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Intensification, and alternative approaches to agricultural change[1]

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Abstract: *The context of the intensification debate is widened by calling attention to two aspects that have been insufficiently taken into account in the large post-Boserup literature. These are farmers' use of capital investment of all forms, and the importance of organisational skills, as distinct from the technical skills on which the literature has concentrated. It is suggested that diversification of production and livelihood opportunities, investment, and finding new ways of using and managing resources are important roads to agricultural change and that 'intensification', explained in a reductionist manner as a response to pressures, is only a part of the story. Adaptation, innovation, and the seizing of opportunity can take place within a wide range of social, demographic and environmental conditions.*

Keywords: *intensification, historical models, agricultural change, landesque capital*

This paper sets out to widen the context of the intensification debate. I propose approaches that depart from use of the 'historical model' proposed by Ester Boserup (1965, 1981). Although criticised and faulted, that model has become almost orthodoxy since the 1980s.[2] I make only limited reference to my own contributions to the debate (Brookfield 1972, 1984, 1986; Blaikie and Brookfield 1987), because I now wish to move beyond these. With the partial exception of the 1984 paper, all – in final analysis – simply modified the Boserup model.

Yet that model treats intensification as an essentially unilinear process, even if we also allow for a unilinear 'disintensification'. It is reductionist in its emphasis on just two main forces impelling change: population growth and the need to combat loss of production through natural deterioration of the soil.

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Cash cropping has since been added as an alternative, and perhaps more effective, trigger of change than population growth. Farmers pay close attention to market signals, and change their land use accordingly. It is certainly easier to see this happen than to see quick response to perception of decline in the marginal product of additional labour, on which the Boserup trigger relies. Writing of history, many have followed Boserup's model sequence in assuming, without firm evidence, that a shifting-cultivation stage everywhere preceded the adoption of any more 'intensive' practices. This sequence can now seriously be questioned. In much post-Boserup literature, the fact that everything hangs on a supposed stepwise transition from less to more intensive forms of land use has tended to impose a deterministic template on a highly diverse set of actual histories.

The histories themselves can rarely be unravelled, and it has been a common method to find evidence that is supposed to index intensive practices and then to assume a Boserup sequence of events. This has been especially so in the discipline of prehistory, as clearly shown by Morrison (1994, 1996) and Leach (1999). Work on pre-maize agriculture in eastern North America, on the other hand, has largely escaped this trap, and thus provides an important part of the evidence for a different account of agricultural origins. Writings by Asch and Asch (1985), B. Smith (1987, 1992) and Butzer (1992) illustrate this evidence. For contemporary societies without sufficient historical record, it remains common to substitute spatial for temporal comparison. Data have been presented on such variables as fallow length, working hours, amount of off-farm work, and returns to labour, against population density. A good example is in Netting (1993: 110–11), in the course of an important book drawing heavily on Boserup's model. In this case, as Guyer (1997: 29) has pointed out, the magnitude of the differences is not comparable with those for population density, suggesting that other and unidentified intervening processes are at work. This is not at all uncommon in the literature, and many other examples could be cited.

Since Boserup's time, sustainability has become the new watchword and clearly each of Boserup's model stages becomes, as part of the model, increasingly unsustainable as it advances. Yet the reality is one of constant adaptation to changing biophysical, social, demographic, economic and political conditions, and this has been so for a very long time. Change is the normal condition, but it is in no one direction nor along any one dimension. The labour-intensification of a production system is only one of several possibilities, and labour is only one dimension.

ARGUMENT

In my 1972 paper I offered what some have regarded as a rigorous definition of 'intensification', though I am no longer sure that an 'intensification' process was what I was really defining. I wrote that 'in regard to land, or to any natural resource complex, intensification must be measured by inputs only of capital, labour and skills against [what I then termed] constant land. The primary purpose of intensification is the substitution of these inputs for land, so as to gain more production from a given area, use it more frequently, and hence make possible a greater concentration of production' (Brookfield, 1972: 31). Later, I would have added 'and to give that production greater security', not necessarily an attribute of intensification.

The equal emphasis I gave to capital and skills along with labour, in 1972, was not sufficiently followed through, especially in regard to capital, and my discussion of 'skills' has been mainly in a technical context. As Mary Tiffen (1996: 177) has remarked, Boserup put emphasis on inputs of agricultural labour because, in her day, the fact that development required capital was a universal assumption. This then meant the capital investment of modern technology. Therefore she focused attention on labour. She felt that many capital investments would add to rather than diminish labour, and reasoned from experience in Asia and Africa to show how labour has increased through the course of agricultural progress.

