Optimistic determinism or explaining a miracle

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CHAPTER 1

Optimistic determinism or explaining a miracle

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Published as:

Dietz, Ton, with Jan Willem Gunning, Andries Klaasse Bos & Adri Zuiderwijk (2009). Optimistic Determinism or Explaining a Miracle.

In: Burger, Kees & Fred Zaal, Sustainable Land Management in the Tropics. Explaining the Miracle. Farnham: Ashgate, pp. 1-20.

Introduction

A long tradition in the study of sustainable rural and agricultural development has culminated in the book, *More People, Less Erosion,* that tried to establish in a concrete situation whether this process of induced change can actually be proven to have happened. The issue of the selection of the area, Machakos District, and time, in the past six decades, remains and as such, the Machakos case can only be considered a case study, but a very extensive one and studied from a very wide angle. However, the timing of the publication and the changed paradigm that spoke from its pages soon helped in bringing attention to this work, and it remains one of very few examples of a thorough study of the relationship between population growth, technological development and the

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standards of living in developing regions. In this chapter, we aim to reflect on the publication by Tiffen, Mortimore and Gichuki to assess its impact, and to discuss the reviews that were written upon the publication of the book.

A landmark in development studies theory

'More People, Less Erosion' soon received a 'star status' in geographical, environmental and development circles, and a bit in the domain of agricultural economics. It was written by Mary Tiffen, Michael Mortimore, both from England, and their Kenyan co-author Francis Gichuki, based on research carried out in 1990-1991. The book was published in 1993/1994, by John Wiley & Sons in England, and simultaneously in Kenya, by ACTS Press. The study was the result of a research project funded and carried out by the Overseas Development Institute in London, which also published some of the preliminary results as working papers. Within a few years the 1993/1994 book was reviewed by many relevant journals, and by many of the leading authors in the field, particularly those from Britain (see annex 1). It was picked up very fast by *The Economist* (with a review in December 1993), and by *The Independent* (in June 1994). In the domain of 'planning and development' the book was reviewed by *Public Administration and Development* (by Shepherd), by the *European Journal of Development Research* (by Lund), and by the *Development Policy Review* (by Upton) in 1994, by the *Journal of Development Studies* (by Clayton) in 1995 and by the *Third World Planning Review* (by Sage) in 1996. In the domain of 'environmental studies' *Land Degradation and Rehabilitation* was first (by an anonymous reviewer), in 1994, followed by the *Journal of Arid Environments* (by Thomas, also in 1994), and the *International Journal of Environmental Studies* (by Brown) in 1995, and by *Disasters*

(by Downing) in 1996. In the domain of 'geography', the *Transactions of the Institute of British Geographers* took the lead (by Briggs) in 1995, and one of the leading British geographers, Gould, singled out a summary chapter in a compilation about People and Environment in Africa (Mortimore and Tiffen 1996, in Binns, 1996) as a summary of a "mold-breaking book" in his otherwise rather critical review of Binns's book in the same *Transactions* (Gould 1996). Another prominent British geographer, Adams, followed with a review in *The Geographical Journal* in the same year, and there even was a review in a journal for physical geographers (*Earth Surface Processes and Land Reforms* by Richards, also in 1996). In the domain of agricultural studies and agricultural economics Macarthur reviewed the book in the *Journal of Agricultural Economics*, and Parton in the *Australian Journal of Agricultural Economics*, both in 1994. Some more practitioners' journals followed soon (*African Farming*, the *ILEIA Newsletter*, and *Pesticides News*). Also the influential journal *Agricultural Systems* had a review, in 1996 (by Ssali). Finally, in the domain of 'African Studies' the French *Cahiers d'Etudes Africaines* was fast, in 1994 (by Thébaud), introducing the book in the French-speaking world, including French-speaking West Africa. The *Journal of Southern African Studies* followed suit (by McGregor). The prestigious *Bulletin of the School of Oriental and African Studies of the University of London* included a review as well (by Allan, in 1995), and *African Affairs* followed in 1996 (by Kenworthy).

The book was also widely cited in scientific journals. The ISI citation index[5] mentions 318 references in ISI journals to the book between 1994 and 2007. Google

[5] http://isiknowledge.com; this includes all clumsy references to the book, e.g. wrong years of publication. Search: Nov. 19, 2007

scholar[6] gives 771 hits and Google itself gives 17,700 hits for "more people less erosion tiffen", 11,900 if also Mortimore is added, and 9,620 if the third author, Gichuki, is added as well[7]. Around the time of publishing the book, Mary Tiffen and Michael Mortimore also published a scientific article in Outlook on Agriculture (Tiffen and Mortimore 1993, December), which was more or less ignored (with only 1 citation in an ISI journal afterwards). A journal publication in World Development, one of the leading journals in development studies (Tiffen and Mortimore 1994, July) was much more successful though. It got 25 citations in ISI journals afterwards[8]. In addition there were two scientific articles in Environment (Mortimore and Tiffen 1994; October and September 1995), which have had 9 and 1 ISI citations respectively, and a scientific article in Development and Change (Tiffen, January 1995), which had 5 ISI citations. Before 1993 some preliminary work had been published as well (e.g. Tiffen 1991), but 1993-1995 really saw an avalanche of publication activities around the 'Machakos story', and the framing of that story in a theoretical 'Malthus defeated by Boserup' line of reasoning. In 1996 a summary of the book was published in a compilation of 'environment and population in Africa' articles for university-educational purposes (Mortimore and Tiffen 1996, in Binns, 1996). Binns's book was cited 16 times, with special attention for the chapter on Machakos.

