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Retaining Agricultural Activities under Urban Pressures: A Review of Land Use Conflicts and Policies*

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ABSTRACT

From a national perspective it is unclear whether the continued expansion of urban development seriously affects America's potential food production over the long run. Yet there are clearly regional biases toward conversion of farmland to urban uses and locally important changes in the appearance of the landscape at the rural–urban fringe. Urbanization also generates spillover effects causing the idling of farmland and the shifting from one type of agriculture to another.

Land use controls aimed at directly addressing the use of the land may be effective in preventing some conversion of farmland to urban uses but the methods are costly and possibly very complex. Incentives to farmers to keep land in agriculture are generally too weak to be effective in retaining agricultural land in the face of strong urban pressures.

I. Introduction

The American landscape is about 33% farmland and only 3% urban and built-up.[1] But this is not a static situation—there is a constant expansion of urban activities into rural areas that has given rise to the discussion, enactment, and implementation of land use controls to redirect urban intrusions away from agricultural land. More and more is being written on the character of urban expansion and on the legal, planning, and economic aspects of controlling that expansion. However, we lack both an overall picture of the conflicts between urbanization and agriculture and an

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[1] The area of land in farms (from the 1974 Census of Agriculture) and the area of the U.S. (excluding Alaska) were used to calculate the proportion of land in farms. Note that this excludes public grazing land and other public land in agricultural use. The area of land in urban and built-up uses is from the U.S.D.A. (1974).

assessment of the capacity of various types of land use controls to protect agricultural activities from these conflicts.

The purpose of this paper is to present an overview of the nature of the effects of urbanization on agriculture and of the potential for effectively retaining productive agricultural land within the sphere of urban influences. Our overview of the problem of retaining agriculture in urbanizing areas is divided into two major parts. In the first, we discuss the direct and indirect effects of urbanization on agriculture. This includes the conversion of land from rural to urban uses and the additional "spill-over" effects generated by urbanization upon agricultural activities. In the second part, which draws upon the typology of land use conflicts, we examine the major types of land use controls and evaluate them along four dimensions of potential effectiveness in retaining agricultural land under urban pressures: (1) the focus of the control; (2) its costs; (3) its complexities, and where there is sufficient experience, (4) participation in the control program. At this point, it is not possible to completely evaluate these land use controls with regard to actual effectiveness in retaining agricultural land with so little evidence to go on. Nonetheless it is possible to assess the potential effectiveness of different controls under different degrees of urban pressure on the land.

II. Effects of Urbanization on Agricultural Activities: Direct and Indirect

i. National Perspective

At the national level some observers have expressed concern that the continued conversion of agricultural land to urban uses may interfere with our long-run ability to produce food and fiber for ourselves and much of the world's population (USDA Committee on Land Use, 1975). However, available statistics suggest that a relatively small amount of agricultural land is converted to urban uses compared to the total stock of farmland in this country. Table 1 presents some estimates of the amount of all rural land, farmland, cropland, and prime land[2] converted to urban and built-up uses (residences, institutions, commerce, industry, urban recreation, and urban and rural transportation uses) per year in the United States.

The first set of estimates in this table was prepared by the authors.[3] It can be seen

[2] The definition of prime land is worth a paper by itself (Raup, 1976). However, throughout this paper (unless otherwise noted) we will define prime land as land in U.S. Soil Conservation Service soil capability classes I and II. Land in these categories is generally fairly flat, well drained, and not subject to serious erosion.

[3] This estimate was made in three steps. First, a nonlinear relationship was estimated between the percent of land areas in urban and built-up uses (URB) and housing unit density (HUDN, in housing units per square mile) using as observations 46 counties in the Northeast and Midwest for 1970. This relationship is $URB = 0.708\ (HUDN)^{0.617}$, $R^2 = 0.87$. Second, this relationship was applied to all SMSA counties in the nation to estimate the average rural land that was converted to urban uses during 1959–69 in metropolitan areas. The acreage of land that was urbanized in nonmetropolitan counties during this period was estimated by multiplying the average land area converted per new housing unit (0.45 acres/housing units) in SMSA counties by the number of housing units built in nonmetropolitan counties. Thus, if urban development occurs at lower densities in nonmetropolitan areas than in SMSA counties, then our estimates of the average of land converted to urban uses may understate the true number for 1959 to 1969.

that our estimate of the amount of rural land converted annually to urban and built-up uses agrees fairly closely with those made by the USDA (1974) and by Hart (1976). During the 1960s about 1,000,000 acres of rural land were converted to urban and built-up uses per year; assuming each land use was converted in proportion to its acreage (see footnote 3) about one-half of this land was formerly in agricultural uses, around one-third was cropland, and about 30% was land in soil capability classes I and II.

TABLE 1

Estimates of the Conversion of Rural Land to Urban and Built-up Uses in the United States

Source	Acreage converted to urban and built-up uses per year			
	All rural land	Farmland [a]	Cropland	Prime land [b]
This study 1959–1969	902,000	442,000	301,000	270,000
U.S.D.A. (1974) 1959–1969	870,000	—	—	—
Hart (1976) using the CNI and Census data, 1958–1967	1,148,000	—	—	—
Potential Cropland Study (Dideriksen and Sampson 1976) using sample CNI points, 1967–1975	2,050,000	995,000	598,000	753,000

Notes: [a] Farmland includes cropland, pasture, and range.
[b] Prime land includes land in soil capability classes I and II.

In 1976, the Soil Conservation Service began releasing results from their Potential Cropland Study (Dideriksen and Sampson, 1976). Based on an inspection of sample plots used for the National Inventory of Soil and Water Conservation Needs (the CNI) the SCS estimated that during the period 1967–75, the amount of rural land converted to urban and built-up uses had doubled to about 2,000,000 acres per year. About one-half of the land converted to urban uses was in farms and one-third was cropland. Also, this study indicates that there is a bias towards the development of prime land; of the land converted to urban and built-up uses about 37% was in soil capability classes I and II.

Finally, our estimates of the average of farmland, cropland, and prime land converted to urban uses during 1959–69 were made by assuming that the proportion of land in any area that was converted to urban uses during 1959–69 was equal to the proportion of land in that use at the beginning of the period. For example, if 60% of the land area in the county was in farms in 1959 we would expect 60% of the land area urbanized during this period to have been farmland.

This set of estimates is admittedly very rough. However, when used in conjunction with the figures from the Potential Cropland Study (Dideriksen and Sampson, 1976) we can get a good feeling for the magnitude of the conflict between urbanization and agricultural land in this country.

This apparent increase in the rate of conversion of rural land to urban uses during the late 1960s and early 1970s may be partially accounted for by a very low density pattern of development associated with the recent revival of population growth in some nonmetropolitan areas (Beale, 1976, Vining and Strauss, 1976). The increase may also be due to changes in housing styles. Currently the Soil Conservation Service is conducting a follow-up study on this question based on the inspection of a much larger sample of CNI plots.

No matter which set of estimates is used, the conversion of rural land to urban uses does not seem particularly large when compared to the total stock of rural land in the country. Table 2 shows that at the present rates of loss no more than 2 to 5% of rural land in any category will be lost to urbanization in the next 25 years.

