Agricultural Research*. Boulder, CO: Westview Press.
Kanogo, T. 1987. *Squatters and the Roots of Mau Mau, 1905-63*. London: James Currey.
Keeley, J. and I. Scoones. 2000. *Global science, global policy: Local to global policy processes for soils in Africa*, IDS Working Paper No. 115. Brighton: Institute for Development Studies.
Kent, G. 1984. *The Political Economy of Hunger: The Silent Holocast*. New York: Praeger.
Kikula, I.S. 1997. *Policy Implications on Environment: The Case of Villigisatoin in Tanzania*. Uppsala: The Nordic Africa Institute.
Kizza, I. N. 1999. *Africa's Indigenous Institutions in Nation Building*. Lampeter, UK: The Edwin Mellen Press, Ltd.
Kjekus, H. 1977. *Ecology Control and Economic Development in East African History: the Case of Tanganyika 1850-1950*. London.
Kliot, N. 1995. Global Migration and Ethnicity: Contemporary Case-Studies. In, R. J. Johnston, P. J. Taylor, and M. J. Watts (eds.), *Geographies of Global Change: Remapping the World in the Late Twentieth Century.* Oxford: Blackwell, pp. 175-190.
Koenig, D. and T. Diarra. 1998. The Environmental Effects of Policy Chang in the West African Savanna: Resettlement, Structural Adjustment and Conservation in Western Mali. *Journal of Political Ecology* 5: 23-52.

Koenig, D., T. Diarra, and M. Sow. 1998. *Innovation and Individuality in African Development: Changing Production Strategies in Rural Mali*. Michigan: The University of Michigan Press.
Konings, P. 1986. *The State and Rural Class Formation in Ghana: A Comparative Analysis*. London: KPI.
Koppel, B. and E. Oasa. 1987. Induced Innovation Theory and Asia's Green Revolution: A Case Study of an Ideology of Neutrality. *Development and Change* 18: 29-67.
Koppel, B. M., (ed.). 1994. *Induced Innovation Theory and International Agricultural Development*.
Kuhn, T.S. 1970. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
Lappe, F. M. and J. Collins. 1977. *Food First: Beyond the Myth of Scarcity*. New York: Ballantine Books.
Lastarria-Cornhiel, S. and J. Melmed-Sanjak. 1999. *Land Tenancy in Asia, Africa and Latin America: A Look to the Past and a View to the Future. Working Paper 27 (WP 27).* Madison, WI: Land Tenure Center.
Leach, M. and R. Mearns. 1996. *The Lie of the Land: Challenging Recieved Wisdom on the African Environment*. Oxford: James Curry.
Lele, U. and S. Stone. 1989. *Population Pressure, the Environment and Agricultural Intensification: Variations on the Boserup Hypothesis. MADIA Discussion Paper 4.* Washington, D.C.: World Bank.
Lin, J. Y. and J. B. Nugent. 1995. Institutions and Economic Development. In, J. Behrman and T. N. Srinivasan (eds.), *Hanbook of Development Economics, V. 3a.* Amsterdam: Elsevier, pp. 2303-2370.
Little, P. D. 1985. Adding a Regional Perspective to Farming Systems Research: Concepts and Analysis. *Human Organization* 44(4): 331-337.
———— 1992. *The Elusive Granary: Herder, Farmer, and State in Northern Kenya*. Cambridge: Cambridge University Press.
———— 1994. Contract farming and the development question. In, Little, P.D. and M.J. Watts (eds.), *Living under contract: Contract farming and agrarian transformation in sub-Saharan Africa.* Madison, WI: The University of Wisconsin Press, 216-247.
Little, P. D. and M. Painter. 1995. Discourse, Politics, and the Development Process: Reflections on Escobar's "Anthropology and the Development Encounter". *American Ethnologist* 22(3): 602-616.
Lorgen, C.C. 1999. *The Experience of Villagisation: Lessons from Ethiopia, Mozambique, and Tanzania*, London: Oxfam.
Lovelock, J. E. 1979. *Gaia: A New Look at Life on Earth*. Oxford: Oxford University Press.
Magistro, J. 1997. The Ecology of Food Security in the Northern Senegal Wetlands. In, A. E. Nyerges (ed.), *The Ecology of Practice: Studies of Food Corp Production in Sub-Saharan West Africa.* India: Gordon and Breach Publishers, pp. 97-134.
Malki, L.H. 1995. *Purity and Exile: Violence, Memory, and National Cosmology Among Hutu Refugees in Tanzania*. Chicago: The University of Chicago Press.
———— 1997. National Geographic: The Rooting of Peoples and Territorialization of National Identity among Scholars and Refugees. In, Gupta, A. and J. Ferguson (eds.), *Culture, Power, Place: Explorations in Critical Anthropology.* Durham: Duke University Press, 52-75.
Mamdani, M. 1996. *Citizen and Subject: Contemporary Africa and The Legacy of Late Colonialism*. Princeton: Princeton University Press.
Marcus, H. G. 1994. *A History of Ethiopia*. Berkeley: University of California Press.
Maren, M. 1997. *The Road to Hell: The Ravaging Effects of Foreign Aid and International Charity*. New York: The Free Press.
Marx, K. 1847. *Wage Labor and Capital*. New York: W.W. Norton & Company.
McCann, J. 1995. *People of the Plow: an Agricultural History of Ethiopia, 1800-1990*. Madison, WI: University of Wisconsin Press.
McDonald, D.A. 1999. Lest the Rhetoric Begin: Migration, Population and the Environment in Southern Africa. *Geoforum* 30(1): 13-25.
McGuinness, H. 1993. *Living Soils: Sustainable Alternatives to Chemical Fertilizers for Developing Countries*. Yonkers, NY: Consumer Policy Institute.
McIntire, J., D. Bourzat, and P. Pingali. 1992. *Crop-Livestock Interaction in Sub-Saharan Africa*. Washington, D.C.: World Bank.
McMillan, D. E. 1987. Monitoring the Evolution of Household Economic Systems Over Time in Farming Systems Research. *Development and Change* 18(2): 295-314.
———— 1990. Curriculum Development in the Study of African Food Issues at a US Land Grant University: A Case Study. In, R. Huss-Ashmore and S. H. Katz (eds.), *African Food Systems in Crisis: Coping With Chage.* New York: Gordon and Breach Science Publishers, pp. 139-158.
———— 1995. *Sahel Visions: Planned Settlement and River Blindness Control in Burkina Faso*. Tucson: University of Arizona Press.