The success of the publications approach can be illustrated by showing the citation history of the book and the most important journal articles (Figure 1, based on Table A.1, see annex). The book was clearly much more successful in drawing the

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[6] http://scholar.google.nl/ Search: Nov. 19, 2007

[7] http://www.google.nl/ search: Nov. 19, 2007

[8] Google scholar gives 37 citations.

attention of scholars than the three journals, although the journals seem to be well chosen as leading journals in the domain of development studies and environmental studies. In total the 1993-95 publications were cited at least 350 times, and the secondary citations reached more than 2800. The various publications were cited most in the year 1999, and authors who cited Tiffen et al. in 1999 (and in 2001) were also cited a lot afterwards. The period around the launching of the Millennium Development Goals was also the peak period of using the 'Machakos miracle' as a positive counterpoint to the doom scenarios for Africa's predicament.

Six publications, which referred to the Machakos case, were particularly influential. Frank Ellis's publication about household strategies and rural livelihood diversification in the Journal of Development Studies (Ellis 1998) introduced the book in a wider field of development specialists and livelihood researchers. Ian Scoones engaged in a debate about new ecology and the social sciences in the Annual Review of Anthropology (Scoones 1999) and hence introduced the book in circles of anthropologists. Jesse Ribot used ideas from the book in an article on Africa (Ribot 1999), which introduced the ideas in circles of Africanists in general, and of social forestry and public administration scholars in particular. Philippe le Billon and colleagues used the book in a study about natural resources and armed conflicts in Political Geography (Le Billon et al. 2001), and hence further introduced the book to scholars in the domain of politics and geography. Finally the first article in Environment got a major face-lift when Eric Lambin and colleagues referred to it in a very influential contribution in Global Environmental Change-Human and Policy Dimensions, in 2001 (Lambin et al. 2001). This journal is widely read in circles of climate change researchers.

[Figure 1.1 around here]

The book inspired authors dealing with all parts of the developing world. The 350 references to the book and the journal articles in the above figure were used in 101 journal articles with general titles, and 257 dealing with a particular country or (sub-) continent. Not surprisingly journal articles about Africa dominated the regional publications (n=218), and if the titles were more specific, most were dealing with East and North-East Africa (n=76), followed by West Africa (n=50), and Southern Africa (n=31). But also authors dealing with Asia (n=29) and the Americas (n=10) referred to this Machakos story as a source of inspiration, or - in a few cases - criticism (one group of authors deliberately used a counter title: “Fewer people, less erosion”, in a publication about Bolivia; Preston et al. 1997). Again not surprising, Kenya dominated the journal attention for particular countries (n=41), followed by Nigeria (n=11), Ethiopia/Eritrea (n=10), South Africa, Burkina Faso and Tanzania (all: n=8) and Uganda (n=7). There was only one publication dealing with environmental problems in Europe (about Italy), which referred to the book, and one dealing with environmental problems in North America (about Canada). The Machakos story clearly appealed to the community of development-oriented researchers, not so much to the ‘mainstream sciences’.

Praise and criticism

Our chapter aims, first, at summarizing a considerable number of book reviews on some selected key topics which are relevant for the subject and have been dealt with by most reviewers, and, second, looks at the follow up in later years. Consequently the chapter may not give a representative summary of what individual reviewers have written, but

we shall try to do justice to everyone by direct quotations from each review. Due to the selection of critical items, together with a certain selection of critical and controversial statements, our chapter may suggest that reviewers are more critical than they in fact are. We therefore want to start off by noticing that the attitude of all reviewers without exception is sympathetic and positive. Authors will certainly be glad with so many and such stimulating critics from the various disciplines that apparently are represented by the twenty-odd referees. Just a sample of relevant statements:

> ‘This book makes exciting reading. It clearly demonstrates that medium and low-potential rain-fed areas can support rapid population growth and high population densities with improved soil and water conservation.' (Upton 1994).
>
> 'The true significance of this book is not that it challenges established orthodoxies in a way that happens to be politically convenient, it is that someone got down to the task of asking sensible and open questions about change over a useful time period (i.e. decades) in semi-arid Africa. Machakos is unusual in having such a rich history of previous studies, but even here this synthesis was not previously available. Such research is time consuming, but it is vital if we are to break out of the endless cycle of simplistic blueprint 'answers' for Africa.' (Adams 1996).
>
> 'This book will take its place in the halls of imperfect resource theory (a crowded shelf) and a prominent place in historical landscape ecology. On the whole it is a widely cited book that few will find the patience to read carefully and critique. It should be an essential read for researchers of Kenyan development policy and its manifestation in sub-humid and semi-arid areas.' (Downing 1996).

The publications by Tiffen et al. have been praised for their thorough analysis and fascinating research results that apparently have surprised many reviewers, because of the positive and encouraging outcomes with respect to the combination of high population growth, maintaining income levels per capita and sustainable land use. Terms such as 'Machakos miracle' and 'development paradox' have been used

frequently, indicating that many researchers tend to think in negative scenarios with respect to economic growth and environmental consequences of sustained high population growth rates. This could be expected, given the overall negative overtones of the bulk of earlier scientific publications on the just mentioned 'triangle' about population pressure - standard of living - land use.

More than twenty book reviews have been brought together in this chapter and we have listed them in Annex A.2. In this paper we 'shorthand' the reference to the reviews by mentioning each author's name; and the reader can trace the corresponding journal in the annex. In seven sections we will summarise the main elements of the book reviews and add our own critical questions and interpretations.

Causality of the relationship between population pressure and innovation

In the conceptual model presented by Tiffen et al. high population growth over a long time period leads to high population pressure and this will start a number of changes including technological development and farm investments, which all together result in the higher productivity of land and even labour, so that an increased income per capita situation will be the end result. It is the proof of Esther Boserup’s theory (Boserup 1965 and 1981). The authors even extend it towards environmental aspects to arrive at sustainable economic development. As can be learnt from their model the starting point is population pressure. 'Authors single out population density as the main driving force and use it to explain why it took decades for the environmental recovery process in Machakos to start.' (Ssali). 'Do more people mean less erosion? Yes at least in this place-time example, but not necessarily as a causal relationship.' (Downing).