However, it can be argued that the conversion of agricultural land to urban uses should not be compared to the total stock of farmland in the country, but rather to the total reserve of land not presently being farmed but readily available for agricultural production. In other words, for every acre of farmland urbanized is there another acre of land in reserve that can readily be brought into agricultural production? The Potential Cropland Study (Dideriksen and Sampson, 1976; Dideriksen, 1976) identified approximately 111 million acres of land in the country which are currently uncropped with a high or medium potential for conversion to cropland; of this about 60 million acres are in soil capability classes I and II. When compared to these figures the conversion of agricultural land to urban uses appears to be somewhat more crucial. At the present rates of loss, the conversion of cropland and prime land

TABLE 2

Percent of Base Year Stock Converted to Urban and Built-up Uses During 1975–2000 in the United States (Assuming Present Rates of Loss)

Base	Acres	All rural land	Farmland	Cropland	Prime land
Rural land Area in 1975 (ex. Alaska)	1,839,000,000	1.2–2.8[a]	—	—	—
Farmland in 1974	1,021,000,000	—	1.1–2.4 [a]	—	—
Cropland in 1974	438,000,000	—	—	1.7–3.4 [a]	—
Prime Land in 1975	385,000,000	—	—	—	1.8–4.9 [a]
Potential Cropland in 1975 [b]	111,000,000	—	—	6.8–13.5 [a]	—
Potential Prime Cropland in 1975 [b]	60,000,000	—	—	—	11.3–31.4 [a]

Notes: [a] Low estimate based on the authors' estimates of the conversion of rural land to urban and built-up uses, high estimates based on the Potential Cropland Study (Dideriksen and Sampson 1976).
[b] Land currently non-cropped with high or medium potential for conversion to cropland. Source: Dideriksen and Sampson 1976.

to urban and built-up uses could equal 7 to 14% of the potential cropland and 11 to 31% of the potential prime cropland in the next 25 years (see Table 2).

Does the continuing conversion of agricultural land to urban uses pose a serious threat to the nation's ability to produce food and fiber in the future? This is not an easy question to answer, but it must be viewed in the context of several important factors: (1) The rising world demand for food and fiber and the increasing dependence of much of the world on this country's food production; (2) the increasing importance of agricultural exports in maintaining a favorable balance of payments; (3) the apparently increasing variability in climatic conditions—it appears that much of the first two-thirds of this century was blessed with unusually good weather (Schneider, 1976); (4) the possibility of future shortages of fertilizer and the need for less energy intensive forms of agriculture; (5) more restrictive environmental standards being applied to agriculture and a decline in the reliance on pesticides and herbicides, and (6) the indication that we have reached a stage of rapidly diminishing marginal returns to advancing technology in the agricultural sector (Belden and Forte, 1976, pp. 18–33).

Thus, there appears to be a great deal of uncertainty concerning future demands for and the availability of food and fiber. One approach to the uncertainty is to maintain as much as possible of our agricultural land base; i.e. to take the "safe minimum standard" approach to conservation (Ciriacy–Wantrup, 1964).

ii. Regional Perspective

In some regions urban development is strongly biased towards agricultural land and the conflict between urbanization and agricultural production appears to be particularly severe. This seems to be the case for example in the West and in New England.

In many parts of the West, irrigated cropland is often directly in the path of urban expansion. Not only does irrigated cropland tend to be located near urban areas, but also because of physiographic reasons it is often the only land that can be easily built upon.

California is the leading agricultural state in the nation, producing 9% of the country's agricultural output in 1974 (in dollars). The value of agricultural output in 1974 was $7.4 billion (U.S. Census of Agriculture). At the same time, the state's population is rapidly increasing—at an average annual rate of 2.7% in the 1960s and 1.2% from 1970 to 1974. Even though the rate of population growth has decreased the state is still adding an average of 238,000 persons per year to its population (compared to 424,000 persons per year in the 1960s). Furthermore, this population growth has been concentrated in the alluvial valleys which contain California's most productive irrigated cropland (Fig. 1).

In California, urban development is strongly biased towards cropped land. For example, using aerial photographs, Zeimetz et al. (1976) found that in two California counties (Santa Clára and Santa Cruz) 16.3% of the land area was in cropland in 1956 but 70.1% of the urban development during the period 1956–63 occurred on cropland.

It appears that urbanization in California has led to a slow, but steady shift of irrigated cropland from metropolitan to nonmetropolitan counties. During 1959–69, irrigated cropland harvested declined 3.9% in the 27 metropolitan counties[4] and increased 6.6% in the rest of the state (U.S. Census of Agriculture). Also, from Fig. 2 it can be seen that there is a very strong relationship between urbanization (as

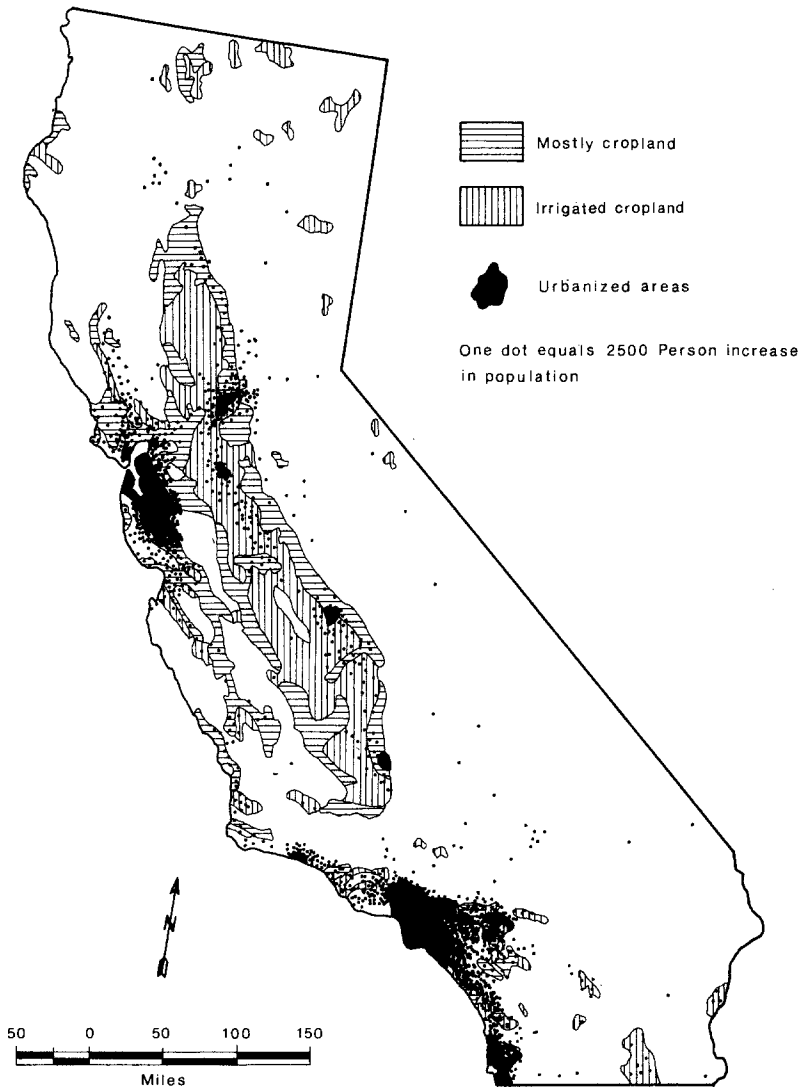

Fig. 1. Location of cropland, 1967 and population growth, 1960–74, in California.
Sources: National Atlas of the United States, US Census of Population, 1960 and 1970, and Current Population Reports, 1976.

[4] This includes all SMSA counties in the state (there are 26), plus all counties containing a city with a population of 25,000 or greater—this adds one county, Tulare.

measured by the number of new housing units built) and the loss of irrigated cropland harvested among the state's metropolitan counties.[5]

Despite these internal shifts the total stock of irrigated cropland harvested in California stayed fairly constant at 6.2 million acres from 1959 to 1969 and even increased to 6.9 million acres in 1974. (This recent increase is probably due to the extremely favorable price and cost configuration facing the farmer in 1973 and 1974). Until now, therefore, California has been able to extend irrigation into the more rural areas of the state and thus keep pace with the loss of irrigated cropland to urbanization. However, because of binding water constraints (which are very evident today) and with 463,000 acres of irrigated cropland within the state's 1985 urban growth boundaries (California Office of Planning and Research, 1974), it may not be possible for the state to continue to maintain its agricultural land base in the face of expanding urbanization.