One consequence of Boserup's persuasiveness, together with other fashions, has unfortunately been, in subsequent literature right down to the 1990s, a huge neglect of farmers' own capital investment. If small farmers are 'resource-poor' then it is supposed they cannot invest unless credit is made available to them, as has happened in the 'green revolution' programmes since the 1960s. Investments in land improvement, requiring a lot of work that is not directly productive, demand saving from direct production. Changing a farming system is investment, and one that requires the first innovators to bear the risk of failure. How much farmers save in this way is little known, but suggestions have been made that farmers wishing to invest in new production systems may save up to a third of their total incomes (Tiffen, 1996).

This might astonish, but an early writer on development remarked that 'we . . . could not save if we had the level of income typical of low-income societies, but to assume that this is true of the people of those societies is gratuitous. In even the lowest-income peasant societies the level of income is not so low that all of it is used for the necessities of life' (Hagen, 1962: 18). Farmers' purposes in making investment in land certainly include enhancement of production and particularly the reduction of risk. Control over biophysical diversity is an essential means to this end; the greater the dynamics of manageable biophysical processes, the larger the need for investment.

CAPITAL AND MANAGEMENT

I now seek to redress the balance that was lacking in my earlier contributions by linking capital to farmers' management (as opposed to technical) skills. The capital assets of an arable farm are not easy to classify, and for small farmers in the developing world there are few studies that do the job adequately. Working capital of buildings, tools, vehicles and working livestock forms the simplest category. The working capital of a farm also includes its human labour force, greatly varying according to household size and structure and relationships with other households. The human labour force has to mobilise its inputs of time in relation to the choice of crops. It has to do this in a way that will avoid or minimise conflicting demands, and be adaptable to the weather. Efficiency in time management, not amount of labour input, is the main determinant of success or failure, and there can be large differences between adjacent farms closely similar in work-force endowment. The organisation of land and labour through time emerges as of central importance in a good deal of modern work on agricultural change. In a book in which he finds considerable merit in Boserup's model, Stone (1996: 111) writes of the Nigerian Kofyar that organisation of labour has been 'in some ways more important' than total labour inputs themselves.

Other assets intersect with the management of the human labour force. Breeding livestock are one example. If used in marriage payments, they are essential contributors to planning the long-term work-force capital of a farm household, as well as being a source of food and a marketable asset in their own right. They may have other important social functions, as in the case of pigs in New Guinea. Both working and breeding livestock are of major importance in the redistribution and natural processing of biomass resources to provide soil fertility. Managing the livestock component of any mixed farming system, and satisfying its requirements, not only absorb large amounts of labour, but also call heavily on managerial and planning skills.

Trees are also capital assets, however they are used. They may provide wood, fruit and nuts or cash income, but they also scavenge, cycle and store nutrients: a proportion, often selected for specific use, additionally fix atmospheric nitrogen. They may perform other services such as watershed and slope protection. Resources devoted to trees and to the maintenance of working and breeding livestock are important elements in the total managed landscape, contributing greatly to production and livelihood. Yet there are major contrasts between whole farming systems, in some of which the use of such resources is well integrated with arable production, while in others they are treated as separate and largely unrelated parts of the farm. A sustained focus in the post-Boserup literature on the proportion of years in which land lies under natural fallow fails entirely to capture these important contrasts in the organisation and integrated use of farm assets. There is, moreover, a good deal else that is neglected in most discussions of intensification.

LANDESQUE CAPITAL AND 'MANUFACTURED SOIL'

The natural potential of the land itself is a form of capital, and farmers can both draw it down, and enhance its qualities. Terraces, dams, drainage and irrigation systems are widely regarded as physical evidence of intensification, because their construction and maintenance requires substantial labour. As a form of 'landesque capital', they and stone walls leave the most persistent of all visible records on the land, and for this reason they have been heavily emphasised in the literature, my own contributions included. But there are many other forms of landesque capital, including field systems as a whole, and major modifications to the soil. These latter find limited place in the literature, and I therefore give them stress in this paper. Largely disregarded even by soil scientists, they can have large and enduring consequences. Just as human use can have the effect of stripping and gullying soils, so it can also create enduring beneficial changes that yield capital for use by future generations.