The book chapter on technical change shows that particularly after 1950 the

process of technical change, in its demonstrated forms, has been accompanied by a dramatic population growth rate during the same period. Both phenomena are closely associated, but cause-effect relationships are only given in a suggestive way, not in a quantitative presentation. 'Testing causality between population and environment requires more formal quantitative modelling and comparative case studies.' (Downing). 'The present study is replete with description, but totally lacking in this sort of modelling or statistical analysis and with only the rudiments of sensitivity testing.' (idem). Downing refers to the methodological dilemma posed in the last chapter of Tiffen et al. under the heading "Population policies". 'The Machakos experience between 1930 and 1990 lends no support to the view that population growth, even rapid population growth, leads inexorably to environmental degradation. It is impossible to show that a reduced rate of population growth might have had a more beneficial effect on the environment ' (p. 284). Downing states that such questions could be solved if testing of the relationships had been undertaken. We are more hesitant. The model presented by Tiffen et al. is already rather complex, and even then one could question if all relevant factors are included. Is it possible to develop the conceptual model as a quantifiable model, given this complexity?

Clayton is more careful compared to Downing as regards the relationship between population growth and environment by using the word 'compatible'. 'The authors provide convincing evidence that population increase, fivefold in the period, is compatible with environmental recovery (...). They rightly observe that a critical ingredient for this to occur is the availability of markets for profitable farming. In 60 years the value of output per hectare has increased tenfold and the value of output per capita approximately threefold.' (Clayton). But he continues on the relationships as

follows. 'The authors posit, on the lines of Boserup, that the growth of population in the district (....) is an important causal (underlining ours) factor in generating new market opportunities which have stimulated investment and innovation - though vital concomitants have been the initiative and enterprise of the Akamba people themselves, with support, rather than top-down intrusion, from government' (Clayton). So various new elements are stressed by Clayton, which could explain income increase of farm households: their own initiative and decision making on the basis of new market incentives and own technological know-how, but also with some support (not intrusion) from the government. Interrelationships become already complicated and one would question the causality of high population growth in the whole system. Similarly one could question if the complex network of relations between variables as portrayed in the book (Figure 16.1) resulting in higher per capita incomes must start so one-directionally at stage one: population growth. For instance: what is the role of external economic factors like new market opportunities, or on the contrary economic contraction of the national economy?

Population pressure and land-labour relationships

In the review contributions, various comments are made on the land-population relations as land-labour relations. In Chapter 4 of the book, population figures show the high population growth rates both in Kenya and Machakos. Based on census figures, the population of Machakos over the 60-year period has become its six-fold (1932: 239,000; 1989: 1.4 million inhabitants), although Table 4.1 in the book shows that the growth rate of Machakos has been lower than the Kenyan average except for the period 1969-1979. One should be a bit careful with these growth rates, though, as the book is. In the

book (p. 62) it is mentioned that the six-fold increase might be an exaggeration. Population growth has no doubt been considerable but may not have been as high as stated: the 1932 census has most probably been an under-estimation, while the 1989 census might have been 'inflated' (the accuracy of that census is questionable). What is not mentioned, though, is the fact that post-Independence censuses have always been organised in August, a time in the year when many children and young adults studying elsewhere returned for their holidays and when many men working elsewhere came 'home'. Those people were then counted in their 'home area'/area of origin, instead of in their area of work/study, where they were residing during most of the year. The actual population and labour availability during most of the year is considerably lower than indicated during census time.

The logical conclusion seems: 'The expanding population has increasingly placed pressure on the land (....) The reduced size of holding has led to a typical pattern of intensification in the farming system.' (Tuley). But the potentially negative influence of high population growth on rural household incomes is not as dramatic as could be expected, since total available land has increased considerably after 1962 by the use of former 'Crown lands', the percentage cropped land has continuously increased (due to changed land use pattern away from livestock grazing) and a growing part of the male population got employment outside agriculture. The interesting fact appears that from 1932 up to 1979 the cropped acreage per agricultural worker has *increased* from 0.5 to 1.05; and even the cropped acreage per person has not fallen (Tiffen et al., Table 4.6). These few statistics just illustrate that the quantitative impact of high population growth on the man/land relationship is not that dramatic and explain why reviewers do not pay much attention to poverty due to increased population pressure over time. Much more

dramatic is the qualitative aspect that, as demonstrated by various contrasting pictures, landscapes were already seriously deteriorated at the start of the 60-year study period and under the usual paradigm environmental recovery could not be expected. However, the authors prove, again with convincing photographs, that the environment had recovered as a result of activities of thousands of farmers (with women major contributors), and this has been the main reason to speak of the 'Machakos miracle'.

We note, though, that it is surprising that few reviewers carefully differentiate 'increasing population density' from 'increasing population pressure'. The book itself is also not very clear about the definition of 'population pressure' (it features prominently in Figure 2.5, p. 28, but is not defined in the list of definitions on p.29 and also not included in the index). Population pressure is not only the shrinking capacity to feed a growing population with locally available food resources. The external market may play a considerable intermediary role, where locally produced goods are being exchanged for externally produced food items at (potentially) positive terms of trade. Also a lot of 'pressure' may be relieved if the local economy is being supplemented by external funds: labour remittances, food and other aid, free or heavily subsidised goods and services. Also, population figures are usually referring to Districts or parts of Districts. At the same time, we know that this area, though relatively densely populated, certainly had land available for expansion. This refers to the problem of scale dependency of the analysis (see further below) and would be focusing attention more on economic stage of development in relation to local circumstances.