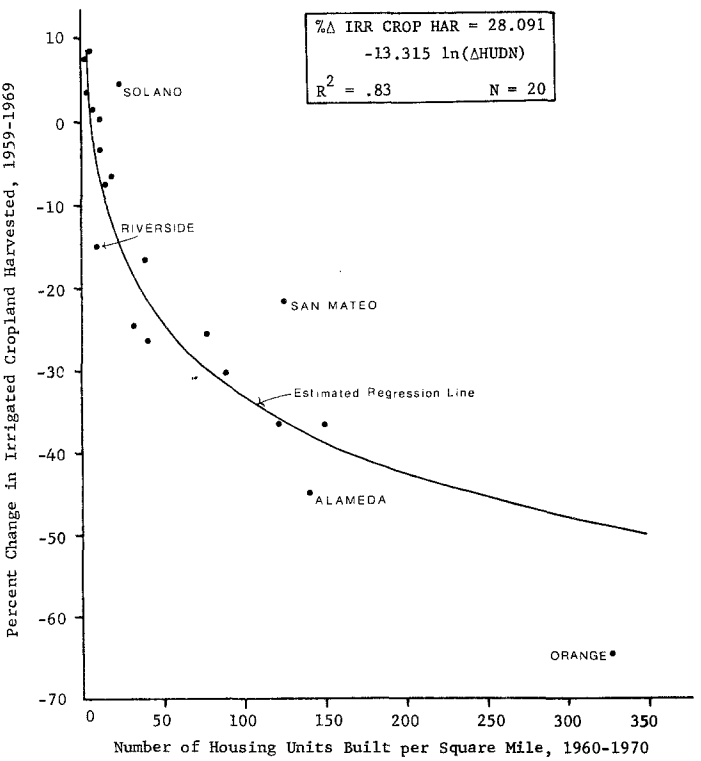

Fig. 2. The relationship between urbanization and the loss of irrigated cropland harvested during 1959–69 for twenty metropolitan counties in California.

[5] Two metropolitan counties (San Francisco and Marin) were excluded from this figure because they contained no irrigated cropland. No counties were included that gained more than 10% in irrigation cropland harvested (this excludes three metropolitan counties—Yolo, San Luis Obispo, and Sonoma). Finally, two metropolitan counties (Placer and San Bernandino) were excluded from this figure since they were extreme outliers. The reason these counties did not fit into the figure is probably because they are both very large with both urban growth and irrigated cropland harvested concentrated in only a small part of the county.

In New England both agricultural land and urban concentrations tend to be located in the river valleys (such as the Connecticut River Valley) and other flat areas. Because of the fairly rugged topography of this region, flat farmland is often the easiest to build upon and, therefore, very likely to be developed for urban uses. Massachusetts appears to present a clear example of the conflict between agriculture and urban growth in the New England region.

Massachusetts, like other parts of New England, has been experiencing an extremely rapid loss of agricultural land. Between 1959 and 1969 the state lost almost 40% of its farmland (U.S. Census of Agriculture). At the same time urban development is strongly biased towards agricultural land—during 1951–71 actively farmed land was about 1.7 times as likely as all rural land to be converted to urban uses.[6]

Despite this bias, urbanization is not the major cause of the loss of farmland in Massachusetts. Only about one-third of the loss of agricultural land in the state during the period 1951–71 was converted to urban uses. Most of the other two-thirds was idled due to relatively low agricultural productivity. Between 1951 and 1971, an average of about 4700 acres of farmland were converted to urban uses per year which when added up over 20 years accounts for about 13% of the state's farmland in 1951.[7]

Some observers have expressed concern that the continued loss of farmland in New England will make the region increasingly dependent on other parts of the country for food supplies. With the increasing cost of transportation (mainly because of rising energy costs), dependence on external suppliers could result in very high food prices in the New England region (Belden and Forte, 1976, pp. 163–165). However, most of the loss of farmland in Massachusetts is not directly related to urban growth. Rather it is due to the declining comparative advantage of agriculture in the state vis-à-vis other sections of the country.

iii. Local Perspective

At the local level the most remarkable feature of the urbanization process is its great dispersion over the landscape. Urban development proceeds by scatteration and some infilling rather than by accretion contiguous to past development. Figure 3, which shows the urbanization process during the period 1967 to 1975 in a 107 square mile area in part of Dakota County, Minnesota, south of Minneapolis–St. Paul, is a good example. It is evident that a relatively small amount of rural land converted to urban uses by this scatteration process will drastically alter the appearance of the landscape, making formerly rural areas neither truly rural nor truly urban. Suburban and exurban land uses are evident along many country roads, yet there remains much undeveloped land. From the local perspective, then, it is not necessarily the volume of farmland or woodland conversion to urban uses that matters, but rather the dispersal of this development over the landscape. These visual effects are another of the "costs of sprawl".

[6] This figure was calculated using data from Foster (1976) on the transition to and from agricultural land uses during 1951–71 for 26 towns in Massachusetts and data from MacConnell (1975) on land uses for every town in the state for 1951 and 1971. The Foster data were adjusted to reflect higher densities of urban development since the 26 towns tend to be located in more rural areas of the state.

[7] This figure was calculated using the data sets cited in footnote 6. Also, during 1951–71 an average of about 10,000 acres of woodland and 1100 acres of idle land were converted to urban uses per year.

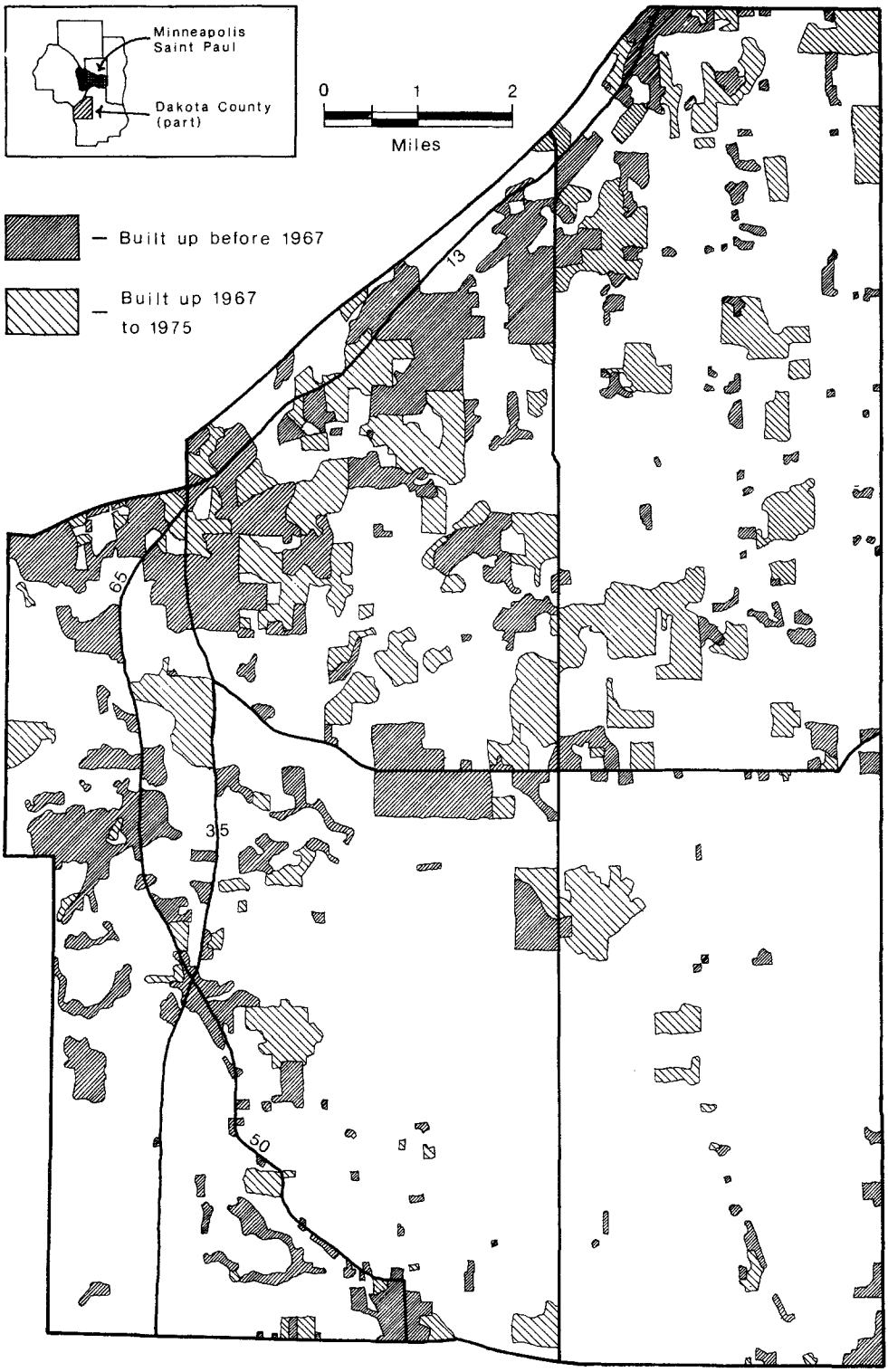

Fig. 3. Built-up land in Dakota County.