Mdlongwa, F. 1998. Zimbabwe Presses Land Distribution. *Africa Recovery* 12(3): 10-11.
Meadows, D. H. et al. 1972. *The Limits to Growth*. New York: Universe Books.
Mehta, L., M. Leach, P. Newell, I. Scoones, K. Sivaramakrishnan, and S.-A. Way. 2000. *Exploring understandings of institutions and uncertainty: New directions in natural resource management*, Discussion Paper 372. Brighton: IDS, University of Sussex.
Merril-Sands, D. 1986. Farming Systems Research: Clarification of Terms and Concepts. *Experimental Agriculture* 22: 87-104.
Migdal, J. 1974. *Peasants, Politics and Revolution: Pressures Toward Political and Social Change in the Third World*. Princeton: Princeton University Press.
Moock, J., (ed.). 1986. *Understanding Africa's Rural Households and Farming Systems*. Boulder, CO: Westview Press.
Moore, H. L. and M. Vaughn. 1994. *Cutting Down Trees: Gender, Nutrition, and Agricultural Change in the Northern Province of Zambia 1890-1990*. Cambridge: Cambridge University Press.
Moore, S. F. 1994. *Anthropology and Africa: Changing Perspectives on a Changing Scene*. Charlottesville: The University Press of Virginia.
Morgan, S.M. and E. Colson. 1987. *People in Upheaval*. New York: Center for Migration Studies.
Morrison, D. R. 1998. *Aid and Ebb Tide: A History of CIDA and Canadian Development Assistance*. Onario, Canada: Wilfrid Laurier University Press.
Mosley, P., J. Harrigan, and J. Toye, (eds.). 1991. *Aid and Power: The World Bank and Policy Based Lending (v. 2)*. London: Routledge.
Moyo, S. 1995. *The Land Question in Zimbabwe*. Harare: SAPES Books.
Murray, D.L. and P.L. Taylor. 2000. Claim No Easy Victories: Evaluating the Pesticide Industry's Global Safe Use Campaign. *World Development* 28(10): 1735-1749.
Mwaura, P. 1998. Namibia Moves Cautiously on Land Deals. *Africa Recovery* 12(3): 12-13.
Neuman, R. P. 1997. Primitive Ideas: Protected Area Buffer Zones and the Politics of Land in Africa. *Development and Change* 28(3): 559-582.
Neumann, R. P. 1998. *Imposing Wilderness: Struggles Over Livelihood and Nature Preservation in Africa*. Berkeley: University of California Press.
Newsom, M. 1995. The Earth As Output: Pollution. In, R. J. Johnston, P. J. Taylor, and M. J. Watts (eds.), *Geographies of Global Change: Remapping the World in the Late Twentieth Century.* Oxford: Blackwell, pp. 333-353.
Niemeijer, D. 1996. The Dynamics of African Agricultural History - Is It Time for a New Development Paradigm? *Development and Change* 27(1): 87-110.
Norman, D. W. and D. C. Baker. 1986. Components of Farming Systems Research, FSR Credibility, and Experiences in Botswana. In, J. Moock (ed.), *Understanding Africa's Rural Households and Farming Systems.* Boulder, CO: Westview Press, pp. 36-57.
Norman, D. W. and E. Gilbert. 1982. A General Overview of Farming Systems Research. In, W. W. Shaner, P. F. Philipp, and W. R. Schmehl (eds.), *Readings in Farming Systems Research and Development.* Boulder, CO: Westview Press, pp. 17-30.
North, D. C. 1994. Economic Performance Through Time. In, Eicher, C.K. and Staatz, J.M. (eds.), 1998, *International Agricultural Development [3rd ed.]*. Baltimore: The Johns Hopkins University Press. pp. 78-89.
Obudho, R. A. and D. W. J. Foeken. 1999. *Urban Agriculture in Africa: a Bibliographical Survey. ASC Research Report 58*. Leiden & Nairobi: African Studies Centre & Centre for Urban Research.
ODI. 1994. *Comments on 'Livestock, land use and agricultural intensification in sub-Saharan Africa'*, London: Overseas Development Institute.
Okai, M. 1999. *Social Valuation in Agricultural Policy Analysis: Its Significance for Sub-Saharan Africa*. Aldershot: Ashgate.
Okigbo, B. N. 1990. Sustainable Agricultural Systems in Tropical Africa. In, C. A. Edwards, R. Lal, P. Madden, R. H. Miller, and G. House (eds.), *Sustainable Agricultural Systems.* Ankeny: Soil and Water Conservation Society, pp. 322-352.
Paige, J. M. 1975. *Agrarian Revolution: Social Movements and Export Agriculture in the Underdeveloped World*. New York: Free Press.
Palmer, R. 1977. *Land and Racial Domination in Rhodesia*. Berkeley: University of California Press.
———— 1997. *Contested Lands in Southern and Eastern Africa: a Literature Survey*. Oxford: Oxfam Working Paper.
Pearse, A. 1980. *Seeds of Plenty, Seeds of Want: Social and Economic Implications of the Green Revolution*. Oxford: Oxford University Press.
Peet, R. and M. Watts. 1996. Liberation Ecology. In, Peet, R. and M.J. Watts (eds.), *Liberation Ecologies: Environment, Development, Social Movements.* London: Routledge, 1-45.
Perkins, J. H. 1997. *Geopolitics and the Green Revolution: Wheat, Genes, and the Cold War*. Oxford: Oxford