The role of technological change

The essence of the Machakos story is that particularly after 1960 many farmers applied

technological improvements that resulted in large increases over time in land productivity. What is important to say from the outset is that the book authors carefully avoid the impression of a big bang set of innovations, a kind of 'Green Revolution', changing the agricultural and environmental conditions more or less overnight. '…continued incremental, adaptive changes, many of which are hardly noticed … can add up to substantial change in the aggregate' (foreword in Tiffen et al. 1994).

Five important agricultural-technological innovations were improved maize production (particularly the flexible incorporation of the short-cycle 'Katumani' maize variety into the cropping system, and the adoption of double cropping), the introduction of horticultural crops, fruit trees and coffee, the ox-plough, the use of compost and manure, and a trend towards stall-feeding and fodder growing, as well as tree planting, and bench terraces.

Technological changes were aimed at increased productivity per cultivated land and labour unit. The role of farmers themselves in the application of changed technologies is pre-eminent. The book reviews accept the importance of these agro-technical changes but do not give them any specific attention, unlike the other important breakthrough: the development of sustainable agro-ecological practices (soil- and water conservation by terracing mainly).

> 'The authors demonstrate that population growth was instrumental in preventing erosion and environmental degradation' (Pesticides News). 'The authors are exploring a case which contradicts much of the general and simplistic pessimism prevailing on the discussion on natural resources management in Sub-Saharan Africa. The myths that population increase inevitably leads to land degradation (....) and that land degradation generally is irreversible, are undermined by the Machakos reality presented in this study' (Lund).

The study teaches us that the main ingredients for realizing - over a long period -

improved and sustainable agriculture are in soil conservation. The special chapter dealing with developments in soil conservation divides the conservation history of Machakos into four periods: 1930-45; 1946-62; 1962-78 and 1978-90. From the viewpoint of massive changes by farmers in erosion control the period of 1962-78 is most interesting. By 1961 the area conserved by two types of terraces, the most prominent feature in SWC in the area, had fallen to 27,000 ha, compared with a peak of 42,000 ha in 1958. The cultivated area was about 110,000 ha (Tiffen, 1994, p 194). During the short rains of 1961 much damage was done by abnormally heavy rainfall. Officially, compulsion (very strong in years before) was ruled out in the period around Kenya's Independence in 1963. Part of the anti-colonial atmosphere of the 1950s can even be attributed to the harsh environmental policies during that period. Observers in the early 1960s regarded the relaxation of 'environmental law and order' as having potentially devastating effects. Closed grazing areas were reopened and red 'sores', the forerunners of serious erosion, began to reappear in 1962-64. At the same time agricultural staff numbers were cut back. Grazing controls, soil and water conservation and controlled settlement largely ceased. About that same period various initiatives of farmers have been mentioned in the book, illustrating how they paid serious attention to soil conservation, despite government ‘withdrawal’.

The level of analysis and individual rationality

The state of soil conservation in the early 1990s shows clear improvements, quantitatively as well as qualitatively, in terracing and other soil conservation elements. In an economic exercise comparing costs and benefits, at farm level, of soil conservation practice (compared with farming without soil conservation) it proves economically

profitable to do so (Tiffen et al. 1994, p 200).

In the book reviews, the environmental recovery has been noticed and appreciated. It is seen as primarily the result of farmers' decision making. However,

> 'The book is ostensibly concerned with development of farming families, but the reader is ultimately given little idea how households secure their livelihood needs or how they make decisions about allocation of resources' (…) 'Although they dot the landscape of the photographs, the Akamba are not accorded a 'voice'. The lack of personal testimonies in the book left me feeling suspicious that the principal architects of 'conservation' were not given the opportunity to express their experiences: perhaps their understanding of environmental change is at variance with that of outsiders who see only evidence of 'recovery'? (Sage).

Other reviewers have accepted the positive facts of environmental recovery accepted, but various critics considered the process by which changes have arrived as obscure:

> '(...) These phenomena and events correlate or concur with the process of environmental recovery in Machakos, but we are left somewhat in the dark as to why this is so. Self-help groups, Christian missions, education and expansion of cash crop production are not restricted to the (sic) Machakos but can be found in many areas, which fared less well. (...) Machakos evidently is a very dynamic and adaptive society. We are, however, not brought to an understanding of the dynamics from the actors' perspective (our underlining) (Lund).

There seems to be a lack of sufficient ‘grounded’ causal reasoning and a chapter is missing bridging the empirical parts and the theoretical 16th chapter in the book. Some critical comments by others also refer to lack of insight in the process and the weight of each factor involved.

In a contribution to a workshop in 1998 to prepare for a follow up research of a Dutch-African-Asian research team (the start of the process that led to this book), where also Mary Tiffen, Michael Mortimore and Francis Gichuki were present, Aad Zuiderwijk criticised the approach by Tiffen et al. for producing ‘much circumstantial

evidence, but with few eye witnesses': 'what lacks are eye-witnesses; the people who made the investments, and who can tell us a lot on what they did, when they did it, why, and how' (…) 'No major effort was put to interview sufficient [numbers of] farmers in different socio-economic positions and agro-ecological zones' (Zuiderwijk 1998). A few people, whose life histories are presented in the book, give the impression of a people-centred book, but it is not and certainly not in a systematic way. As a result, we do not get an idea about the downside of agricultural intensification. Who are the losers? What about the socio-economic (and socio-cultural) differentiation in the area? What about changing relationships within communities and with the outside world? Income diversification and the diversification of the regional economy (with a lot of growth in transport, trade, and real estate, and important contributions from remittances) are major driving forces of investments in agricultural intensification, so it seems, but who does, and who does not?