Using data gathered by William MacConnell and his associates (1975) for massachusetts for 1950–51 and 1970–71, it is possible to get some idea of the extent of urban intrusions into rural landscapes. Figure 4 shows those towns in Massachusetts where less than 10% of the land was in urban uses in 1950–51 and where more than 10% of the land was in urban uses in 1970–71. This is but a rough indicator, but it suggests that urban land uses are dispersing over much of the Massachusetts landscape.

The effects of urbanization transcend the conversion of land from rural to urban uses—they also influence what the farmer does to the land. Urbanization and population decentralization bring a nonfarm population to rural and semi-rural areas. As this nonfarm population increases in size it is not surprising that the farmer's political and economic status in his community becomes relatively diminished and that nonfarm needs become politically important. Moreover, the presence of a growing nonfarm population generates new problems with which the farmer must contend. In short, there are spillover effects from urbanization and population decentralization.

Among those spillover effects that are political and economic in nature are (1) regulation of routine farming activities to suit urban neighbors: limiting the hours during which noisy machinery can be operated or slow moving tractors can be driven on main roads, or restricting pesticide or fertilizer use; (2) acquisition of farmland to build roads, reservoirs, and other components of urban infrastructure; and (3) increase in property taxes and special district assessments to pay for new urban-oriented services. The increasing density of nonfarm population also may bring new problems for the farmer, such as damage to crops caused by air pollution, mischievous destruction of farm equipment or crops, or harrassment of farm animals by both children and adults. Because spillover effects present the farmer with a set of managerial issues and expenses that he did not have to cope with before, it may become necessary to accommodate regulations on farming activity, to build new fences to keep children out of the orchards, to work at community relations explaining to nonfarmers that farming is a business, and so on. One would not expect all farmers to be equally able or willing to cope with these problems. Some farmers complain bitterly and talk about selling out, while others seem to have sufficiently mastered the art of community relations to continue farming successfully.

In addition to declining political and economic status and spillover effects, land speculation constitutes an important, if not the most important, component of indirect effects. Where urban pressures are strong farmers may become active speculators in their land, disinvesting in their farms while anticipating a large capital gain from the sale of their land some time in the near future (Conklin and Dymsza, 1972). Farmers living under less urban pressure may still be involved in land speculation but it tends to be more passive—watching the appreciation of land values so that upon retirement the farmer expects to sell his land for a large profit.

The combination of declining status, spillover effects, and land speculation leads the farmer to regard the future of agriculture in his community as an impermanent part of the landscape (Miner, 1976) or at least generates an uncertainty about the future of agriculture. This uncertainty has identifiable spatial expressions. Given strong pressures from urbanization the tendency is for farmers to idle their farmland. This is a localized phenomenon but it nonetheless accounts for a substantial

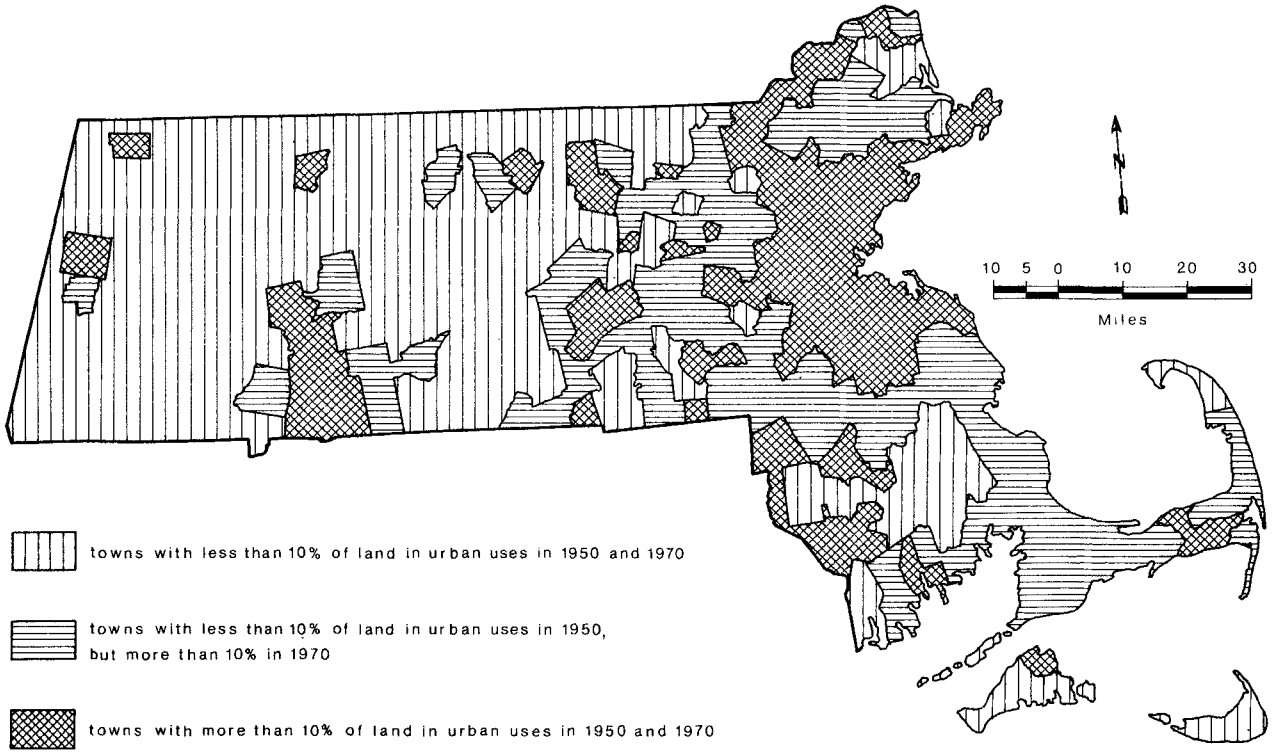

Fig. 4. Expansion of urban land use in Massachusetts, 1950–70.

amount of acreage, perhaps as much as one acre idled due to urban pressures for every acre converted to urban uses in the Northeastern United States (Plaut, 1976) and accounting for as much as 100,000 acres of idling of farmland in six of the eight counties in the Philadelphia metropolitan area between 1930 and 1970 (Berry, 1976).

Much more widespread may be the slow switchover from those types of agriculture requiring large long term investments to other types of agriculture where urban pressures are weaker but still perceived. For some farmers in those regions affected by weak urban pressures, land uses in the next 10 or 20 years appear too uncertain for them to undertake large investments which would not pay off for 20 years. For instance, in the Middle Atlantic states, there is a slow but perceptible decline in dairying activity in metropolitan counties and rapidly growing nonmetropolitan counties relative to slowly growing nonmetropolitan counties (Berry et al, 1976). However, there is no noticeable decline in agriculture in general associated with urbanization, which suggests that field crops or other types of agriculture are slowly replacing some dairying.

The idling of farmland and the slow switchover to types of agriculture that require less investment and a shorter time horizon are schematically mapped in Fig. 5. In this simple spatial model we note the distinction between the localized nature of the idling phenomenon and the far more widespread decline of high investment forms of agriculture.

