Turning but not Toppling Malthus: Boserupian Theory on Population and the Environment Relationships

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Summary:
Subsequently to the Brundtland Report, the 1992 Earth Summit, and the resulting Agenda 21, the issue of population and development has increasingly evolved into discussion on the "population, environment and development nexus". In the face of this new mandate for research on population, environment and development dynamics, theoretical frameworks are limited. Conceptual thinking on population and environment within both the social and natural sciences has traditionally suffered from a long-term confinement within opposing "Malthusian" versus "Cornucopian" views. The work of Ester Boserup, however, continues to transcend the boundaries of this polarized discourse. This paper reviews the main points of Boserupian theory and its relevance to developing regions, in particular to sub-Saharan Africa. Recent reinterpretations of Boserup's work relevant to population and environment relationships in developing countries are also considered.

Indexing terms:
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Introduction

In response to the 1992 Earth Summit and Agenda 21 (United Nations 1993), population scientists have actively reordered priorities on their research agendas. The issue of population and development has increasingly evolved into the 'population, environment, and development nexus' (e.g. Cleaver and Shreiber 1992). In the face of this mandate for research on population and environment dynamics, theoretical frameworks are limited. Conceptual thinking on population and environment within both the social and natural sciences has, in fact, traditionally suffered from a long-term confinement within 'Malthusian' versus 'Cornucopian' polarities. These opposing points of few have made it, somewhat notoriously, into the popular media through the antagonistic work of the biologist Robert Ehrlich (1968 and with A. Ehrlich 1990) and the economist Julian Simon (1981 and 1990). The work of Ester Boserup, however, continues to transcend the boundaries of this polarized discourse by pointing to a more integrated , if less trodden, way for both researchers and policy-makers.

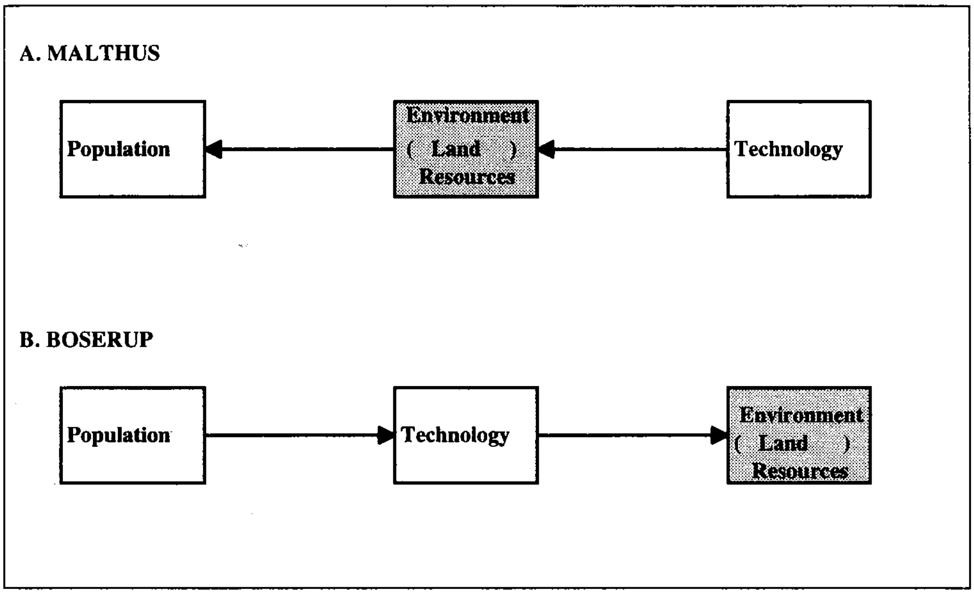
As T. Paul Schultz observes, Boserup "turns" Malthus on his head (Schultz in Boserup, 1990, p.2). Indeed, Boserup, also an economist, may turn Malthus but she very consciously does not topple him. Her work, as a result, has stimulated some social scientists to synthesize the insights of Malthus with her own ideas in analyzing population and environment relationships. Several demographers, most notably Bilsborrow (1979, 1989, and 1992), have thus, formulated frameworks that integrate Boserupian and Malthusian ideas and account for population impacts on as well as responses to their environment. It is the aim of this paper to review the main points of Boserup's theory and its relevance to developing regions, in particular to sub-Saharan Africa. We then briefly consider Bilsborrow's recent reinterpretation of her work which also focuses on population and environment relationships in developing countries.