Economics vs. Anthropology; the integration of disciplines

Economists and economic anthropologists would have loved to see more calculations and more life histories showing how investments in agriculture and in terraces could have been so rewarding, that it was indeed worthwhile for diversifying farmers to do so. And: what was the historical order? Did investments in terraces (and in agricultural technology in general) follow periods of high rewards per area and per labour hour? Or did investments in terraces result in higher rewards per area and per labour hour?

This brings us back to the 'farmers did it' story. The downplaying of government agencies as drivers of change by Tiffen et al. in their conclusions, and the highlighting of farmers' own initiatives as a response to market forces (which many reviewers have

also picked up as a major element of the study) is not always convincing. About the more recent terracing activities in the late 1980s and early 1990s Tiffen et al. write (on p. 200-201): 'food-for-work and tools-for-work have helped poorer farmers achieve terraces through mwethya groups (so-called self-help groups, which were often assisted by government and non-governmental agencies; our addition), but hired labour has been used by those with the necessary resources'. So: relatively rich farmers can do it alone; the others need external support and encouragement? And one can even go one step further: did the farmers who 'did it alone' actually do it alone? Isn't it more realistic to say that they used a lot of cheap, hired local labour, which had become available in the area due to the fact that so many poor farmers did not benefit from market changes and land improvements, as they only had minimal land areas, and did not benefit from marketing of crops, as they had few anyway, and certainly not the crops with occasional windfall profits?

In a contemporary study, published in 1995, about the same Machakos area, a group of authors from a political ecology background put more emphasis on the historical political economy of the area; the differentiation between relatively rich, successful, and self-reliant farmers and a considerable group of poor, impoverishing households. They write:

> 'For over a century, Ukambani, the home of the Akamba people, has been the object of intense scrutiny and repeated interventions by international and national "experts". Outsider narratives have portrayed the region as a crucible for a series of crises, including human and livestock epidemics, "overgrazing", soil erosion, low productivity, underdevelopment, fuelwood shortage, biodiversity loss, and threatened wildlife. Akamba farmers and herders recount a very different story in which land alienation, land hunger, and limits on mobility of people and their herds have restructured the ecological and spatial order of their homeland, to the benefit of some and the detriment of many. The history of crisis construction and resolution by

outsiders, juxtaposed with the diverse experience of people within the region suggests that simple solutions to single problems may actually create new crisis, in Ukambani and elsewhere' (Rocheleau et al. 1995, 1037).

Replicability and path dependency; Local actors, local conditions

However: how 'special' is Machakos? Both for scientific understanding and for development practice a crucial question is how a transition towards sustainability can be induced on a larger scale and what would be the conditions favouring such processes of change? This requires a detailed understanding of the factors that induce farmers to invest in farming systems that are sustainable. And it also calls for proper (and not ideologically motivated) analysis of the role of government agencies in some phases, and with enough attention for geographical differentiation: it might well be that in some areas farmers can be the main driving forces of terracing and other investments in environmentally sustainable agriculture, but that in other areas they need an external lead agent (as in most of Machakos the government played that role during the last decades of the colonial era) provoking change, despised as it often was, and that in still other areas farmers will not be able to invest, neither now, nor in the foreseeable future. If that geographical specificity is needed in Machakos, and we think it is, the questions of where, when and by whom begs for more theoretical attention.

Many reviewers see the 'Machakos miracle' as a good example of sustainable management of land use in a fragile environment. Tiffen et al. also put their story in this perspective: it is a book about 'the replacement of natural vegetation by sustainable farming systems, which over time maintain an adequate level of nutrient replacement, and which conserve soil and water in forms useful to man' (Tiffen et al. 1994, 14).

However, further analysis asks for a careful and clear breakdown and operationalization of the concept of 'sustainable management of land use'. Here the book already gives a lead in its down-to-earth definition (p. 29): ‘the maintenance or improvement, over several years (of fluctuating rainfall), of soil chemical and physical properties on cultivated land, of pasture productivity on grazing land, of farm trees and regenerative woodland communities, and of groundwater recharge, compared with conditions at a chosen baseline (or the commencement of a period of study or observation)’.

The authors of the book summarize their findings about sustainability on p. 242 and 261-262. On soil chemical properties (soil fertility levels) they write that 'they have been unable to reach firm conclusions', although agricultural output per hectare has increased considerably and that would have been very difficult with declining soil fertility levels; on the other hand all farmers complained about problems of obtaining sufficient manure from their animals and of cash for purchasing fertilizers; with a decreasing grazing land/crop land ratio - in the early 1990s 1.5:1 - this may become a major bottleneck in the nutrient cycling system. On soil physical properties they write that 'soil erosion has been eliminated on much cultivated land, and greatly reduced on others'. On soil texture there is ‘a trend towards more sand, at the expense of the silt and clay fractions’. On pasture productivity they write: 'there are beginning to be signs of improvements in grazing lands'. On trees they write that 'the fuel shortage ... has never reached the often predicted crisis point, and there are now more trees, grown for many different purposes'; and there is no conclusion about groundwater recharge.

For any follow-up comparative research it is important to use the same definitions, operationalization and measurement approach. What is also rather crucial is the *chosen baseline*. In the book the chapter on rainfall has mainly been used to show a

rather extreme variability and unpredictability but especially the fact that there has not been a trend in rainfall. If there would have been a positive rainfall trend, this could at least partly have explained the higher agricultural yields and the vegetation coverage. However, more attention could have been given in the book to the impact of bad years (droughts, but excess rainfall or diseases/pests can also cause major problems) on changes in land and crop management during and immediately after such bad years.

Replicability and path dependency: The geography and history of the Machakos case

Where history and geography meet, there is always the question about the adequacy of 'time slices' and 'area cuts'. This is not a topic many reviewers take seriously. We do.