University Press.
Peters, P. 1994. *Dividing the Commons: Politics, Policy, and Culture in Botswana*. Charlottesville: University Press of Virginia.
Pincus. 1996. *Class, Power and Agrarian Change: Land and Labor in Rural West Java*. London: St. Martin's Press.
Pingali, P., Y. Bigot, and H.P. Binswanger. 1987. *Mechanization and the Evolution of Farming Systems in East Africa*. Baltimore: Johns Hopkins for the World Bank.
Pinstrup-Andersen, P. 1999. Modern Biotechnology and Small Farmers in Developing Countries. *IFPRI Research Perspectives* 21(2).
Piot, C. 1999. *Remotely Global: Village Modernity in West Africa*. Chicago: The University of Chicago Press.
Poats, S. V., M. Schming, and A. Spring, (eds.). 1988. *Gender Issues in Farming Systems Research and Extension*. Boulder: Westview Press.
Popkin, S. L. 1979. *The Rational Peasant: The Political Economy of Rural Society in Vietnam*. Berkeley: University of California Press.
Poul Engberg-Pedersen et al. 1996. *Limits of Adjustment in Africa: The Effects of Economic Liberalization, 1986-94*. Oxford: James Curry.
Pretty, J. 1998. On Feeding the World. *The Splice of Life: The Genetics Forum's Magazine* 4(6).
Radcliffe-Brown, A.R. 1952. *Structure and Function in Primitive Society*. London: Cohen & West.
Radcliffe-Brown, A.R. and D. Forde, (eds.). 1950. *African Systems of Kinship and Marriage*. London: Oxford University Press for the International African Institute.
Ranger, T. 1983. The Invention of Tradition in Colonial Africa. In, E. Hobsbawm and T. Ranger (eds.), *The Invention of Tradition*. Cambridge: Cambridge University Press.
Rauniyar, G. and F. M. Goode. 1996. Managing Green Revolution Technology: An Analysis of a Differential Practice Combination in Swaziland. *Economic Development and Cultural Change* 44(2): 413-437.
Reardon, T. 1998. African Agriculture: Productivity and Sustainability Issues. In, C. K. Eicher and J. M. Statz (eds.), *International Agricultural Development.* Baltimore: The Johns Hopkins University Press, pp. 444-457.
Ribot, J.C. 1999. Decentralization, Participation, and Accountability in Sahelian Forestry. *Africa* 69(1).
Richards, P. 1983. Ecological Change and the Politics of African Land Use. *African-Studies-Review* 25(2): 1-83.
———— 1996. *Fighting for the Rainforest: War, Youth & Resources in Sierra Leone*. Oxford: James Curry.
Roe, E. 1998. *Except Africa: Remaking Development, Rethinking Power*. New Brunswick: Transaction Publishers.
Sanders, J. H., B. I. Shapiro, and S. Ramaswamy. 1996. The Economics of Agricultural Technology in Semiarid Sub-Saharan Africa. Baltimore and London: The Johns Hopkins University Press.
Sarris, A. and H. Shams. 1991. *Ghana Under Structural Adjustment: The Impact on Agriculture and the Rural Poor*. New York: New York University Press (for IFAD).
Schmidt, E. 1992. *Peasants, Traders, and Wives: Shona Women in the History of Zimbabwe, 1870-1939*. Portsmouth, NH: Heinemann.
Schroeder, R.A. 1999a. Geographies of Environmental Intervention in Africa. *Progress in Human Geography* 23(3): 359-378.
Schroeder, R. A. 1999b. *Shady Practices : Agroforestry and Gender Politics in the Gambia*. Berkeley: University of California Press.
Schumacher, E. F. 1973. *Small Is Beautiful: A Study of Economics As If People Mattered*. London: Blond and Briggs.
Scoones, I. 1994. *Living With Uncertainty: New Directions in Pastoral Development in Africa.* London: Intermediate Technology Publications.
Scoones, I. and C. Toulmin. 1999. *Policies for Soil Fertility Management in Africa*. Sussex, UK: IDS and IIED.
Scott, J. C. 1972. Patron-Client Politics and Political Change. *American Political Science Review* March: 91-113.
———— 1976. *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia*. New Haven: Yale University Press.
———— 1998. *Seeing Like A State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven: Yale University Press.
Scudder, T., E. Colson, and M.E.D. Scudder. 1982. *An evaluation of the Gwembe South Development Project, Zambia*, IDA working paper series. Binghamton, NY: Institute for Development Anthropology.
Sharpless, J. 1997. Population Science, Private Foundations, and Development Aid: The Transformation of Demographic Knowledge in the United States, 1945-1965. In, F. Cooper and R. Packard (eds.), *International Development and the Social Sciences: Essays on the History and Politcs of Knowledge.* Berkeley: University of California Press, pp. 176-202.
Silberfein, M., (ed.). 1998. *Rural Settlement Structure and African Development*. Boulder, CO: Westview Press.
Singh, I. J., L. Squire, and J. Strauss, (eds.). 1986. *Agricultural Household Models: Extensions, Applications, and*