I. Malthus versus Boserup

The oft repeated central tenet of Malthusian theory (1798 and 1803, republished 1960) is that the growth of human populations always tends to outstrip the productive capabilities of land resources. The result is that resources place a direct restriction on population growth and size and 'positive' checks (famine and increased mortality) or preventative checks (postponement of marriage and limitation of family size) work to reduce population growth. Writing before the agricultural revolution, Malthus presumed that the productivity of resources, namely land, were fixed because agricultural technology was largely fixed --as was the case in Malthus' pre-industrial world. From a Malthusian perspective, technology and environment (considered in terms of land resources) are therefore seen as independent variables that work together to determine the dependent variable of population, which he sees mainly in terms of population growth and size (Figure 1).

As later interpretations of Malthus have pointed out, he does not entirely discount the possibility of technological change--since historically important innovations had obviously occurred to his time, for example the plow (e.g. Lee 1989). Rates of population growth and population size may sustainably increase, according to Malthusian theory, through technological innovation, for example use of the plow, that can expand the productive potential of land resources. Ron Lee calls this element of Malthusian' theory an "invention-pull view of population history" which suggests that the "carrying capacity of an area expands due to autonomously occurring inventions" and "population size quickly follows" (Lee, 1986, p.98). The core of Malthusian theory, may therefore, be best captured by the 'dependent' role he assigns to population growth in relation to the independent factors of environment and technology.

Figure 1. Population, Environment, and Technology: Malthus and Boserup



Boserupian theory similarly focuses on the relationships between these three factors: population, environment, and technology. Her concept of 'population,' in contrast to Malthus, encompasses population density as well as absolute size and growth. Like Malthus, her concept of environment refers mainly to land resources and related factors such as climate and soil quality. Since her focus is either historical civilizations or developing countries, 'technology' for Boserup, as for Malthus, refers mainly to the tools and inputs used in agriculture, the primary productive activity in these societies. Writing after the agricultural and industrial revolutions and during the green revolution, Boserup's (1965, 1976, 1981) concept of technology naturally refers to a wider range of agricultural tools (e.g. tractors), techniques (e.g. fallow patterns), and inputs (e.g. fertilizer). It is important to recognize that neither Boserup nor Malthus specifically address 'population', 'environment', and 'technology' per se but rather the topics of land use or food production. Implications on the linkages between these factors are subsequently inferred from their work.

In arraying relationships between population, environment, and technology, Boserup turns the Malthusian linkages around (Figure 1) proposing that:

> It is generally agreed that successive change in technology has an important influence on population size . . . The opposite side of the interrelationship, the influence of population size on technology, has attracted less attention (Boserup, 1981, p.3).

In response, Boserup focus her attention on exploring the role of population as an independent variable that influences both the development of agricultural technology which, in turn, shapes the productive capacity of resources.

The origin of Boserup's view has historical roots in diverse economic and social theory and may be traced to the work of Smith, Marx, and Durkheim as well. In his well known concept of the economy of scale, Smith specifies the need for a growing population that will permit more efficient production through the division of labor. Marx's concept of "verkeher" also refers to the need for population growth and a minimal density that allows productive action (Marx and Engels, 1846, p.42, note 1). Similarly, Durkheim proposes a threshold "dynamic density" of population that will support the necessary division of labor and more efficient production (Durkheim, 1893, pp.151-153). What unifies Boserup with these lines of historical thought is the independent role assigned to population. Smith, Marx, and Durkheim (although strange bedfellows in general) all propose that population growth induces change in the organization of labor which subsequently extends the productive capacity of resources. Boserup, writing in the midst of the concurrent rapid population growth and technological change which have characterized much of the 20th century, extends population-induced change in the organization of labor to include population-induced change in technology which may similarly extend the productivity of resources.