Soils in effect manufactured by generations of farmers include, for example, the *plaggen* soils of northwestern Europe, with deep A-horizons, which result from centuries of manuring. The composted mounds of the Enga region of Papua New Guinea are also manufactured soil. In two Central African systems, one based on fire (*citimene*) and one on tillage (*fundikilla*), improvements in soil chemical condition have been shown to persist for years (Strømgaard, 1992). Improvement in soil phosphorus and other nutrients can locally persist not merely tens but even hundreds of years. Examples include soils on an ancient terrace in Peru studied by Sandor and Eash (1995), or in the enriched *terra preta dos Indios* along the Amazon and its tributaries (N. Smith, 1980; Eden *et al*, 1984).

The agriculturally diverse West African region contains some striking examples of soil modification, among them the infield farming of the Kofyar in their old homeland on the southern edge of the Jos plateau in Nigeria (Netting, 1968). The ongoing reclamation of mining spoil for productive agriculture by people further north on the same plateau includes a particularly inventive use of compost (Phillips-Howard, 1994; Alexander, 1996). Heavy use of compost, together with manure, is also developed by some farmers on the Fouta Djallon plateau of Guinea: there is a sharp contrast between low-yielding temporary cultivation on about four-fifths of the land, and permanent cultivation in enclosed infields, or *tapades,* occupying about one-fifth of the area. The infield soils are, to all intents and purposes, manufactured, and their pH may be up to two points higher than that of the outfield soils (Barry, Fofana and Diallo, 1996). They have a history of more than a century and are still made and sustained. When a *tapade* is left unused after its farmer has gone away from the area, it is not casually taken over by anyone else; *tapades* are important capital investments.

In the Kissidougou region of the same country, a dramatic transformation of savanna into forest is described by Fairhead and Leach (1996). The process has been as follows: early in the 20th century, savanna land grew mainly upland rice, with two to four years' cultivation separated by long periods of grass fallow. In modern times, most rice is grown in swamp sites, which have been substantially enlarged and improved. The uplands have become the site mainly of groundnut and cassava cultivation. Unlike the grains, these crops are mounded, with the grass mulch composted in the mounds. Preferred garden sites are old village locations, where deeper and richer soils are found. Mounding practices are extended beyond these limits into savanna, which in time becomes like the old village sites in terms of soil conditions. Infiltration and water retention are improved, horizons are mixed partly by tillage and partly through enhancing termite activity. Soils become more workable and 'oily', with an increase in clay content. The savanna grasses are replaced by shorter grasses that are less vulnerable to fire. Then, because the land between the mounds is not tilled, tree germplasm and seedlings are not destroyed and gain benefit from improved soil conditions. In time, a mixture of savanna and forest species is displaced by the latter, so that a forest thicket becomes the fallow in place of grass. Aware of these dynamics, Kissidougou farmers consciously manipulate them in order to enrich the productivity of their land.

THE PLACE OF DIVERSITY

Certainly, labour goes into these long-term investments and into their subsequent maintenance, but if this is 'intensification' its product is enduring a long time after the creators of the fixed capital have perished. Changes in the biota introduced by people are equally enduring, and these cover much larger areas than do improved soils. Many such changes have been destructive, but in an era obsessed by 'environmental crisis' there has been some exaggeration of the damage done.[3] Over big areas the effect of human use has been to increase the diversity of the biophysical environment, even to increase biodiversity while changing its content. Use of biophysical diversity, always well understood locally, is common to small farmers at almost all levels of population density, and it is often at a within-field level. Biophysical diversity is dynamic, affected both by short-term variability and longer-term change, and there are no static equilibrium states from which systems have departed under human use, or to which they can be returned. Successful adaptation to this dynamism, at any level of population density or state of commercialism is essential to survival. Management of biophysical diversity is important, and so is flexibility in response to climatic and other external changes.

Transformation of farming systems of the type described as 'agricultural revolutions' has often found new ways of managing this diversity. In the farmer-driven English agricultural revolution of the 16th to 18th centuries, a rigid division of land between continuous (but fallowed) arable on the one hand and permanent pasture on the other, was replaced by 'ley farming', the alternation of arable with pasture and meadow. The consequences included substantial improvements in productivity, greater diversification, and considerably lower costs of production. The system 'married the livestock to the soil and extracted the greatest possible cereal and animal produce from the farm, whilst continually improving its fertility' (Kerridge, 1967: 202).

In parts of West Africa, the pan-tropical practice of intercropping mixing different cultivars in the same field has been elaborated through experimentation in ways that improve both total productivity and its security, both in areas of land shortage and on low fertility soils supporting only sparse population. So far from being 'traditional', these elaborations are seen by Richards (1985: 70) as 'progress toward an agricultural revolution well adapted to West African conditions'.