*Policy*. Washington, D.C.: World Bank.
Skocpol, T. 1982. What Makes Peasants Revolutionary. In, Skocpol, Theda (ed.), 1984, *Social Revolutions in the Modern World.* Cambridge: Cambridge University Press. pp. 213-239.
Smith, J., A. D. Barau, A. Goldman, and J. H. Mareck. 1994. The Role of Technology in Agricultural Intensification: The Evolution of Maize Production in the Northern Guinea Savanna of Nigeria. *Economic Development and Cultural Change* 42(3): 537-554.
Snyder, K. A. 1996. Agrarian Change and Land Use Strategies Among Iraqw Farmers in Northern Tanzania. *Human Ecology: An Interdisciplinary Journal* 24(3): 315-341.
Stebbing, E. P. 1938. The Man-Made Desert in Africa: Erosion and Drought. *Journal of the Royal African Society* Suplement, January: 3-40.
Stein, H. and E. J. Wilson III. 1993. Robert Bates, Rational Choice and the Political Economy of Development in Africa. *World Development* 21(6): 1033-1081.
Swift, J. 1996. Desertification: Narratives, Winners & Losers. In, M. Leach and R. Mearns (eds.), *The Lie of the Land: Challenging Recieved Wisdom on the African Environment.* Oxford: James Curry, pp. 73-90.
TAC. 1978. *Farming Systems Research at the International Agricultural Research Centers*. Rome: TAC Secretariat.
———— 1988. *Sustainable Agricultural Production: Implications for International Agricultural Research*. Rome, Italy: FAO.
Thomas, D. 1996. Dam Construction and Ecological Change in the Riparian Forest of the Hadejia-Jama'Are Floodplain, Nigeria. *Land Degradation & Development* 7(4): 279-295.
Tiffen, M., M. Mortimore, and F. Gichuki. 1994. *More People, Less Erosion: Environmental Recovery in Kenya*. New York: Wiley.
Tripp, R., (ed.). 1991. *Planned Change in Farming Systems: Progress in On-Farm Research*. New York: John Wiley & Sons.
Tripp, R.et al. 1990. Farming Systems Research Revisited. In, C. K. Eicher and J. M. Staatz (eds.), *Agricultural Development in the Third World [2nd Ed.]*. Baltimore and London: Johns Hopkins University Press, pp. 384-99.
Turner, B., G. Hyden, and R. W. Kates, (eds.). 1993. Gainesville: University of Florida Press.
Turner, M. 1999a. Merging Local and Regional Analyses of Land-Use Change: The Case of Livestock in the Sahel. *Annals of the Association of American Geographers* 89(2): 191-219.
———— 1999b. No Space for Participation: Pastoralist Narratives and the Etiology of Park-Herder Conflict in Southeastern Niger. *Land Degradation & Development* 10(4): 345-363.
Twumasi-Ankrah, K. 1995. Rural-Urban Migration and Socioeconomic Development in Ghana: Some Discussions. *Journal of Social Development in Africa* 10(2): 13-22.
Vail, L., (ed.). 1988. *The Creation of Tribalism in Southern Africa: Studies in the Political Economy of an Ideology*. Berkeley: University of California Press.
van Horen, C. and A. Eberhard. 1995. Energy, Environment and the Rural Poor in South Africa. *Development South Africa* 12(2): 197-211.
Vansina, J. 1990. *Paths in the Rainforests: Toward a History of Political Tradition in Equatorial Africa* . Madison, WI: The University of Wisconsin Press.
Vayda, A.P., (ed.). 1969. *Environment and Cultural Behavior: Ecological Studies in Cultural Anthropology* . Garden City, NY: Natural History Press.
Wade, R. 1997. Greening the Bank: The Struggle Over the Environment, 1970-1995 (v.2). In, D. Kapur, J. P. Lewis, and R. Webb (eds.), *The World Bank: Its First Half Century.* Washington, D.C.: Brookings Institution Press, pp. 611-734.
Walker, P.A. and P.E. Peters. 2000. *The meanings of boundaries: Contested landscapes of resource use in Malawi*, Unpublished paper:
Wambugu, F. 1996. Control of African sweet potato virus diseases through biotechnology and technology transfer: Turning priorities into feasible programs. In J. Komen, J.I. Cohen, and Z. Ofir (eds.), *Proceedings of a Policy Seminar on Agricultural Biotechnology for East and Southern Africa.* Agricultural Biotechnology Policy Seminars No. 2.
———— 1999. Why Africa Needs Agricultural Biotech: There Is an Urgent Need for the Development and Use of Agricultural Biotechnology in Africa to Help Counter Famine, Environmental Degradation and Poverty. *Nature* 400(6739): 15-17.
Warner, M. W., R. M. Al-Hassan, and J. G. Kydd. 1997. Beyond Gender Roles? Conceptualizing the Social and Economic Lives of Rural Peoples in Sub-Saharan Africa. *Development and Change* 28: 143-168.
Watts, M. J. 1983. *Silent Violence: Food, Famine & Peasantry in Northern Nigeria*. Berkeley: University of California Press.