Boserup asserts that Malthus overlooks an important mechanism for increasing production, namely, agricultural intensification, or the "gradual change towards patterns of land use which make it possible to crop a given area of land more frequently than before," which is induced by population growth (Boserup 1965, p.43). In describing this development, she states that small sparsely distributed populations use 'fallow' to retain soil fertility. They farm different plots in different years and allow the most recently used land to lay unused to regain fertility. However, with increased density, a growing population can use land more frequently and increase output by substituting technological inputs such as fertilizer or irrigation for fallow to retain soil fertility. Thus, Boserup proposes a "dynamic" relationship between arable and fallow land that changes in response to population density (Boserup 1965, p.13, p.15 and p.20). In contrast to the Malthusian idea of 'invention-pull' population growth, Boserup proposes 'invention-push' agricultural change. To Boserup, advances in agricultural technology such as the plow, irrigation or fertilizer cannot be seen as independent or exogenous inventions. Their development and dissemination have evolved in relation to population growth.

Given this dependent linkage between population dynamics, agricultural technology, and production, she defines six different food systems with increasing technological levels and their associated population density (Table 1). Although defined discretely, Boserup stresses that the strategies used by any population, particularly a growing population, is an evolving mixture of these levels. For example, a sparse but growing population that had previously used long-fallow systems will gradually begin to use shorter fallow on some of its land while keeping the remaining proportion devoted to traditional long fallow. Similarly as a population continues to grow it gradually makes transitions from shorter-fallow to annual cropping or annual cropping to multi-cropping more than once a years on all of its land. Thus, their is a "continuum of types of

Table 1. Boserup: Agricultural Systems and Population Density

System	Description	Population Density (Persons/km2)
1.Gathering /Pastoralism	Wild plants, roots, fruits and nuts gathered Possibly domestic animals	0-4
2.Forest-fallow	1 or 2 crops followed by 15-25 years fallow	0-4
3.Bush-fallow	2 or more crops followed by 8-10 years fallow	4-64
4.Short-fallow	1-2 crops followed by 1-2 years fallow	16-64
5.Annual cropping	1 crop each year with few months fallow	64-256
6.Multi-cropping	2 or more crops in same fields with no fallow	>256

Source: Boserup, 1981, p.9, Table 3.2, p.19 and Table 3.7, p.23

land use" or "coexistence of cultivation systems" such as exists in the world today (Boserup, 1965, p.14 and p.56).

Boserup also counters the Malthusian assumption that a growing agricultural population ultimately leads to falls in agricultural output. She argues that in the short-term a period of sustained population growth would lower output per man hour. This occurs since more intensive methods mean more hours of work (additional hoeing, weeding, the application of fertilizer and the construction of irrigation ditches) on the part of the agricultural laborer. The ratio of output to labor costs, thus, deteriorates in the short run. In the long term, however, workers would become more efficient at the tasks required by the new intensive regime. More importantly, the growing population would stimulate more efficient production by allowing the division of labor. Therefore, a growing population or increased population density leads ultimately to long term increases in output that outweigh short-term declines (Boserup, 1965, p.39-42). Similarly she rejects the related assumption that rural population growth inevitably leads to labor surplus and push-migration to urban areas. She asserts that intensive agriculture, as stated above, has higher labor demands than more primitive low technology systems (Boserup, 1990, p.14-18). As result, the switch to more intensive agriculture can preclude the production of labor surplus and push-migration out of rural areas.

