The Intensification of Agriculture: Ester Boserup

Although addressing herself against the neo-Malthusians, Ester Boserup (1910-1999) is very consistent with Malthus and current ecological-evolutionary theory.[1] She states that there are two basic views on the relationship between population growth and food supply. You can look at how changes in food production affect population growth; or, you can look at how population change affects agriculture. She asserts that Malthus and his followers believed that food supply can only grow slowly, and that the supply of food is the main factor governing the rate of population growth. Population growth is therefore seen as the result of previous changes in agricultural productivity. Changes in the availability of arable land, agricultural innovation, invention, or other changes that increase agricultural production will lead to population increases. "In other words, for those who view the relationship between agriculture and population in essentially Malthusian perspective there is at any given time in any given community a warranted rate of population increase with which the actual growth of population tends to conform."[2] Boserup approaches the problem from the opposite direction. She sets out to demonstrate that the primary stimulus to agricultural development and productivity is population growth. In sum, agricultural development is caused by previous growth in population rather than the other way around.

Boserup believes that classical economists such as Malthus were misled because they were writing at the time of the expansion of agriculture in the Americas by European settlers. Because of this, they made a distinction between two different ways to raise agricultural output:

[1] Ester Boserup was born in Copenhagen in 1910 and was a graduate of the University of Copenhagen in 1935. Her degree was in theoretical economics within a broad social science background. Her research in economic development began with a decade at the UN and its agencies in the late 1940s; she spent the remainder of her career as a consultant and independent researcher. She died in 1999.

[2] Boserup, 1965, p. 11. This is not strictly true. Malthus well recognized the reciprocal relationships between food supply and population; the speed of the growth in food supply was not an important factor in his theory, for Malthus posited that this growth could not long keep pace with unchecked population growth. However, neo-Malthusians, those who took Malthus's theory as a prediction of a population overshoot and subsequent collapse, may well be accused of viewing food production as relatively inelastic.

expansion into new land by creating new fields, and more intensive cultivation. But this distinction is not suitable; primitive agriculture does not make use of permanent fields, it shifts cultivation from plot to plot, allowing a fallow period in order to give the land time to regenerate. "[I]n primitive agriculture there is no sharp distinction between cultivated and uncultivated land, and it is impossible to distinguish clearly between the creation of new fields and the change of methods in existing fields."[3]

The true measure of the intensification of agriculture, according to Boserup, is *frequency of cropping*. "Once the time-honored distinction between cultivated and uncultivated land is replaced by the concept of frequency of cropping, the economic theory of agricultural development becomes compatible with the theories of changing landscape propounded by natural scientists."[4] Soil fertility is not simply a gift of nature, a given quality that never changes. Rather, soil fertility is highly variable and closely associated with agricultural methods.

Boserup groups land use into five different types, in order of increasing intensity. The first is *forest-fallow* in which plots of land are cleared in the forest and planted for a year or two. The land is then left fallow in order for the forest to regenerate, from 20 to 25 years. With *bush-fallow*, the fallow period is only six to ten years in which time the land is covered in bush and small trees. "The periods of uninterrupted cultivation under bush-fallow systems varies considerably. It may be as short as one to two years (similar to conditions under forest fallow) and it may be as long as the fallow period, i.e. six to eight years. *Short-fallow* is a system in which the fallow is one or two years. In the fallow period the land is invaded by wild grasses. With *annual cropping* the land is left uncultivated for only several months between harvest and planting. Within this group Boserup also includes crop rotation systems. Finally, *multi-cropping* occurs when the same plot of land bears two or more crops every year; in such a system there is no real fallow period.

Boserup does not mean for the land-use typology to be a classification scheme only; rather, it is meant to broadly characterize the main stages of the evolution of agriculture from prehistoric times to the present. "Even if we cannot be sure that systems of extensive land use have preceded the intensive ones in every part of the world, there seems to be little reason to

[3] Boserup, 1965, pp. 12-13.