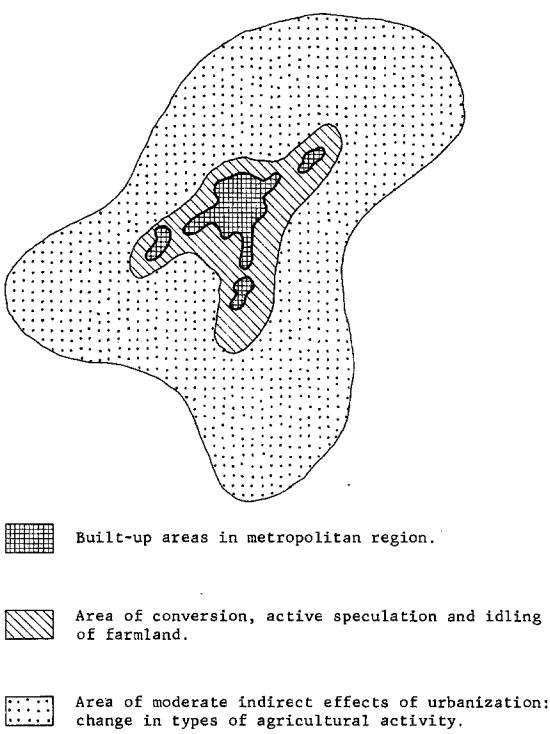

Fig. 5. Spatial expression of effects of urbanization on agricultural activities.

III. Land Use Controls

A. Introduction

Concern with both the direct and indirect effects of urbanization and population expansion has given rise to a variety of land use controls, some actually having been implemented, others merely a topic of discussion. In general, the major land use controls can be classified as being either direct or indirect, corresponding to the types of urban pressures they address. That is, direct land use controls attempt to limit the use of the land to agricultural uses, open space uses, low density residential uses, and the like. In contrast, indirect controls offer incentives to farmers (and sometimes to others) to keep their land in farms or open space uses. These incentives are intended to mitigate some of the indirect effects of urbanization such as increasing property taxes.

Among the major types of direct approaches to retaining agricultural land are:

Exclusive Farm Use Zoning

Although there are examples from several dozen communities throughout the country, this type of control appears to be most widely utilized in the Pacific Region, especially in California, Oregon, and Hawaii. In California, the approach to agricultural zoning has been large lot zoning. For example, Madera County contains agricultural zones with minimum lot sizes of 640 acres, and Tulare County has some land zoned at an 80 acre minimum. However, neither county is undergoing severe urban pressures. In metropolitan regions, Solano County and Marin County have some agricultural land zoned at 160 acres and 60 acre minimums respectively. Here again there has not been enough urban pressure in these areas to test the effectiveness of the large lot zoning approach. In contrast to large lot zoning, the Oregon Land Conservation and Development Commission has required that each city and county delineate reasonable urban growth boundaries to accommodate future growth. Outside these boundaries all land must be zoned for rural uses and all agricultural land with soils in capability classes I–IV must be zoned exclusively for farm use (Coughlin, 1977). However, to date, most counties and cities have not yet completed their zoning or delineated their urban boundaries to accommodate future growth. Hawaii's Land Use Commission has established the boundaries for four major districts or zones: urban, agricultural, conservation, and rural. In 1964, the total land area in the agricultural zones was 2,124,400 acres which by 1974 had been reduced to 1,968,727 because of reclassification to urban or because of a decline in pineapple growing (Myers, 1976; Keene et al., 1976).

(2) Public Purchase of Development Rights

The idea here is for the municipality, county, or state to purchase development easements on farmland to prevent the land from being converted to urban uses. This approach is being used in Suffolk County, Long Island and in a Farmland Preservation Demonstration Program in four townships in Burlington County, New Jersey, in the Philadelphia metropolitan region.

(3) Public Purchase and Lease or Sale of Farmland

The mechanics of this program require that a government agency acquire the fee to farmland and then, in order to prevent development of that land, either sell or lease the land to farmers (for farming purposes only) while retaining the development rights. This type of program has been used sparingly in the United States: e.g. a few Massachusetts towns have acquired and leased out several hundred acres of farmland. A much larger program can be found in Saskatchewan, where approximately 1000 square miles of farmland have been purchased by the Saskatchewan Land Bank Commission and leased to farmers over a long term (until they reach the age of 65) (Saskatchewan Land Bank Commission *Regulations* and *Annual Reports*). However, this program is a response to problems of land tenure for younger farmers lacking a great deal of capital to start their own farms or to enlarge their farms, and is not an attempt to guide urban development. Nonetheless it could be used in areas subject to urban pressure.

(4) Preemption of Farm Sales

France's Sociétés d'Aménagement Foncier et d'Etablissement Rural are probably the best example of this approach since there does not seem to be any major effort towards using preemption in the United States. When farmland inside designated areas is offered for sale on the private market the appropriate Société can preempt that sale and purchase the land itself for the agreed upon fair market price. It then attempts to sell the land to a farmer who wishes to enlarge his operation or to make his holdings contiguous. Between 1964 and 1975, the Sociétés have purchased 2,112,500 acres and sold 1,767,500 acres of farmland (Ministry of Agriculture). This same approach could be applied in areas subject to urban pressures taking the form of purchase and lease (or sale) to a farmer with the development rights remaining with the public agency. In France the program is used to allow farmers to consolidate their holdings into more efficient patterns for commercial agriculture.

(5) Transferable Development Rights

In this approach some land is zoned for little or no further development (a no-growth zone) and other land is zoned for development (a growth zone). Land owners in the no-growth zone may attempt to sell (i.e. transfer) their development rights to developers in the growth zone who would use the rights to exceed density limitations in the growth zone. Developers would bid for the transferable development rights out of the increment in surplus obtained from building at higher densities. Although this approach has received considerable attention, it has been enacted in only a few localities and cannot be said to be functioning in any of them (Helb et al., 1976; Nieswand et al., 1976; Bennett 1976; Costonis, 1973).

The most widely implemented indirect land use controls are of two types:

(a) Differential Assessment of Real Farm Property

Under this approach the farmer is offered an incentive to keep his land in agriculture through current use value assessment rather than market value assessment of

his land. If there are strong urban pressures on the land, the tax savings can be substantial since the market value contains considerable speculative development value. Such programs had been enacted in 42 states as of 1975 (Keene et al., 1976).

There are three basic types of differential assessment (Hady and Sibold, 1974). One is pure preferential assessment in which farmland and other eligible land is assessed at its current use value. A second is deferred taxation which is pure preferential assessment with the condition that if the land is taken out of the eligible use a specified number of years of back taxes on the difference between the market value and current use value of the land must be paid. This is a kind of penalty as well as a way for the community to recapture tax expenditures. The third is a restrictive agreement which may be entered into by the farmer and a government agency. The farmer signs a contract stating that he will keep his land in an eligible use for a specified number of years (usually ten) in return for a preferential assessment on his land. This is the least used type of differential assessment but it is also the most stringent.

(b) Agricultural Districting

New York's Agricultural Districting Program (Bryant and Conklin, 1975, Conklin and Bryant, 1974) is the best example of this multiple incentive type of approach although features of the districting idea can be found in Oregon and Maryland. In New York, farmers may voluntarily work collectively to form a district. Within the district, farmers are protected to some extent from regulations on farming activities, from special assessments for sewer, water, light and other utility districts, and from local use of eminent domain to acquire farmland for public uses without adequate consideration of alternative sites for urban infrastructure. In addition, there is to be a state policy of encouragement of agriculture in the districts and the option for farmers in districts to apply for differential assessment of their property with deferred taxation.