In a valley of the Peruvian Andes the role of diversity in a context both of land and labour shortage is minutely explored by Karl Zimmerer (1996). Both these shortages are centuries-old, but both have acquired new dimensions in the rapid commercialisation and other changes that followed the Peruvian land reform of 1969. The farmers are cultivators of land ranging from 2700 to 4100 metres above sea level (masl) who grow a great variety of landrace crops, especially of potatoes and maize. Family farms have a median number of eight small fields scattered through this range, though the poorer farmers have more of the higher altitude land and less of steeply-sloping lower valley sides. Hill farming is devoted overwhelmingly to potatoes, while maize is the dominant crop in the valley. Between hill and valley spaces lie the two main classes of commercialised land. These are oxen-ploughed fields on the less precipitous middle slopes under a range of crops, now dominated by contract-grown barley and modern varieties of potatoes. In moister areas, early-planted potatoes are grown and obtain higher prices during months of scarcity.

Among the many changes since 1970, expansion of commercial farming on the middle slopes is the most far-reaching. It has led to a repacking of diversity in the tiny valley fields below, to an elaboration of manuring and intercropping with leguminous beans and Andean lupin, and the second grain crop, quinoa. Labour scheduling has become more rigid due to regular threats of drought, disease and pests, and also because of the tight scheduling of the contracted barley harvest on the slopes above. The extremely bio-diverse hill farming, by contrast, has greater flexibility in terms of the scheduling of work. Fields in each of the four production spaces have characteristic properties in terms of qualities, and their appropriate calendars, tools and work techniques. Modern change has involved the shifting of marginal fields between one type and another, and of elaborating production methods in order to secure a range of commercial and subsistence production. In the case analysed by Zimmerer, resource constraints and high population density have been present almost throughout, and the main mediator of change has been the continued adaptability of the peasant farmers in the presence of repeated external innovations and pressures.

FLEXIBILITY

The ability to use different resources, and employ different strategies for making a living, is clearly present in Zimmerer's example, and it includes the use of long fallow periods even in association with very demanding land management techniques on the cultivated land. Examining four villages within and east of the 'Kano Close Settled Zone' in northern Nigeria, along a gradient of rainfall, rainfall variability, population density, and 'intensity' of land use, Adams and Mortimore (1997) make much of flexibility as a strategy.[4] Six elements are identified, flexibility in the scheduling of farm labour inputs, use of a diversity of cultivars, use of other economic plants, shifting of field locations (land rotation), use of grazing resources and, not least important, the use of diverse livelihood strategies, including off-farm employment.

They find the first three common to all situations, as indeed they might on the analogy of others, but land rotation is less possible where more and more land is under permanent cultivation, and lack of grazing resources requires dependence on crop residues for livestock feed. Even the time available for off-farm employment is limited because of the demands of labour scheduling for relay- and long-term crops on the farm itself. Yet whether this last system grew out of others or did not, it remains resilient, with sustained yields.

Non-farm employment, whether away or at home, is an important livelihood strategy in almost all situations. It is especially important in areas of variable climatic conditions. Use of non-farm employment responds to opportunity as well as to pressures, and this is strikingly demonstrated by the massive development of rural industrialisation in 18th and early-19th century Japan. This not only so constrained farm labour supply as to lead to widespread break-up of large farms, but also led to significant reduction in the population of many towns and even cities, unable to compete with lower-cost rural production and trading (T. Smith, 1959, 1988; T. Smith with Eng and Lundy, 1977). This took place during a century and a half in which the population of Japan as a whole, and also of most parts of the country, had ceased to grow, and during which there was major technical progress in agriculture, greatly increasing productivity. A pattern evolved early, and has persisted, in which from a quarter to four-fifths of rural community income is derived from sources other than agriculture (T. Smith, 1988:86).

While the Japanese story has few if any parallels in the historical record, non-farm employment is very general. There can be few agricultural communities anywhere, and probably never have been, in which the available working time of all able men, women and older children is spent on the production and preparation of farm produce, and the ancillary tasks, including hunting, gathering and fishing as well as collection of firewood and water. Artisan work and trading occupy many people part time and some full time. Many people, especially men but increasingly also women, travel away from the community to work for part of each year, and their incomes and remittances contribute importantly both to livelihood and capital investments. To cite only one well-researched example, a quarter of household cash incomes in one quite isolated village in Mali, in 1981, came from migration earnings and trading profits; the remainder came from crop and livestock sales (Toulmin, 1992: 52). Investment in working and breeding livestock, and in the landesque capital of wells, was substantially financed from these sources.