Some presentation of evidence is done at the level of the Akamba area as a whole (so including Kitui); most presentation of evidence takes the (old) district as a spatial level of scale (with the problem that before Independence the Machakos Reserve was different from post-independence Machakos District), and finally there is a presentation of important evidence at a lower level of scale.

There is a lot of suggestive explanation in the book where - due to paucity of data - the writers take whatever exemplary sub-district cases are available (e.g. Nzaui on p. 157, or Yatta on p. 172) and they add their own in-depth study locations (see the book’s map on p. 4). However: at this level of in-depth study areas the 'weights of evidence' differ: looking at the number of times case-study evidence is being presented, most attention was given to Masii (an area with 51-100 inh/km2 in 1932 and 1948 and 100-200 in 1962 and 1979, see p.49). This is followed by Kangundo (26-50 in 1932, 100-200 in 1948, 200-400 in 1962 and 400+ in 1979) and by Makueni (less than 25 in

1932, 1948, and probably also 1962, and 50-100 in 1979. The other areas which are presented as 'study locations' get less attention: Mbiuni, Mbooni, Ngwata and Kalama. How representative are these specific areas for trends in the whole district? And: if the study areas differ so much in the crucial variables (population density and population growth) wouldn't it be useful for modelling purposes to differentiate them according to a typology, e.g. a typology of land pressure (if that is possible)? Also, the distance to Nairobi, and the role of coffee production should have been given more attention. Are the most convincing pieces of evidence in coffee areas, near Nairobi? If so, what are the gradients to lower sustainability and less successful innovations away from the coffee zones, and away from Nairobi? Wouldn't it be true that economic processes of market-related intensification would be far more important than population pressure as such if this geographical aspect would be taken into account and could explain much of the process of achieving sustainability in dryland agriculture?

On the 'time slices' we can conclude that, where the book presents 'hard evidence' there is a remarkable emphasis on the early 1960s, and the late 1970s, hardly anything on the 1950s, late 1960s and early 1970s, and relatively little on the more recent period. It would be interesting to discuss if this is important or not with regard to the conclusions that are reached. What is intriguing, though, is the relationship suggested by Tiffen et al. (p. 88) between terracing and 'increased market demand, from Kenyan towns and from export markets, transmitted by private traders'. This market demand particularly focuses on coffee, fruit and vegetable production, while much of the growth of that market-led expansion (re-) started in 1974, accelerated in 1976-79 for coffee, and became relevant for fruit and vegetables mainly from 1980 onwards. At the same time, terracing had already started in the 1940s, and had become very widespread

in 1978, and mostly preceded the market boom (Tiffen et al. 1994, 69-71). Reading the book, one often wonders: what happened when, where, in what order, and more systematically collected detailed life and investment histories would have helped to solve that riddle. We have tried to do that in this book (see Chapters 2 and 3).

The book by Tiffen et al. ends with a chapter called 'Replicability, Sustainability and Policy.' The question 'unique or replicable' states a number of factors that make Machakos rather unique, while other factors can be added as well. The authors believe that the differences with other areas are in most cases relative rather than substantive. This includes colonial land occupation and the subsequent availability of new land at Independence, suddenly relieving the tight man/land ratio. In our view this makes Kenya or at least Machakos, a special case. However, the research team tends to be carefully optimistic:

> 'Comparative reviews of farming systems show that increasing population density correlates with crop-livestock integration, as well as with intensification, in all the major ecological zones of tropical Africa(...). The growth of the non-farm sector' (such an important explanatory factor in Machakos, our addition) 'is also common (...). Such comparative studies indicate that the Machakos experience is being replicated elsewhere and is likely to have wide applicability' (Tiffen et al. 1994, 276).

In the reviews various doubts and scepticisms have been put down with respect to replicability over time and place, though.

> '(...) Nor can it be assumed that proximity to the large urban market of Nairobi, and the relatively free markets for crops in Kenya, are not key factors in permitting an increase in the market surplus of agricultural produce from Machakos. In short, differences in current population density, quality of natural resources, location in relation to markets, and the general socio-economic environment in other parts of Africa might lead to very different results' (Upton).

Also Ssali had his doubts:

> 'Machakos differs from other semi-arid areas in Africa in two ways: climate (bimodal rainfall and cooler

temperatures); and unoccupied land (Crown land) that became available after Independence' (Ssali).

Ssali believes that the influence of Nairobi, the mushrooming city next-door to the Machakos District may be underestimated in the book. It is a challenging question to answer: what makes Machakos a 'breakthrough case', what are the 'transition factors' to sustainable land use, and how specific have they been. Those are questions asked by follow up research.

The follow-up: towards more comparative analysis

After 1994-95 the book's success inspired other scientists to think about follow-up studies, designed to test some hypotheses and refine others. Our book is one of those, but also Mary Tiffen and Michael Mortimore designed and carried out a follow-up study, of which we will give a brief overview. But first we should highlight four other recent publications, in which 'Machakos' is put in perspective.

First, Steve Wiggins (2000) used some of the Machakos evidence in a comparative overview of 26 African cases (although he does not use the book, but an earlier paper by Tiffen, presented at a conference of economists in 1992; Tiffen 1992). He concludes that village studies show a rural Africa that gives less cause for alarm than the macro-level agricultural statistics from national agencies, which are mostly very worrying for the 1980s and 1990s. But he adds that the village level studies all show that the crucial variable is market access.

Second, in a brief, but very illuminating contribution, Boyd and Slaymaker re-examined the hypothesis that population growth and agricultural intensification result in improved soil and water conservation, drawing on six new case studies from Burkina Faso, Ghana, Nigeria, Senegal, Tanzania, and Uganda (Boyd and Slaymaker 2000).