B. Effectiveness of Land Use Controls

Ultimately the effectiveness of land use controls can be measured in the quantity and quality of the farmland retained or open space preserved that otherwise would have been converted to urban uses or changed significantly in use as a result of indirect effects of urbanization. However, most land use controls have not been in existence long enough under suitable test conditions to evaluate their effectiveness. It is nonetheless possible to identify four underlying characteristics or dimensions of land use controls which are likely to be critical in determining the effectiveness of a program.

i. Focus of the Program

A program can either focus directly on the use of land or on the indirect effects of urbanization. In theory, direct controls on land use seem to be a straightforward solution to the problem of land conversion. Yet there is considerable feeling among planners and legislators that some of these direct controls may not really be permanent or that their applicability is quite uncertain (see Myers, 1976, for example). There are numerous examples of zoning that have been changed to accommodate new uses

of land that are able to bid up land rents; hence in the face of strong urban pressure zoning ordinances may be impermanent.

Uncertainty about the future of direct controls may be found in the fear of many municipalities that zoning approaches to open space preservation will be "shot down" by the courts, producing a reluctance to use this type of control (Bosselman et al., 1973). Introduction of direct controls may also inject uncertainty into the rules by which speculators, developers, and builders operate, upsetting the status quo, and creating resistance to the use of direct controls (Babcock, 1973). Finally, direct controls may be misunderstood by the population in general. Without the diffusion of clear, correct information on a program there is likely to be reluctance to approve direct controls at all (see Gowen and Mackenzie, 1975, for a case study of such an instance).

Indirect controls offer incentives to the farmer but these incentives may be relatively minor when the farmer considers whether or not to sell his land. For instance, the farmer faces several "push" factors that may force him to sell. Among the push factors are (1) a long term low net income from farming due to the relatively low productivity of his land or to unfavorable price and cost configurations (Hart, 1968); (2) advancing age which forces the farmer either to sell his land on the open market or to sell it to a relative or neighbor expanding his own farm; (3) intolerable spillover effects from urbanization (Berry et al., 1976); and (4) high property taxes which may result from urban pressures or which may be high relative to his long run net income. It is apparent that high property taxes or urban spillover effects are not the only considerations a farmer takes into account when deciding whether or not to sell his land. In fact, general economic conditions and impending retirement are probably the most important considerations for the farmer who enjoys farming (Berry, 1975; Keene et al., 1976).

A farmer may also be pulled into selling his land by the high prices offered by speculators or developers. The slight increase in the use value of his farmland resulting from capitalization of decreased taxation will probably not be sufficient to offset the large development value the speculator or developer is willing to pay. Where urban pressures are strong, development values may be on the order of several thousand dollars per acre while the increase in the use value of his property as taxes are decreased may be only a few hundred dollars per acre at most.

Empirical evidence on the relative importance of property taxes on the rate of loss of land in farms has been assembled by Plaut (1976) and Berry (1975) for selected counties in Ohio for the periods 1964 to 1969 and 1969 to 1973, respectively. These analyses suggest that where the soil is highly productive, property taxes per acre of farmland will have a negligible effect on the rate of change in land in farms; where the land is only marginally productive a lowering of the property taxes per acre of farmland will encourage some farmers to continue farming a while longer, but over the long run, general economic conditions in agriculture will probably be of greater importance than property taxes in the use of the land; and where urban pressures are strong they will tend to overwhelm any ameliorating effects of lowering property taxes on the rate of loss of land in farms. Moreover, Plaut found that the effective tax rate had no discernible effect on the rate of change in land in farms even though

a lower tax rate would be largely capitalized into higher farmland use values. Apparently the increase in use value due to lower tax rates generally does not make the agricultural use value of the land competitive with the high speculative bid rents for land under strong urban pressures.

In conclusion, the focus of the control will be an important determinant of the potential effectiveness of land use controls. Direct controls are potentially more effective in areas of strong urban pressures because they address the problem of conversion of land from rural to urban uses. Indirect controls are better suited to the role of a complement to direct controls in areas subject to strong urban pressure and active land speculation. In such areas direct controls remove, by one means or another, the right to develop the land, leaving only the current use or low density development as the allowable use of the land. The indirect controls could then ameliorate some of the spillover effects of urbanization in regions whose land use is regulated by direct controls. Where urban pressures are less intense indirect controls can be used to mitigate some spillover effects which annoy the farmer but are not likely to put him out of business altogether. Whether they would be effective in slowing changes in the type of agricultural activity brought about by low level urban pressures remains to be seen.

ii. Costs

All controls impose some sorts of costs either upon the public in general or upon a relatively small group of landowners or others. In most cases, the largest costs are those associated with direct controls in areas under substantial urban pressures. Restricting development in such areas by means of public purchase of development rights or public purchase of the land (with or without lease or sale to farmers) requires large capital outlays. For example, landowners' offers for sale of development rights on farmland in Suffolk County, Long Island as of February, 1975 averaged about $6500 per acre; as of June 1, 1977, landowners' offers for the sale of development rights on farmland in the New Jersey Farmland Preservation Demonstration Area averaged about $2900 per acre.[8] These may very well be overestimates in that they are the landowners' offers, not the county's or state's appraised values or actual transaction prices. Nonetheless they indicate that the public cost of direct control can easily go into the tens of millions of dollars to preserve only a few thousand acres.

If the direct control involves regulation of private property such as zoning imposed in an area subject to urban pressures, these costs would be borne by the private landowners who suffer a diminution in the value of their land. Traditionally the courts have overturned such regulations if the diminution in value has been large but the definition of "large" varies substantially from case to case (Bosselman et al., 1973). Public benefits must be balanced against private costs (*Pennsylvania Coal Co. v. Mahon et al.*), the basic idea being that such regulation becomes tantamount to a taking of private property fof public purposes without just compensation if the diminution in value constitutes too great a private cost. However, a recent decision did not use the taking analogy but merely framed the diminution question in terms

[8] These figures were obtained by John Pickett from Suffolk County Officials and the New Jersey Farmland Preservation Demonstration Program as part of RSRI's general research on land use controls.

of whether the property owner was frustrated in the use of his property for a reasonable economic gain (*Fred F. French Investing Co. v. City of New York*).

A few recent cases have looked at the diminution question much differently. For example, in *Just v. Marinette County* (201 NW 2d 761), the court held that the diminution question was irrelevant if applied to potential future gains from development as opposed to a diminution from current use value. Thus, it may be possible to use the police power (with no compensation required) to regulate land use to protect existing public benefits as long as the landowner retains the right of current use. Creation of new benefits such as a public park that deprives the landowner of the returns on current use would still require compensation, of course.

The case of transferable development rights brings up the issue of the uncertainty of compensation for the landowner whose land is restricted in use. The only important court case so far on this matter (*Fred F. French Investing Co.*) disallowed a transferable development rights ordinance applying only to French's property since the value of the transferable development rights was so uncertain as to "frustrate" the private property owner in the economically gainful use of his land.

Indirect controls involving differential assessment have a rather subtle cost—the shifting of the tax burden from participants to other property owners in the taxing jurisdiction (which would also include program participants if not all their property were differentially assessed). The quantity of such shifts is very difficult to ascertain; apparently it is often rather small but under the right circumstances it can impose tax increases of several hundred dollars per year per capita on non-participants in the program (Hady and Sibold, 1974; Keene et al., 1976).

iii. Complexity

The complexity of a land use control may prove to be a hindrance in its enactment or implementation, perhaps not scuttling the program entirely but rather making its operation inefficient or haphazard in relation to the goal of retaining (prime) farmland. It may arise through the introduction of an unfamiliar concept, through the attempt to operationalize abstract concepts basic to the program, or through the need to establish a new institution.

To illustrate the significance of introducing unfamiliar concepts, early programs involving the separation of development rights from other rights in land sometimes met with great hostility from rural landowners (Strong, 1975). That long standing bundles of rights could be broken apart and dealt with separately was perceived as a complexity threatening to traditional values.

Complexity associated with operationalizing basic concepts can be illustrated by the difficulties in making routine the definitions of "prime" agricultural land and agricultural "use value". "Prime land" is an ill-defined and relative term (Raup, 1976) and turning it into an administratively useful concept often means overlooking some aspects of productivity, market accessibility, and the general economic conditions that contribute to the "primeness" of soils. The simplest approach is to map out those areas containing soil capability classes I and II if a soil survey exists but this is a definition based upon erodibility and other conservation characteristics of

soils (which are often highly correlated with productivity, however). A few planning agencies have attempted to classify soils on the basis of productivity indices using available soil survey information but so far no widely applicable method of identifying prime soils has been agreed upon.