On the other hand, she also states that for small populations with low density it is not worthwhile switching to more intensive regimes that require more labor inputs and that entail short-term productivity losses. She asserts that density must increase to a certain level before it is worthwhile accepting short term declines in labor output and the "hard toil of intensive agriculture" (Boserup, 1965, p.51). Once higher densities occur, however, it becomes imperative for the population to undertake the increased labor investment of more intensive systems for the sake of the long term advantage of increased output.

Boserup formulated her theoretical understanding of the relationship between population growth and agricultural change on historical Europe. Due to periodic famines and plague in Europe prior to the 18th century, the population was not large enough for the long-term benefits of more intensive agriculture. For that reason, more intensive methods such as irrigation, which were used in a few more densely populated areas like Italy and the Low Countries, were known throughout the rest of the continent but were not adopted (Boserup, 1981, p.114-116). In this context, she proposes that conditions were not "ripe for the diffusion" of new agricultural technology "on a large scale" (Boserup, 1981, p.96).

However, in the mid-18th century cycles of famine abated. The European population began to grow and population density increased such that more intensive methods of agriculture were adopted. For Boserup this increase in mid-18th century Europe drove both the agricultural and industrial revolution. Population-induced intensification of agriculture in Europe resulted in the necessary food surplus needed to support growing urban manufacturing areas. Moreover, the growing population in both urban and rural spheres raised the opportunity for economies of scale or the creation of infrastructure such as roads. This, in turn, allowed the wider transfer of agricultural inputs, stimulating further intensification of agriculture, greater surplus and ultimately further urbanization and industrialization (Boserup, 1990, p.19).

II. Boserup on sub-Saharan Africa

Although Boserup formulated the basis of her theory of population growth and technological change in agriculture based on historical Europe, she applies it to understand patterns of development in contemporary developing countries. She asserts that in relation to developing countries "neo-Malthusian theories . . . are misleading because they tend to neglect the evidence we have of growing populations which managed to change their methods of production in such a way as to preserve and improve the fertility of land" (1965, p.20). We single out her interpretation of the current situation in sub-Saharan Africa as an example.

Boserup sees sub-Saharan Africa as historically a sparsely populated continent relative to other world regions. As result, subsistence agriculture and low-technology, long fallow systems predominate in the region. As Boserup states:

> Because past rates of population growth were much lower in Africa than in other parts of the world, extensive land-using subsistence systems, that is, long-fallow agriculture andpastoralism--continue to be much more prevalent than elsewhere. In large parts of Africa, there is more land than the sparse population needs for growing crops" (Boserup, 1990, p.258).

Countering Malthusian images of overpopulation, Boserup points out that in sub-Saharan Africa only a proportionally small percentage of land is currently cultivated while large areas remain non-cultivated as permanent pasture, forest or grassland. As Boserup suggests, recent data on sub-Saharan Africa shows that over 95 percent of all land falls into one of the non-cultivated categories (Boserup, 1990, Table 1, p. 117 and The World Resources Institute, 1990, Table 17.3, pp.272-273).

Boserup counters the prevailing view that the non-cultivated land included in the categories of forest, permanent pasture, grassland or other is marginal or of poor quality (Boserup, 1990, p.117). Rather she suggests that a proportion of this land may actually be playing a role in long-fallow systems (Boserup, 1981, p.16-17). Moreover importantly, much of this land could be transformed into frequently cultivated land given the necessary inputs such as fertilizer or irrigation. As Boserup asserts, economists fail to distinguish between land "which is used and land which could be used if the population was larger or they used modern equipment" (Boserup, 1990, p.117).

She concludes that there is much scope for intensification of agricultural production in sub-Saharan Africa and notes that unlike historical Europe, modern agricultural inputs, such as Green revolution technologies, exist that are capable of vastly increasing output (Boserup, 1981, p.202). On the other hand, she states that current population growth rates are much higher in sub-Saharan Africa than in historical Europe and that "agricultural intensification must take place more quickly" (Boserup, 1965, p.65). She recognizes rapid population growth in sub-Saharan