Their conclusions are rather sobering. They hardly found other examples of a reversal of natural resource degradation and a trend towards environmental recovery. Environmental successes were limited to relatively small sections with high value crops. Hence, soil and water conservation improvements will only be taken serious by farmers when these improvements have the potential to increase the yields of these high value crops, when agricultural land is in short supply, and when farmers still have a 'farm ethos'. Measures to support farmers to adopt land and farm improvements should be part of wider measures to support their overall livelihoods, which increase market access, and secure attractive producer prices.

Third, Murton revisited some of the Machakos evidence and came to conclusions that put far more emphasis on the losers in the process.

> '[...] changes in Machakos District, Kenya have been accompanied by a polarization of land holdings, differential trends in agricultural productivity, and a decline in food self sufficiency within the study area. [...] when the 'Machakos experience' of population growth and environmental transformation is examined at a household level, it is shown to be neither a homogenous experience nor a fully unproblematic one' (Murton 1999, 37).

Finally, Jules Siedenburg (2006) critically examined the Machakos evidence, and tries to put it in a balanced perspective, with admiration for the 'solid outcomes', but critiquing the 'unhelpful hyperbole' of the theoretical interpretations, and much of the reception of the study. His comments:

> 'It is suggested that the Machakos study comprises hopeful data, on the one hand, and problematic calculations and assertions, on the other. After exploring problems with the study, the article suggests an alternative interpretation of the data that is arguably more pertinent to contemporary concerns with rural poverty and environmental degradation as well as more widely applicable in sub-Saharan Africa' (Siedenburg, 2006, 75).

Let us see how Mary Tiffen and her team coped with these and other suggestions and criticisms when they designed and carried out a comparative follow up study, which was funded by the Natural Resources Policy Research Programme of the UK Department for International Development (DfID). They took the criticism serious that the 1994-95 studies were all so close to Nairobi, that the urban influence might have been the main driving force, and not increasing population densities. In Kenya they therefore did a study in a more remote and more arid part of Ukambani, the new Makueni District, towards the South. They also focused more than in the book on the 'policy requirements for farmer investments'. The new studies in Makueni were done with a major involvement of Francis Gichuki, the third author of the 1994 book, and working as a senior lecturer in soil and water engineering at the University of Nairobi, Department of Agricultural Engineering. They were mostly on water management (Gichuki 2000a-e). Studies were added on soil fertility, crop, livestock management and investments and income (Mbuvi 2000, Mbogoh 2000, Fall 2000, Nzioka 2000, Nelson 2000). Finally Francis Gichuki, Stephen Mbogoh, Mary Tiffen and Michael Mortimore produced a synthesis booklet (Gichuki et al., 2000). The studies show a design in which natural sciences and social sciences work alongside. The time depth is mainly between 1989 and 1998, which is a bit surprising, as the convincing power of the 1994 book had partly been based on the long time perspective.

The new study had the intention to compare the Kenyan area with two other African dryland zones. The two other dryland areas, which have been added for in-depth analysis, were Diourbel in Senegal and the Kano-Maradi area in Nigeria and Niger. A huge team of researchers participated in each of these studies. Twenty-four researchers worked on Diourbel, and together produced eleven working papers. The team was led

by Abdou Fall of the Institut Sénégalais de Recherches Agricoles in Dakar (ISRA). A number of topics are the same as in Kenya: specific studies about water, soil and tree management, about crop and livestock development (during the 1960-1999 period), and commercialisation, about income diversification and farm investments, and about human resource elements (and particularly the functioning of institutions like the family and local support arrangements, and attention for education). In Senegal there was less specific analysis of rainfall trends, but more specific attention for demographic trends, the impact of national policies affecting farmers, land rights and access arrangements, and land use change and occupational change. In January 2001, a synthesis study was presented about the Diourbel Region (Faye et al 2001). On Maradi in Niger and Kano in Nigeria comparable studies were done as the ones in Senegal, sometimes in joint working papers, often in specific documents for Maradi and Kano. For Maradi an English-language and a French-language synthesis was made (Mortimore, et al. 2001a and b), but none for the Kano area.

The proceedings of the concluding workshop (Drylands Research 2001) suggest agreement about four major issues: the importance of markets and of urban markets in particular, the importance of the rural non-farm sector, the importance of access to land, and the importance of local social institutions, in particular the institution of the family (and the way families manage their finances), the institution of education, and of values attached to education. However, quite a number of the critical points raised by the reviewers, and by us in our review of reviews were more or less ignored by the participants of this workshop, and this is particularly true for the issues of social inequality, and for the impact of geography, and distance to urban markets more specifically.

Instead of publishing a new book, Mary Tiffen and Michael Mortimore decided to use their new insights in a variety of journal articles, and to use their 'drylands website' for summarising findings, and posting on-going work (see http://www.drylandsresearch.org.uk). Their focus was mainly on the Sahel (e.g. Mortimore 2001 and 2002), not so much on comparing Kenya and the West African cases (in fact only Tiffen 2002). There was a lot of engagement with policymaking and thinking about the research-policy interface (e.g., Tiffen and Mortimore 2002, Mortimore 2003, and especially Mortimore and Tiffen 2004). And this seems to be the major direction in which current work is going (e.g., Tiffen and Mortimore 2006). Still it is a pity that a real integration of the recent comparative study has not yet been published, and a comparison of these findings with the Machakos story also still needs to be done.