The definition of the use value of farmland is simply the market value of farmland agreed upon between a willing buyer and a willing seller if there were no urban influences in the area. However, where there are urban pressures it is not possible to observe what this value is since most or all sales reflect urban influences. Yet an estimate of use value is necessary for differential assessment and for determining the development value of land (market value minus use value) in development rights purchase programs. Several methods of estimating use value are employed although none is perfectly satisfactory (Locken, 1976). Some states use comparable sales of farm properties not subject to urban influences but these may be so distant from the farmland preservation area that no sales are truly comparable. Other states attempt to estimate the net income from farming activities and then capitalize that income to obtain use value. There are several methods of estimating net income since such data are hard to find; in general, allowances are often made for type of farming activity and soil conditions in estimating net income. Choosing a capitalization rate is not very straightforward for it is really an economic fiction designed to convert a flow concept (net income) to a stock concept (the value of an asset). Capitalization rates are usually based upon current market interest rates with some adjustments for property tax rates, risk, inflation, and changing farm productivity although adjustments are usually not very sophisticated.

The establishment of a new institution is best exemplified by transferable development rights. In its "purest" form this method functions as an on-going private market in transferable rights, the market being established by the government or a planning agency (Berry and Steiker, 1977). Transferable development rights are created by government action and assigned to landowners on the basis of the development value of their land or some other criterion; this constitutes the supply side of the market. On the demand side a fairly accurate appraisal of the bidding for additional density by developers in the growth zone must be made. Given control over the supply side, some feeling for the dynamics of the market in transferable development rights, and the ability to intervene in the market, it may be possible to ensure a high enough price for transferable development rights to compensate landowners in the no-growth zone for the diminution in the value of their land. This appears to be a problem whose level of sophistication lies beyond that of the typical planning agency or even of most economists. Hence the future of transferable development rights does not seem promising.

iv. Participation

Land use programs may be mandatory or voluntary. If they are mandatory it is possible to include that land in the program that seems desirable to protect (e.g. prime farmland in contiguous districts). Zoning ordinances are examples of such mandatory programs but they may bring about sufficient resistance by landowners

and speculators that it is difficult to actually implement an effective program at all. Most controls to date have been voluntary, in part to reduce the friction created by unwilling participants. Of course, this approach suffers from the defect that not all desirable land may be included in the program and much marginally desirable land may be included, often in scattered, discontiguous patterns.

By far the most experience with voluntary programs is that of the indirect land use controls. We shall briefly review participation patterns in California's Williamson Act (a restrictive agreement type of differential assessment) and New York's Agricultural Districting Program.

In California, local governments may delineate agricultural preserves on their own initiative or by request from private landowners thereby allowing eligible landowners in the preserves to participate in the program (Keene et al., 1976). A number of studies of this restrictive agreement program have been carried out (Fellmeth, 1973; Gustafson and Wallace, 1975; Keene et al., 1976; and Hansen and Schwartz, 1976, for example). All tend to agree that the program, although including a great deal of land, is not especially successful at preventing urbanization of farmland or other open space. This can be seen from the pattern of participation. Gustafson and Wallace have observed that the pattern of participation is such that: (1) near urban areas there is little land enrolled in the program; (2) the coastal areas of the state exhibit very low participation rates; and (3) the lack of planning for agricultural preserves has led to scattered and discontiguous inclusion of land in the program. According to Hansen and Schwartz the lack of participation around urban areas is due to over-optimistic expectations about the development potential of the land by landowners on the rural-urban fringe. Hansen and Schwartz calculated that under a more realistic view about land values and development potential it would be economically worthwhile for most landowners on the rural-urban fringe to participate and receive a tax reduction even though they must enter a contract for at least ten years.

As of June, 1976 about two-fifths of New York's farmland was enrolled in the State's Agricultural Districting Program (see Fig. 6). However, participation in the program does not seem related to urbanization or soil quality. Using a Kruskal–Wallis analysis of variance on estimates of the proportion of farmland enrolled in the program by county, we could not find a statistically significant difference in participation rates in counties classified by metropolitan or nonmetropolitan status and growth rate at the 0.30 level. A similar analysis of variance on participation rates in counties classified by the proportion of soil in capability classes I and II failed to be significant at the 0.20 level.

Interviews with ten cooperative extension service agents across the State and study of the minutes of fifteen public hearings on proposed districts gives us some insight into the pattern of participation. Three overlapping situations appear conducive to the formation of agricultural districts:

(1) Strong leadership. One or a few individuals may strongly favor the creation of a district and undertake most of the effort in persuading others to join the district, in carrying out the field work in mapping the district, and in filling out the paperwork.

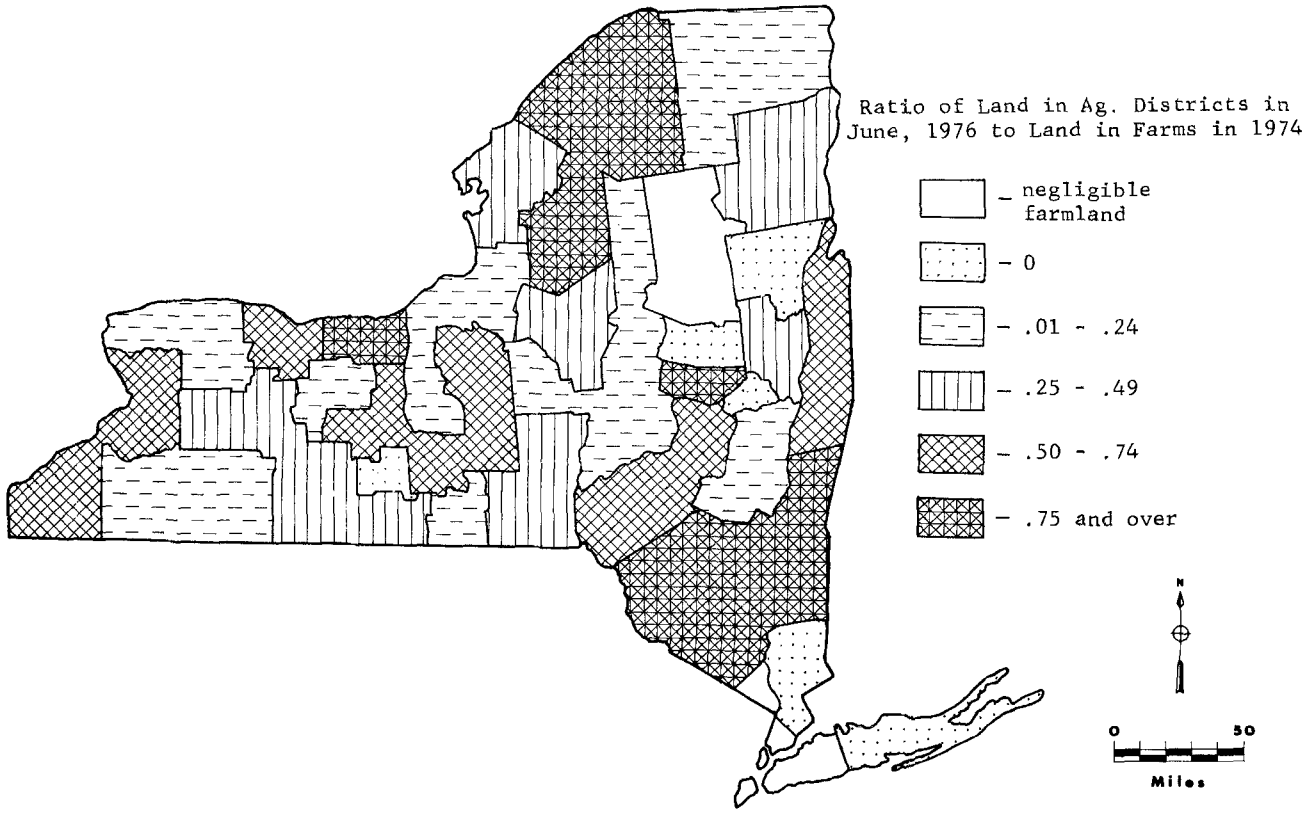

Fig. 6. Participation rate in agricultural districts in New York. Sources: New York State Department of Agriculture and Markets, Agricultural Resources Commission, 1974 Census of Agriculture.

