Economic and Social Evaluation of Converting
Agricultural Land to Non-Agricultural Uses

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Motto: "...the writers of history have seldom noted the importance of land use. They seem not to have recognized that the destinies of most of man's empires and civilizations were determined largely by the way the land was used..."

Tom Dale and Vernon Gill Carter, Topsoil and Civilization, 1955
I. Scarcity of Agricultural Land and World Food Prospects

Industrial growth and urban development have a major effect upon agricultural land use as a whole. Some of the physical qualities which make land valuable for agriculture, like topography, location, fertility, climate, also make it suitable for other uses.

During the past few decades, in both advanced capitalist and socialist countries, non-agricultural use of land was considered as the highest and best use. In socialist countries, as a result of fundamental ideological bias toward material expansion, the primacy of industrial production has been the most striking characteristic of economic policy. Also, the strong economic competition between the socialist and capitalist political blocks has reinforced the emphasis given to rapid growth in the production of industrial goods. The ideology of growth and the belief in the power of technology are strongly entrenched in the socialist countries. Hence, many of those countries have converted their agricultural land to "better" (industrial) uses even in the face of food shortages.

In capitalist countries the "best use" of land has been based upon the concept that the best allocation of land is that pattern of use which brings the highest return to its operators. And, this return is measured in strictly monetary terms. Therefore, the criterion of highest return in money was the ultimate criterion of land use patterns. Because the net return earned by agriculture in the U.S. has been lower and not growing as fast as the return in industrial, commercial, or residential use, land has been re_allocated from agricultural to industrial--urban uses (Raleigh Barlowe, 1958, p. 14). This pattern for the United States also seems to be present for other countries.
A comparison of the average labor productivity in agriculture (measured by the gross value added) in Poland, and in other countries, suggests that labor productivity in the non-agricultural sector is from two to three times as high as in agriculture. Exceptions are Britain, Belgium, and the Netherlands (W. Herer and W. Sadowski, 1977, p. 174). Hence, as a result of economic gains in non-agricultural land use, the competition among land use practices has favored more intensive land use. As a result, every year witnesses a large number of high potential productivity agricultural lands being shifted to non-agricultural uses in both socialist and capitalist countries--diminishing each nation's, and hence the world's, stock of productive farm land. Also, growing population in urban and industrial areas requires agricultural products (food and raw materials). It is quite natural that most urban and industrial centers are located near highly productive agricultural areas. Expansion and growth of those urban centers encroaches on agriculture; in many cases it is the most productive agricultural land.
In this paper we will only consider the losses of agricultural land for non-agricultural uses as a result of industrial and urban development. We will discuss substantial losses of agricultural land due to erosion, desertification, salination, etc. As a result of the conversion of agricultural land to non-agricultural uses, the annual loss of agricultural land has been very large. In Poland, 18% of the agricultural land converted to other uses in 1975 was prime--most productive agricultural land. The problem of taking over agricultural land for non-agricultural uses is also very serious in the United States, especially in its sprawling pattern of land use for urban development, which has been operating over the entire post-war period. For example, current estimates by the U.S. soil Conservation Service with respect to California, indicate that a total of 1,733,656 acres are expected to be urbanized and a total of 808,871 acres are expected to be devoted to recreation. This is calculated to an average of 388 acres per day that will be converted during this period (1967-1980). Approximately 25 percent of the total acreage that is expected to be converted is prime agricultural land (Classes I and II). Table 2 which presents a summary of land use changes that were found to have occurred in a 30 year period near a large reservoir of water in Kentucky (James McEvoy III and Thomas Dietz, 1977, p. 11).