[4] Boserup, 1965, p. 13.

doubt that the typical sequence of development of agriculture has been a gradual change—more rapid in some regions than in others—from extensive to intensive types of land use."[5]

Once you use "frequency of cropping" as your measure of intensification, theories of the economic development of agriculture can be directly linked with changes in local landscape, flora, and fauna. For example, as people shorten the fallow period, forests deteriorate and bushes take over the land. Further intensification still will bring wild grasses. "The invasion of forest and bush by grass is most likely to happen when an increasing population of long-fallow cultivators cultivate the land with more and more frequent intervals."[6] In this way, many forest and bush areas gradually became savannah as a result of the intensification of agriculture. Many believe that a large share of the open grasslands of the world originated in this way. These new grasslands provide food for cattle, horses, and other animals suitable for domestication. Such a view runs counter to the traditional theory of the origins of herding societies. Traditional theory held that nomadic tribes turned to agriculture only when their herds could no longer support their population. "The sequence is now supposed to be the reverse: tribes which previously cultivated short-lived plots in the forest and bush land have come to rely on the grazing of animals only after they cultivated forest plots for a very long period ending in the transformation of the forest into grass land."[7] Other tribes, according to Boserup, used the animals attracted to the new grasslands to help cultivate and fertilize the fields.

Boserup also insists that attention must be focused on the fact that it is an *agricultural system*. As population increases, most of the land brought under more frequent cultivation in a given area was already used for something: fallow, hunting ground, or grazing areas. "It follows that when a given area of land comes to be cropped more frequently than before, the purpose for which it was hitherto used must be taken care of in a new way, and this may create additional activities for which new tools and other investments are required."[8] Thus, population changes often have direct effects upon agricultural technology. For this reason, Boserup claims, even

[5] Boserup, 1965, pp. 17-18.

[6] Boserup, 1965, p. 20.

[7] Boserup, 1965, pp. 20-21.

[8] Boserup, 1965, pp. 13-14.

primitive agricultural output can be increased significantly by additional inputs of labor—far more than neo-Malthusian authors assume.

The traditional view is that the main cultivation tool is the chief criterion for classifying primitive agricultural systems. Thus we have Simple Horticulture (digging stick), Advanced Horticulture (hoe and irrigation), and Agrarian societies (plow and animal power). This view places undue emphasis upon technological advance (through either innovation or contact). "This theory is apt to mislead because it ignores the fact that the kind of agricultural tool needed in a given context depends upon the system of land use: some technical changes can materialize only if the system of land use is modified at the same time, and some changes in land use can come about only if they are accompanied by the introduction of new tools."[9] In forest fallow cultivation, the burning of undergrowth frees the land of weeds and hoeing is completely unnecessary. When the fallow is shortened, bushes and weeds take root, burning is not an effective method of clearing the land, so the hoe is needed. As the fallow shortens, grasses take root and these are difficult to remove through hoeing, thus the plow becomes necessary. Not only that, but with the disappearance of the roots of bushes and trees, the plow also becomes possible. Finally, Boserup adds that as grass lands replace forests with the shortening of fallow, they are often invaded by nomads seeking to feed their herds. Thus animals suitable for cultivation and fertilization appear "around the time when the local cultivators need them and become able to use them."[10]

With the shortening of fallow, new methods of regaining fertility must also be developed and employed.

- Forest fallow—ashes left after burning natural vegetation.
- Bush fallow—ashes and organic materials brought from surrounding lands.
- Short fallow—manure from animals and humans.
- More intensive systems—a variety of techniques including compost, silt, manure, household waste.

Both the methods of cultivation and fertilization become more labor intensive with the shortening of fallow. While such methods produce more crops per acre, they also require far more human labor to produce these yields—and the increases in yield are not commensurate with

[9] Boserup, 1965, p. 23.

[10] Boserup, 1965, p. 25.

the effort. Far more work is needed to produce food; with population increase a household has to work far harder to maintain its standard of living. The short term effect of intensification, Boserup maintains, is necessarily to lower output per man-hour. "But sustained growth of total population and of total output in a given area has secondary effects which—at least in some cases—can set off a genuine process of economic growth."[11] These secondary effects of intensification include a compulsion to work harder and more regularly, changing work habits and raising overall productivity; intensification facilitates the division of labor and the spread of urbanization, communication, and education, as well as population and urban growth which stimulates the further intensification of agriculture.