———— (ed.). 1987. *State, Oil, and Agriculture in Nigeria*. Berkeley: Institute of International Studies, University of California.
———— 1992. The Shock of Modernity: Petroleum, Protest, and Fast Capitalism in an Industrializing Society. In, Pred, A. and M. Watts, *Reworking Modernity: Capitalisms and Symbolic Discontent.* New Brunswick: Rutgers Univeristy Press, pp. 21-64.
———— 2000. Contested communities, malignant markets, and gilded governance: Justice, resource extraction, and conservation in the tropics. In, Zerner, C. (ed.), *People, plants, & justice: The politics of nature conservation.* New York: Columbia University Press, pp. 21-51.
Weight, D. and V. Kelley. 1999. *Fertilizer Impacts on Soils and Crops of Sub-Saharan Africa*, International Development Paper No. 21. East Lansing, MI: Michigan State University, Department of Agricultural Economics.
Wharton, C. R. 1969. The Green Revolution: Cornu[31]copia or Pandora's Box. *Foreign Affairs* 47: 464-476.
Wilmsen, E. N. 1989. *Land Filled With Flies: A Political Economy of the Kalahari*. Chicago: The University of Chicago Press.
Winkleman, D. and E. Moscardi. 1982. Aiming Agricultural Research at the Needs of Farmers. In, W. W. Shaner, P. F. Philipp, and W. R. Schmehl (eds.), *Readings in Farming Systems Research and Development.* Boulder, CO: Westview Press, pp. 31-43.
Wolf, E. 1969. *Peasant Wars of the Twentieth Century*. New York: Harper & Row.
———— 1982. *Europe and the People Without History*. Berkeley: University of California Press.
Worden, N. 1995. *The Making of Modern South Africa: Conquest, Segregation and Apartheid*. Oxford: Blackwell.