There are many examples where highways, airports, and new suburbs remove more than a million acres of prime agricultural land each year. This raises the question--to what extent will this removal of primary agricultural input--land--impinge on the ability of the United States to continue to increase its output of agricultural commodities to supply both its own needs and those of other nations? The tendency to use agricultural land
Table 2

Changes in Land Uses Recorded Over a 30 Year Period Near a Large Reservoir

<table>
<thead>
<tr>
<th>Type of Use</th>
<th>1938</th>
<th>1951</th>
<th>1960</th>
<th>1967</th>
<th>Total Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural</td>
<td>111,285</td>
<td>110,617</td>
<td>110,186</td>
<td>104,144</td>
<td>7141 (-)</td>
</tr>
<tr>
<td>Residential</td>
<td>310</td>
<td>941</td>
<td>1,388</td>
<td>7,191</td>
<td>6881 (+)</td>
</tr>
<tr>
<td>Commercial</td>
<td>18</td>
<td>39</td>
<td>53</td>
<td>127</td>
<td>109 (+)</td>
</tr>
<tr>
<td>Public</td>
<td>48</td>
<td>64</td>
<td>44</td>
<td>199</td>
<td>151 (+)</td>
</tr>
<tr>
<td>Water</td>
<td>5,535</td>
<td>5,535</td>
<td>5,535</td>
<td>5,535</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>117,196</td>
<td>117,196</td>
<td>117,196</td>
<td>117,196</td>
<td></td>
</tr>
</tbody>
</table>

Note: all figures in acres.

of high value for other uses has been general in nearly all "advanced" countries, not only in the U.S. Besides land allocation between industrial and urban development, another very important factor having a strong impact on land use is agricultural technology developed in the last 25 years. This new technology has created a sense of security that soil and deficiencies can be overcome with fertilizers, irrigation, drainage, and other measures. Loss of the best agricultural land can be substituted by all these technological solutions, and reduction of agricultural land can be offset by additional inputs of fertilizers, pesticides, machinery, equipment, etc. The success measured in agricultural productivity per unit of land with application of new technology has created a view of unlimited power of technological achievements which will solve the problem of agricultural production. The problem is: Can agricultural technology abolish the scarcity of land
resources? A result of this belief is the optimistic conviction that conversion of agricultural land to non-agricultural uses would not create problems of food shortages. But in spite of those expectations, the fundamental fact about agriculture is that it requires land and good agricultural land is fixed, and now a diminishing supply. In the United States and European countries, good agricultural land is already in use and reducing the impact of conversion to other uses. The most important characteristic of the modern intensive agricultural technology is essentially based on energy resources; fossil fuel is converted to grain and fiber. Therefore, if the price of oil was low, relative to prices of other production factors over the past 15-20 years, then there have been investments in agricultural technology which are extremely energy intensive (machinery, equipment, fertilizer, irrigation—all of them use enormous amounts of energy resources). The present oil price increases, of course badly affect the agricultural sector and decrease profitability and utility of energy intensive technology. A misfortune of the green revolution is the new hybrids of corn that need large amounts of fertilizers and irrigation which are both energy intensive. It is not possible to substitute agricultural land by a growing input of energy resources because global resources of traditional fuel are limited, and the price system is already taking its limits into account. An interesting approach to the above problem is that of Ferdinand E. Banks (1976). The increasing prices of oil as well as the law of diminishing returns, will pose some limits on energy use for agricultural purposes. Long before the full impact of technology upon production was clearly understood, Alfred Marshall, from the early classical school, formulated this law which proclaims that "whatever may be in the future developments
of the arts of agriculture, a continued increase in the application of capital and labour to land must ultimately result in a diminution of the extra produce which can be obtained by a given amount of capital and labour." (Alfred Marshall, 1938, p. 153).

The phenomenon of the increasing input of production, and decreasing returns per unit of this input, is now common in the world's agricultural production (energy intensive type). Energy became this productive input of capital which is bringing now diminishing returns. The Law of Diminishing Returns can be recognized in diminishing productivity (return) of agricultural output per extra unit of energy input. Already documented is the diminishing return per extra unit of input of fertilizers on agricultural output; further application of fertilizers would not increase agricultural production significantly. There are calculations already done which show that doubling agricultural output results in energy input increasing tenfold. Therefore use of larger amounts of fertilizers may make economic sense only in the short run, but energy resources are limited and more costly every year. So far, we have almost exhausted the possibility of our current form of agricultural technology based on intensive energy use.