Past achievements and future work

One publication of the follow-up project is becoming particularly influential in scholarly circles: the analysis of linkages between agricultural growth, urbanisation and income growth in a publication in World Development (Tiffen and Mortimore 2003). It makes a strong plea for a major boost for urban productivity, in order to stimulate agricultural development and rural improvements. In fact the study acknowledges the importance of urban markets in any assessment of rural Africa's dynamics. However, one would then want to see how important distances to these urban markets are, how geography matters, and what markets actually do. Despite a promising research design in the Makueni-Diourbel-Maradi-Kano comparison, systematic answers are still missing, though a recent article deals with the relationship between urbanisation and agricultural change

(Tiffen 2006). This then appears to be the overriding lesson from the 1994-2007 period: the prospects of rural environmental management, and of agricultural change in Africa's rural areas depend on the development of urban demand, and instead of continuing with urban-rural divides in scholarly and policy circles, these domains should be combined for fruitful analysis.

Annex A.1

Year	Total		Book		World Developm.		Environment		Dev & Change	
	N cited	C cited	N cited	C cited	N cited	C cited	N cited	C cited	N cited	C cited
1994	10	97	9	93			1	4		
1995	15	147	13	140			1	7	1	0
1996	20	136	19	135			1	1		
1997	23	283	21	277			1	1	1	5
1998	28	359	25	301	1	5	2	53		
1999	47	479	38	394	8	79	1	6		
2000	28	326	25	263	1	40	1	5	1	18
2001	32	520	28	344	3	36	1	140		
2002	29	181	26	178	3	3				
2003	24	112	22	95	1	11	1	6		
2004	28	115	24	81	4	34				
2005	31	68	29	67	1	0			1	0
2006	21	21	19	21	1	0			1	0
2007	22	14	20	13	2	1				
total	358	2858	318	2402	25	209	10	223	5	23

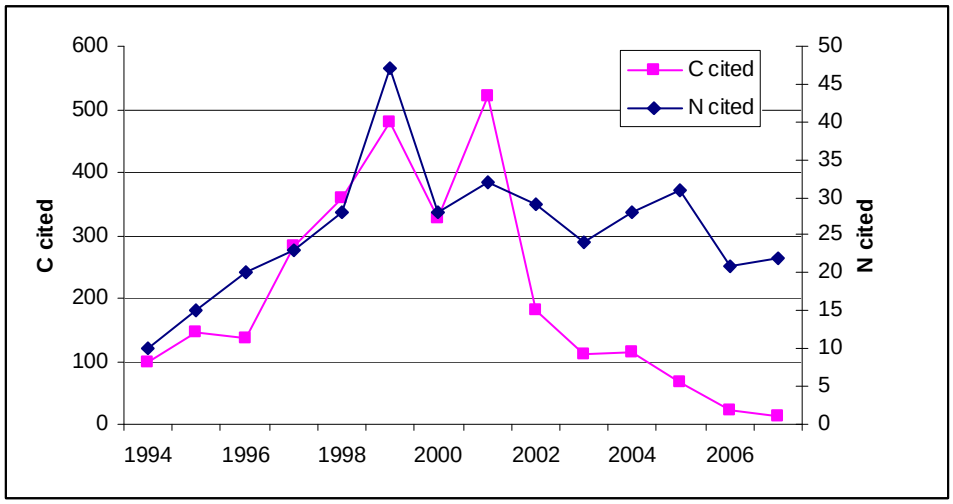
Annex A.2

Consulted book reviews of Tiffen et al. 1994.

Name of reviewer	**Name of Journal; vol., no and pp.**	**year**
W.M. Adams	The Geographical Journal, 162 (1), p. 85	1996, March
Allan, T.	Bulletin of the School of Oriental and African Studies, University of London, 58, 430	1995
N.N.	African Farming	1994, Jan/Feb.
Briggs, J.	Transactions of the Institute of British Geographers, 20 (4), 520-521	1995
K. Brown	Internat. Jnl. of Envir. Studies, 49, 68-69	1995
E. Clayton	Jnl. of Development Studies, 31 (4), 641-642	1995, April
Th. E. Downing	Disasters, 20 (1), 88-90	1996, March
N.N.	The Economist, p. 68	1993, 11 Dec.
N.N.	ILEIA Newsletter	July 1994

J.M. Kenworthy	African Affairs, 95 (379), 307-308	1996, April
N.N.	Land Degradation & Rehabilitation	1994 January
Chr. Lund	European Journal of Development Research, 6 (2), 194-196	1994
J. MacArthur	Journal of Agricultural Economics, 45 (3), 395-397	1994 Sept
J. McGregor	Jnl. of Southern African Studies, 20 (2), 317-324	1994 June
R. North	Independent	20/6/94
N.N.	Pesticides News, 23	1994, March
Parton, K.A.	Australian Journal of Agricultural Economics, 38 (2), 208-210	1994, Aug
K. Richards	Earth Surface Processes and Land Reforms, 21 (8)	1996
C. Sage	Geoscientist 6 (.)	1995
C. Sage	Third World Planning Review 18 (2), 263-264	1996, May
N.N.	Spore, Vol. 49, p.4	1994, Febr.
H. Ssali	Agricultural Systems, 51 (1), 113-115	1996
A. Shepherd	Public Administration and Development, 14 (3), 317	1994, Aug.
B. Thébaud	Cahiers d'Etudes Africaines, 34	1994
D. Thomas	Journal of Arid Environments, 28 (1), 82-83	1994
C. Toulmin	Africa, Vol. 65, no 1, pp. 152-153	1995
S. Trumper	Farm Africa Newsletter	1994, April
P. Tuley	Tropical Agric. Assoc. Newsletter,	March '94
M. Upton	Development Policy Review, 12(.), 328-334	1994
W.S.K. Wasike	The Environmentalist	??

Figure 1.1. Citation history of 1993-1995 publications by Tiffen et al. according to ISI



N = Number of times cited in ISI journals; C = number of times referencing publications cited in ISI journals.