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[1] Agro-environmental change can be considered change in agricultural technology if technology is conceived as not just a material item, but as involving the spatial and temporal organization of production; it is "the sum of knowledge of the means and methods of producing goods and services" (Bannock et al. 1992: 419). For example, technology is not only machetes and tractors, but also seasonal work rhythms and crop arrangements. Different theories, however, will use different measures of technology, productivity, and yield.

[2] The centers have grown from four, at that time, to sixteen by the year 2000. The initial four centers were IRRI, CIMMYT, IITA and CIAT—which had developed from the 1940s on from the collaboration of the Rockefeller and Ford Foundations with national governments in Nigeria, Mexico, the Philippines, and Columbia respectively

[3] The books that exemplified, expressed and strengthened the critique include Wharton (1969); Griffin (1974); Lappe and Collins (1977); Griffin and James (1981); Kent (1984).

[4] For Anthony (1988), drawing on Kuhn (1970), the biases of the Green Revolution were examples of how "The breakdown of a scientific paradigm is preceded by 'the persistent failure of the puzzles of normal science to come out as they should' " (102).

[5] I have elsewhere explored in more detail how FSR came to be limited and diffused (deGrassi 2000). See also Norman and Gilbert (1982: 20), CIMMYT(1992: 47), Berry (1986), and Little (1985). Jennings likewise explains, "Economic thought at CIMMYT emerged from that interpretation which best corresponded to the dominant thought community: the agricultural scientists. Rather than economists influencing agricultural scientists, it was agricultural scientists who influenced the selection of economic thought that best matched their own goals … The basis for rejecting other economic paradigms derived, therefore, not from a freedom of discussion but a constrained and restricted community" (1988: 173).