We will now explore another option for agricultural production: new land which can be converted to agricultural land. In Europe and the United States, good agricultural land is already in use but there are still some possibilities of converting virgin land into agricultural production in Africa and Latin America. (Asia already uses available agricultural land.) But the experts point out an enormous amount of capital, energy, and ecological sophisticated knowledge are necessary for bringing into production any sizable quantity of new land. Before virgin land will reach agricultural economic value, it must be "produced" and it will cause very
high costs, probably higher than conservation of available agricultural resources. More precisely, costs of bringing new land into agricultural production are needed to be determined.

While the conversion of agricultural land to non-agricultural uses takes place, available agricultural technology is not ready to solve the problems of scarcity of agricultural land because of growing costs of energy, and diminishing returns of energy inputs in agricultural production. Bringing the new land to agricultural uses doesn't seem to be a good option according to the costs of this operation. The factors mentioned above restrict the possibility of growth of agricultural production without meaningful changes in land use pattern and new achievements of technology--saving resources.

Nowadays, the supply of agricultural land for production of food has become one of the most important aspects of ecological scarcity--the future of our planet depends on how much food we can produce to feed our people. Approximately 4 billion people inhabit the earth today and if the current rate of population growth continues, there will be 8 billion people on the globe in 2010 and 16 billion by 2045 (even giving optimistic assumptions that fertility is bound to decline). Even today, far too many suffer from a sheer lack of food. "The nutritional shortfall is such that even with a perfect distribution of current world food production, everyone would be somewhat malnourished..." So increasing population pressure always creates the need for food. But how much land is needed is different areas to satisfy these requirements varies with productivity of land, the level of technological development and consumption habits of people. The food surplus produced by the United States doesn't seem to be very optimistic. The United States no longer has large buffer stocks of food or sizable amounts of productive land to feed the world. The sharp price rise of
agricultural products during the last few years indicates that the world lives on a very thin margin of food supply which is vulnerable to the slightest diminution of supply (W. Ophuls, 1977, p. 50).

The questions which have to be raised are: Can the world produce enough food; what will be the costs; and with what adjustments? Also, what are the chances to win the race between technology development and population growth?

Let us discuss for a while, the problem of technology available for agricultural production. Of course, technological progress has played a very important role in helping man to keep ahead in the race, but people get used to it and they regard the flow of new technology as endless. Still, without a doubt, new technology can help in solving man's future land-requirement problems, but man has to use this technology while understanding the physical limits of our planet. Current forms of agricultural technology will not fulfill the needs for food production for reasons which were discussed on previous pages. Therefore, only new levels of agricultural technology can possibly alter this assessment, but unfortunately such a new technology is not yet in sight. This new technology has to change toward resource saving technology.

Some authors like J. Gillies and F. Mittlebach, argue that because the allocation of agricultural land is determined by market prices, if the prices of agricultural products rise then a return yield in agricultural use of land will be higher, and then we will observe a transfer back from urban to agricultural uses.

Let us also discuss another possibility for agricultural production: reversal conversion of non-agricultural land to agricultural uses in the situation of food supply shortages. When we look at miles of asphalt,
highways, and airports, houses and streets, commercial, industrial, and residential areas, the problem of reversal conversion to agricultural uses seems to be a rhetorical one. We also have to admit the fact that the agricultural land is not simply a factor of production because for agriculture, the fundamental principle is that it deals with life with living substances. "Its products are the results of processes of life, and its mean of production is the living soil. A cubic centimeter of fertile soil contains milliards of living organisms, that full exploration of which is far beyond capacities of man." (E.F. Schumaker, 1973, p. 110)

Land is the mele-economic factor of production because man has not made it and when it is spoiled, man cannot make it again. Also, reversal conversion of non-agricultural land would be extremely costly if we even assume that sort will not be contaminated with persistent, harmful substances and its fertility will not be destroyed--the costs of reversal will be dependent on costs of development of this land during non-agricultural uses. It seems to be very expensive to attempt such activity in comparison with the costs of conservation of prime agricultural land. Therefore, by irreversible loss we mean that we never will be able to bring back land to agricultural purposes as cheaply as the costs of conservation (Mason M. Gaffney, 1965, p. 546)

All these divagations bring us to the conclusion that world land use practices should be corrected as soon as possible. We will discuss below the economic mechanism of land conversion.
II. Institutional Bias: Market Failure, Government Regulation Failure

Our societies, both socialist and capitalist, are giving a financial target to a particular economic activity, without regard to any damage it may cause in other parts of the economy. Conversion of agricultural land to non-agricultural uses is a typical example of this attitude. Karl Marx, more than a century ago, described this watchword of market capitalism as follows: "Apres nous le deluge." This kind of attitude might be observed on the land market -- private owners strive to maximize current benefits at the expense of the future. The future well-being of society on the implications which may affect other markets doesn't enter the calculations of private land operators.