Thus intensification, Boserup maintains, could only take place in response to population pressures within a given area. Even when people have access to more intensive techniques and tools, the investments in labor are so large that they are not likely to be made unless population increase made them necessary. Unless population pressures are keenly felt, people may well reject more intensive methods of cultivation as being a bad bargain—far more work for only marginally more food.[12]

Another major contribution to the literature on social evolution made by Boserup was her book *Woman's Role in Economic Development* (1970). In this book Boserup made clear that gender is one of the main criteria for the division of labor in all societies, but that there is a great diversity in this division of labor between the sexes across societies. The primary factors that are related to work and the subsequent status of women, she finds, are population density and the availability of land. This division of labor in farming systems carries over into non-farm activities as well.

Boserup also directly addresses the neo-Malthusians who insist that population growth is destroying the natural fertility of the land. It cannot be denied, Boserup says, that the food potential of many of the world's areas was diminished or destroyed by over-grazing and more intensive forms of agriculture. Some think that cutting down forests for agriculture has led to drier climates and the spread of deserts, while still others point to erosion brought on by

[11] Boserup, 1965, p. 118.

[12] Boserup, 1965, p. 41.

intensive cultivation and grazing.[13] But this is not the whole story. Many tribes also irrigated the dried up lands, developed terracing to prevent erosion, or improved soil fertility and yield through animal manure and animal cultivation.

> It is true that some regions which previously supported a more or less dense population are barren today, but it is equally true that regions which previously, under forest fallow, could support only a couple of families per square kilometer, today support hundreds of families by means of intensive cultivation. Growing populations may in the past have destroyed more land than they improved, but it makes little sense to project past trends into the future, since we know more and more about methods of land preservation and are able, by means of modern methods, to reclaim much land, which our ancestors have made sterile.[14]

Boserup does not so much refute Malthus as to round him out by providing a more complete picture of the multitude of relationships between population, agricultural production, and the environment. While Malthus focused upon the necessity to keep human numbers in line with the food that could be produced, Boserup focuses upon how the amount of food that can be produced is dependent upon human numbers. Both recognize that the production of food can be intensified. Boserup demonstrates that primitive agricultural production is quite responsive to increased labor. Malthus, on the other hand, also recognized that the production of food could be increased, but he asserted that such intensification could never equal natural population growth for long. Boserup did not dispute this; she did document the fact, however, that growing population often stimulates an intensification of agricultural production. Malthus made similar assertions in his *Essay on Population* as well. For Malthus, the principle of population "keeps the inhabitants of the earth always fully up to the level of the means of subsistence; and is constantly acting upon man as a powerful stimulus, urging him to the further cultivation of the earth, and to enable it, consequently, to support a more extended population."[15] Boserup's contribution is that she clearly elaborated the relationships between population growth and agricultural production and empirically verified the relationships throughout the social evolutionary process. Boserup's

[13] Boserup, 1965, p. 22.

[14] Boserup, 1965, p. 22.

[15] Malthus, 1798, p. 281.

positing of the relationships between population growth and the intensification of production had great influence on ecological-evolutionary theory in anthropology and sociology.[16]

The majority of modern-day social evolutionary theorists trace their roots back to Spencer, Morgan, Tylor, or even Darwin, their opinion of Malthus perhaps being biased by the secondary literature. While I have no desire to downplay the significance of these early evolutionary theorists on contemporary evolutionary theories, I believe that Malthus deserves a significant amount of credit as well. Gerhard Lenski and Stephen K. Sanderson are two modern practitioners of ecological-evolutionary theory—theory in which the relationships between population and production play a major role. Like most, Lenski and Sanderson have been influenced by other theorists but their overarching theoretical systems are heavily influenced by Malthus and Spencer. Both place the relationships between population and production at center stage in determining sociocultural stability and change.

[16] For example, Mark Cohen (1979) used Boserup's basic argument to link population pressure to the original agricultural revolution in which hunters and gatherers made the transition to agriculture in response to population pressure forcing a change in their way of life.