[6] Hayami and Rattan (1971) developed a similarily micro-scopic, depolitized idea, termed induced innovation (both technical and institutional), which essentially was a bi-product of the depoliticized assumptions staff at the international agricultural research centers were working at, and never really explicitly addressed Africa, having its influence more as a contributor to the nascent FSR (Hayami and Ruttan barely mention Africa at al in their magnum 1985 work). They built upon Boserup's

emphasis on endogenous causes of technical change, as well as the 'appropriate technology' sentiments of the time (e.g. Schumacher 1973), to conclude that when factor market prices reflect factor scarcities, then technologies, and the institutions that produce them, will be 'induced' into existence (e.g. the CGIAR) (cf. Koppel and Oasa 1987; Koppel 1994; Lele and Stone 1989; Pincus 1996).
Ahistorical social and agronomic functionalism and evolutionism is replicated in facile theories of new-institutional economics (for an excruciating example, see Okai (1999)), and social capital—see Bardhan (1989b; 1989a); North (1994); Lin and Nugent (1995); Harris et al (1995). Lin and Nugent (1995: 2307) thus write, "Since institutions are rules governing behavioral relations among individuals, it is the functions that the rules perform that make institutions matter … The most basic function is to economize, i.e. to allow one or more of the agents to improve their welfare without making others worse off, or to allow them to attain a higher level of their objectives within their constraints." The cause of the phenomenon is the ultimate effect, end or purpose it serves; need explains form. Cf. Mehta et al (2000).

[7] Skochpol comments on the risk debate that we are trying in vain to get at some essential nature of the peasant at the expense of looking at political and military structures (Skocpol 1982: 229). She argues that we should "focus our attention on historical and cross-societal variations in the social and political factors … [rather than dwell] on ahistorical conceptions of the nature of 'the peasant' as a supposedly general human type" (1982: 214). Indeed, a potent critique of theories about ideal-types, such as '*the* African farmer,' and static, bounded systems is that it denies people a geography and history (for a potent critique, see Wolf 1982; cf.Asad 1987). This is not to say that risk is some fiction made up by academic and policy discourse. Bryceson (2000) and Bryceson and Jamal (1997) are key to putting the peasantries in historical context.

[8] Evolutionism reappeared in the 1950s debates between the neo-evolutionisms of Leslie White and Julian Steward.

[9] Boserup likewise based her ideas of history as technical change on cross sectional data, whereupon differing societies in the contemporary world corresponded to different stages of development "The method used is *cross-country* comparison of recent data; the main purpose of the exercise is to throw light on *historical* interrelations between population size and technology" (Boserup 1983: 6, emphasis added).

[10] Actually, according to Boserup, population growth provided the impetus for technological change and thereby set off a dialectic of demographic and technological shifts: "Once these motivations led to invention or importation of technologies, the technological change would then result in further population change, which in turn would induce still further technological change … Other areas would have little or no technological change because of stagnant populations, and would continue to have stagnant populations because of no technological change" (ibid, 5).

[11] Significant recent works on population-induced intensification include Tiffen et al (1994) and Turner and Hyden (1993) among others. A series of I believe fatal critiques to Bourn's piece have been compiled in ODI (1994). Longitudinal studies include Scoones (1994); Vaughn and Moore (1994); Fairhead and Leach (1996; 1998); Watts (1983); Guyer (1997); McCann (1995).

[12] including Franz Boas in anthropology and Gershenkron and Albert Hirschman in development studies.

[13] There were racial and sexual components of these ideologies and forces, but I have neither the expertise nor space to address them in this present essay. My thanks to Gillian Hart for astutely pointing this out.

[14] Many of the ideas stemming from colonial rule derived from, and in turn contributed to, the discipline of anthropology. Anthropologists were often complicit in the colonial enterprise, although there were progressive anthropologists working against, or at least to dampen, colonial forces, albeit in specific idioms (Asad 1973; for Zambia see Ferguson 1999: 24-37; Crehan 1997: 53-75). For Ghana, the notable anthropologists were Rattray, and then later Meyer Fortes working amongst the Tallensi of the north.