Protagonists of the market system believe in the flexibility of market, and its adjustment to the price signals. They are convinced that the first sign of food shortage, as a result of diminishing agricultural land, and increase of agricultural production costs, will bring back land, capital, and people to the agricultural sector. But the market may fail to respond smoothly and appropriately to the price signals generated by agricultural land scarcity, high costs of reversal conversion, high costs of developing new land for agricultural uses, etc. As I described it in the first part of this paper, industrial and commercial uses of land are bringing higher returns to employed capital and, therefore, individual owners prefer those uses.

In the market economy, market value doesn't make any difference between goods taken from nature, like land or manufactured goods. Therefore, the land is treated like any other market good according to the principle of profit-making and market, in setting prices without taking any responsibility for goods which are purchased. If prime agricultural land is purchased
for other uses and the offered price is attractive for farmers' transactions, conversion of agricultural land to other uses will then take place.

The market ignores natural resources as special goods, and scarcity or unrenewable characters of resources are not taken into account. The land market assumes that the supply of land available to each individual operator is limited only by his willingness and ability to pay. This physical supply of land, or future prospective scarcity of agricultural land doesn't appear on the market, which doesn't assume the existence of limits. Under land market conditions, the control of land normally goes to those who can pay more. On the market, developers expecting higher returns than farmers are willing to pay higher prices for land. Also, farmers are not protecting the agricultural land against conversion. For example, farmers from California tried to protect their farm districts from encroachment. In general, such efforts have not been successful; in part because those farmers are ambivalent. They want their land left in farms, but they also want a chance to sell it at the best possible price. It seems to be highly doubtful that agriculture can create barriers against conversion. A farmer doesn't know when he might receive an offer for his land and he will be glad to sell it.

Allan Schmidt's (1968, p. 25) research shows that land prices on the market are much higher than farmland values, measured in terms of agricultural output. For example, for farmland valued at $300 a farmer may receive $1000 to $3000 from a developer who is taking over his land for non-agricultural uses. According to the estimates mentioned above, farmers will seek for a chance to sell their land. It has been projected that in the thirty years remaining, three-fourths of California's existing farmland will be gone (Richard Merrill, 1976, p. 174). Private market of land may, as a result,
cause serious increases in food prices and then the market allocation of resources will affect society at large. The effects of land market transactions will spill over due to food price increases. (Food shortages and food price increases may affect poor countries especially, and rich countries with income distribution problems.)

But in a country like the United States, the idea of intervention in the land market has many opponents. Robert C. Ellickson (1976, p. 719) considers agricultural land as an elastic supply; his policy of agricultural land conservation may reduce food prices, but also significantly raises housing prices. I agree that conservation of agricultural land will have some implications, but what will happen if the present tendency of converting agricultural land to other uses continues? Of course, there is a risk in conservation of agricultural land, because we may overestimate our future needs for it, but this error seems to be more tolerable than the burdens of all costs related to the reversal process of non-agricultural land to agricultural uses.