SUMMING UP

In 1822, a Japanese agricultural writer, Okura Nagatsune, saw the principal object of progress as being ‘to reduce the people’s labour’. This was achieved by developing more efficient methods, by which to increase yields, reduce costs, or require less strength and skill than the methods which they supplanted (T. Smith, 1988: 177, 212). This involved not only invention, but also great attention to the management of time. Important as a longer term objective was improvement in the productive capacity of the land. It is useful to recall that, at the time Okura wrote, the major increase in agricultural productivity that was happening took place in the context of severe and growing shortage of farm labour, a major increase in non-farm employment, and a static population. The key to survival, let alone success, was seizure of the opportunities that the time offered.

Emphasis on innovation and opportunity, investment in fixed or landesque capital, and improved management of resources, is also the modern lesson from Machakos in Kenya. There, a supposedly desperate situation of environmental deterioration in the 1930s has given way to rising production, improved welfare, and reduction of erosion, in this case with a fast-growing population (Tiffen, Mortimore and Gichuki, 1994). To say this is not to advance any alternative stage theory of agricultural transformation, for the circumstances are in all cases peculiar to the place and time. It is, however, to suggest that a successive pairing of Malthusian pressures with Boserup technical leaps is not the only way in which agricultural transformation can be explained. In one 'intensification' paper that I would still, largely, stand by, I stressed the importance of innovation, rather than intensification. Innovation involves bringing the factors of production together in new ways, and it need not only be technical invention (Brookfield, 1984).

Farmers always include a minority of innovators who experiment, and some of whom find better ways of doing things. The majority who are followers then change their ways in imitation. This is how farmer-driven agricultural revolutions have happened. Often, farmers change their systems incrementally, bit-by-bit, 'transforming them while in use' (Doolittle, 1984: 125). By creating capital 'incrementally' farmers can make investments that would be beyond their means in the short term. Studying on-going change, it would in many cases be more informative to seek out the innovators and focus on their practices, rather than to describe what the 'average' farmer does. A good example of such an approach, in describing farmers' response to land degradation in Ghana, is provided by Amanor (1994: 206–11).

Finally, how much of this can usefully be described as a process of intensification? Much of what has been described involves new skills in use of 'dynamic' land, and of both agricultural and non-agricultural opportunities, not increased inputs into any constant land or, indeed, increased current inputs of any kind except of management skills. Simple labour intensification of the same methods on the same land does not lead to progress and can lead to prolonged stagnation, even over two centuries and into modern times as I showed in the case of the West Indian island of St Kitts (Brookfield, 1984). It can increase exposure to risk.

Diversification of production and livelihood opportunity, investment and finding new ways of using and managing resources are roads to agricultural change, and the triggers of change are not only those of external pressure. As Niemeijer (1996: 93) has expressed it, 'the more dynamic the natural or social environment, the more important it becomes to rapidly adjust subsistence patterns to benefit from new opportunities and to avoid pressing constraints. . . . in dynamic environments the survivors are those who rapidly adapt'. In a constantly changing, never stable world, adaptation, innovation and the seizing of opportunity have been, and until now remain, the keys to survival and successful change. This can happen within a wide range of social, demographic and environmental conditions. In other words, we need informed understanding in a multi-variate structure. 'Intensification' is only a part of the story, and its reductionist explanation can lead away from understanding. Progress requires ways in which to analyse transformation which can use theory, but which avoid being misdirected by preconceived notions.

NOTES

1 Since this paper was written, its arguments have been further developed and illustrated over several chapters in the writer's *Exploring Agrodiversity*, New York; Columbia University Press, 2001.

2 Among many who have reviewed or enlarged Boserup's work note should be taken particularly of Spooner (1978), Grigg (1979), and especially Robinson and Schutjer (1984), who elegantly linked Boserup's reconstruction to the more dismal prognostications of the Neo-Malthusians. Commentaries and variations have been advanced by Cowgill (1975), Turner, Hanham and Portararo (1977), Turner and Doolittle (1978), Turner, Hyden and Kates (1993) and others, as well as by the present writer.

3 This paper is not the place in which to develop the large topic of land degradation, important though it is in a workshop devoted to 'agricultural intensification'. Simple intensification of inputs without change in their nature does lead to degradation in many situations. Land degradation has been over-emphasised in the literature but, as major contributor to a whole book on the topic, I am in a poor position to complain (Blaikie and Brookfield, 1987).

4 Adams and Mortimore take the risk of using a spatial comparison for interpretation of possible long-term change in practices. But they use the Boserup model with caution.

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