[15] Alley cropping failed precisely because it was so technical and premised upon the evolution of farming systems: it required too much labor, was susceptible to termites, defoliated with diseases, and produced little biomass on low fertility and acidic soils. Also, since controlled trials were grown with corn, researchers only later discovered the difficulties of growing root-crops and tubers in the rows. See McGuiness (1993); Carter (1995); Degrande and Duguma (2000)

[16] Much of the formative FSR work was done by Robert Tripp (an anthropologist), Derek Byerlee (an economist), and Mike Collinson (also an economist) of the Economics Department at CIMMYT. Byerlee went on to become director of the Economics Program, and now serves as Director of Agricultural and Rural Development at the World Bank.

[17] The MSU papers include Gilbert et al (1980); Eicher and Baker (1982); Crawford (1982); Collinson (1982). Important CIMMYT works are Byerlee and Collinson (1980); Byerlee et al (1982); Byerlee and Tripp (1988)

[18] The University of Florida established a Farming Systems Research and Extension (FSR/E) Program in 1979 (with the option of a minor in FS), and in 1982 received a USAID grant to fund a Farming Systems Support Project, with UoF subsequently joining an international group of Farming Systems Associates. The 1970s droughts sparked the Institute of Food and Agricultural Sciences (IFAS) at the University to shift research funding to African issues, also shifting the orientation of the Center for African Studies from liberal arts to rural development. The Center sponsored new faculty positions, conferences, publications, workshops, etc. An annual spring seminar, initiated in 1982, began to yield papers, and finally produced two books, one of which was the magnum *Food in Sub-Saharan Africa* (Hansen and McMillan 1986), issued in the midst of the 1980s famines (McMillan 1990).

[19] Accounts of the development of FSR include Tripp (1991) Moock (1986) and Singh et al. (1986). The UN's Food and Agricultural Organization continues to publish its book series on farming systems (now totaling more than 15 works).

[20] Rachel Carson's (1965) book *Silent Spring* on agro-chemical pollution made the wider pubic aware of environmental questions. Other more ecological books followed, including Ehrlich's (1968) *The Population Bomb*, as well as the gloomy quantitative modeling of Meadows et al's (1972) *The Limits to Growth.*

[21] Newsom (1995); Adams (1995). An interesting side note is that the optimist Julian Simon and the pessimist Paul Ehrlich were to later make a bet on whether resource prices would rise to a given level by 1991 or so. The media just ate up the story, and Ehrlich ended up losing, much to his publicized chagrin.

[22] Wambugu (1996; 1999); Conway and Sechler (2000); Adamu (2000); Gressel (1996); Pretty (1998).

[23] My thinking on these subjects has been profoundly influenced by a general area of scholarship termed 'political ecology.' See Bryant and Bailey (1997) for an introduction, Peet and Watts (1996) for a review of the lineage, and Ashton and Philton (1985) for formative antecedents of the recognition of the importance of multiple situated factors in development.

[24] To be explicit, it would be impossible and inaccurate to try and devise some typology or universal predictions using these factors as a checklist. The number of factors and their differing forms and combinations require that the specific context be identified in each case.

[25] The debts were acquired due ISI policies, corrupt dictators, declining commodity markets, misguided projects, raising interest rates, oil-price shocks, inflation (Mosley et al. 1991).

[26] Land-tree tenure often depends on time, geographic location, type of tree, type of land, social status of user (in terms of kin, gender, ethnicity, age, class, religion), and type of use of land and trees (eatable and non-eatable products; harvesting vs. use for hanging or blocking; commercial use vs. subsistence; and owning, fallowing, rental or disposal in terms of pledging, leasing, lending, selling, destroying or giving away). Certain uses (including planting, tending, harvesting, or clearing) of some types of trees may indicate types of ownership of land

[27] This is an approach known as atomism, first countered by Durkheim. It could also be considered a case of the ecological fallacy: "using population or group-level data to draw conclusions about individuals" (Murray and Taylor 2000: 1739, citing Blalock 1982). Such an approach parallels and draws from neo-classical economics and more recent 'New Political Economy' or neo-instrumentalists: see Bates (1981); cf. Stein and Wilson (1993). However, as Berry (1984) notes, at the base of neo-classical micro-economic models are the pillars of subjective preferences and uncertainty. And so, "If rules, transactions and values are ambiguous and negotiable, then economic activity cannot necessarily be explained in terms of decisive choices or efforts to gain exclusive control over goods and resources" (Berry 1993: 14).



[28] See for instance the 1990 population distribution map at http://grid2.cr.usgs.gov/globalpop/africa/app-6.php3.