Some regulatory actions have been undertaken to correct the market system. Market imperfections in the allocation of land is supposed to be corrected by regulatory ordinances like zoning and taxation, which are based on land use planning, and are designed to bring some order to the land market. The role of zoning in the conservation of agricultural land is to prevent improper use of land and undesired development. Zoning, as the case studies and literature illustrated, is not taken seriously in land market transactions. Because land is supposed to be used according to its 'highest' and 'best' uses, zoning is changed as desired: technical and legal deficiencies of zoning are well known. Therefore, zoning doesn't accomplish the expectation of bringing some order into land conversion--but instead,
introduces more uncertainty and increases the risk of land holding by making the date of land conversion less predictable. Instead of correcting imperfections in the market, zoning increases them. In practice, zoning only sanctifies what every individual wishes on the land market. The history of public regulation in the United States shows naive assumptions that once public controls (like zoning) are created, they will be administered in the widest public interest. The reason for zoning failure is the lack of a clear and explicit purpose of land planning that takes into account broader social aspects of land use. Zoning, as a tool of carrying on a land use plan, is suffering from the same weakness as the planning of land use. There are indeed general planning organizations which try to visualize the final course of land use, but they have no means to carry ideas into operation. Therefore, decision-making in land conversion is highly dispersed, and a fragmented process not taking to account the overall well-being of society (Marion Clawson, 1971, p. 5). No person or organization is responsible for the final result of land use activities. In this situation, each land operator is seeking for his own gain.

The other instrument which is used to preserve agricultural land is tax relief laws; lower taxes on farm land at the edge of cities. Maryland and California adopted these measures but none of these programs which have aimed at preservation of agricultural land has been effective. For example, in California, land conservation on the Williamson Act requires farmers, in return for tax relief, to sign contracts to keep the land un-developed for at least ten years, though the land owner who wants to develop his property earlier can usually obtain the agreement by paying a substantial penalty. Land under contract is taxed in proportion to its agricultural productivity rather than to its potential value for the developer and,
According to A. Schmidt, estimations of agricultural value are very low in comparison with real estate value. In fact, taxation measures don't dictate the use of land for higher return. Both regulatory instruments, like zoning and taxation, are very weak in preservation of agricultural land. Also, in socialist countries, regulatory instruments don't prevent agricultural land from converting to other uses. Usually a strong industrial lobby easily finds a way to avoid penalties or taxation, which have to be paid in case of conversion. In Poland, in 1975 and 1976, 60 percent of developers avoided payments required by law in 1971.
III Social Criteria for Directing Land Use

As described above, individual action on the land market results in a misuse of land, and shifting costs to other members of society. Among land use experts, there is an opinion that greater public control of land use is certainly needed. Therefore, land market has to be controlled by land-use planning based on the maximization of public welfare. Land-use planning is supposed to be the opposite of improvisation. The long-run perspective in land-use policy and diminished roles for private competition for land seems to be an avoidable issue because land is too important to be left to private-profit motivation. The market system gives to private owners the freedom to decide how they might use or abuse their land. Private property rights are on a market system principal. Public action to direct land use practices and to restrict some free market operations, has to be undertaken--especially with growing competition for land uses. Planning of land use in capitalist systems doesn't mean the necessary exclusion of market. There is a possibility to substitute individual property rights with limited ownership rights in the use of land. As an individual owner of a rifle has no rights to use it for all purposes and occasions, some restrictions should also be applied to private land owners.

The preservation of agricultural land, from other uses, might be achieved by the formation of a special new market of prime agricultural land; this land could then be used or sold only for agricultural production. Of course, the difference between the agricultural value of land and the development value should be paid to the farmers as a form of compensation. There is also the possibility of agricultural land conservation by purchasing ownership rights from farmers (by the local government) for a period of 30 years to make sure that the agricultural land will not be sold for other
uses. There are many available solutions, but they will require greater social control.

The individuals, corporations, government agencies, etc., plan in order to maximize their own gains, and land use policy is the aggregated result of action on these private plans. For example, zoning and taxation relief reflect competition between different groups of interest rather than social cooperation and solidarity toward land resources problems.

The most important intervention in the land market seems to be the major transfer of property rights, as mentioned above. A free land market may create negative changes such as food price increases. Society will not want to tolerate these changes--especially the poor will be the worst affected. Land use reform should be introduced by the formulation of a comprehensive plan which would include social criteria of land-use. Despite enormous amounts of literature and discussions, there doesn't exist comprehensive land-use planning (Robert Nelson, 1977, p. 192). A comprehensive, long-range, life plan has to contain a variety of implications which an individual doesn't recognize, because they may be inconsistent with his actual personal goals.
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