(2) A crisis situation. In the semi-rural or remote regions of the state there are often proposed public projects or other public actions affecting agricultural land which are sufficient to induce farmers and others to initiate a proposed district. Among the crises which led to districts are a proposed airport (Erie County), a proposed reservoir (Schoharie County), a proposed power line (Wayne County), proposed enactment of local zoning and building codes which would annoy some farmers (Wayne County), and upward reassessment of property taxes on farmland (Orange County).

(3) Anticipated mild urban spillover effects. In some cases the proposed district is formed to help create an atmosphere of relative certainty within which to make investment decisions or to help mitigate possible future nuisances. Often this situation occurs in towns relatively remote from strong urban pressures.

Some areas of the state are conspicuously lacking agricultural districts. A few remote areas such as Schuyler County have not experienced a crisis situation and have also lacked strong leadership to push the district through to completion. Areas subject to rapid urbanization also have low participation rates. The pressures of urbanization are either felt to be too strong to be ameliorated by agricultural districts or too attractive, through land speculation, to be worth the effort of forming a district (Bryant and Conklin, 1975). The area immediately surrounding New York City is an example large enough to show up at the county level. In addition, the fact that metropolitan counties do not in general show a higher participation rate in the program than nonmetropolitan counties suggests that this kind of nonparticipation is fairly common in and near rapidly growing areas of metropolitan counties.

IV. Conclusions

The effects of urbanization on agricultural activities are quite different at the national, regional, and local levels. From a national perspective it is uncertain whether the continued loss of farmland and prime farmland to urban uses will interfere with nation's long run ability to produce sufficient food and fiber for ourselves and other parts of the world. In some regions, such as California, the conflict between urbanization and agricultural production is especially strong since development is biased toward farmland. At the local level it is not the quantity of farmland converted to urban uses that is generally disturbing, but rather the dispersed pattern of development which significantly alters the appearance of the landscape, changing it from rural to something intermediate between rural and urban.

Besides the conversion of farmland to urban uses the process of urbanization can result in land speculation and other spillover effects which indirectly interfere with agricultural activity. Strong urban pressures can induce the localized idling of farmland, and weaker urban pressures can cause the slow switchover from those types of farming requiring large capital investments (such as dairying) to other types of agriculture (such as field crops).

The potential effectiveness of direct and indirect controls in alleviating these problems or potential problems is summarized in Table 3 for two cases: (1) where

there exist strong direct effects of urbanization on agriculture as well as idling of farmland due to urban pressures; and (2) where there are moderate indirect effects of urbanization on agricultural activities.

In areas with strong direct effects and idling of farmland, direct land use controls seem potentially more effective because of their focus on the use of the land. In such areas indirect controls offer incentives that are overwhelmed by land speculation and development pressure, but they may be useful complements to direct controls, especially if the farmer can be protected from many types of urban spillover effects.

Direct controls are not all alike, however. Their large costs may fall upon the public, given some sort of public purchase program, or they may fall upon private landowners in a regulatory type of control. Moreover, the distribution of their costs may even be uncertain as in the case of transferable development rights. When large costs fall upon private individuals one must also take account of the courts possibly ruling out regulatory controls. The concept of preemption may prove to incorporate the least difficult cost with which to deal because public outlays are spread out over time as land comes onto the market (rather than concentrated in a few large scale purchases) and the legal difficulties with diminution in land values are avoided.

Transferable development rights may be regarded as the direct control with the least potential for retaining farmland because of its complexity.

TABLE 3

Potential Effectiveness of Direct and Indirect Land Use Controls in a Nutshell

	Type of urban pressure	
Policies	Strong direct effects and idling of farmland	Moderate indirect effects
Direct controls	fairly effective, but costly; distribution of costs and complexity vary greatly among controls	neither necessary nor demanded
Indirect controls	ineffective but good complement to direct controls—more robust controls provide broader complement	may be effective —more robust controls are more effective

Finally, with respect to participation we expect that voluntary direct controls may be easier to enact but less likely to bring forth a pattern of participation conducive to protecting large contiguous tracts of prime farmland. Participation will be constrained by fears of new controls and the possibility of real or imagined private costs. Mandatory programs would, therefore, seem potentially more effective in spite of the objections that many farmers would have to being included in such a program, especially if it is a regulatory program.

In those regions experiencing moderate indirect effects of urbanization but relatively little conversion of land from rural to urban uses and little idling of farmland (due to urban pressures) we expect that indirect controls would be adequate to solve many of the urban-generated problems faced by farmers. Protecting the farmer from various spillover effects may be sufficient to remove the uncertainty over investments induced by indirect effects although we have no evidence on this one way or the other. Clearly a more robust program like New York's Agricultural Districting is potentially more effective than a single purpose differential assessment program. Imposition of direct controls would probably be unnecessary in these areas because such a small proportion of the land is likely to be converted to urban uses and because there is little active land speculation.

It is apparent that those types of land use controls which directly affect the use of the land and which constrain land speculation on the rural-urban fringe have great difficulties which hinder their widespread adoption or implementation. In contrast, indirect controls of one type or another have been enacted in most states but their effectiveness under strong urban pressure is at best slight. When used by themselves, they are better suited to protecting farmers from moderate spillover effects from urbanization in semi-rural areas of the nation.

REFERENCES

Babcock, R. (1973), *The Zoning Game.* Madison: University of Wisconsin Press.

Beale, Calvin (1976), "The Revival of Population Growth in Nonmetropolitan America," ERS–605. Economics Research Service U.S.D.A.

Belden, Joe and Gregg Forte (1967), *Towards a National Food Policy,* Exploratory Project In Economic Alternatives.

Bennett, Margaret (1976), *Transfer of Development Rights; Promising but Unproven New Approach to Land Use Regulation.* Philadelphia: Pennsylvania Environmental Council.

Berry, David (1975), "The Effect of Property Taxes on the Loss of Farmland: The Potential Effectiveness of Preferential Assessment." Proceedings of the Middle States Division of the Association of American Geographers Meetings.

Berry, David (1976), "Idling of Farmland in the Philadelphia Region, 1930–1970." Regional Science Research Institute Discussion Paper Series No. 88.

Berry, David and Gene Steiker (1977), "An Economic Analysis of Transfer of Development Rights," *Natural Resources Journal* 17, January: 55–80.

Berry, David, Ernest Leonardo, and Kenneth Bieri (1976), "The Farmer's Response to Urbanzation: A Study of the Middle Atlantic States," Regional Science Research Institute Discussion Paper No. 92.

Bosselman, Fred, David Callies, and John Banta (1973), *The Taking Issue.* Washington, D.C.: Council on Environmental Quality.

Bryant, William, and Howard Conklin (1975), "New Farmland Preservation Programs in New York," *Journal of the American Institute of Planners* 41.

California Office of Planning and Research (1974), *Prime Agricultural Lands Report.*

Ciriacy—Wantrup, S.V. (1964), "The 'New' Competition for Land and Some Implications For Public Policy," *Land Economics* 40.

Conklin, Howard, and William Bryant (1974), "Agricultural Districts: A Compromise Approach to Agricultural Preservation," *American Journal of Agricultural Economics* 56, August: 607–613.

Conklin, Howard and Richard Dymsza (1972), Maintaining Viable Agriculture in Areas of Urban Expansion. New York State Office of Planning Services.

Costonis, John (1973), "Development Rights Transfer: An Exploratory Essay," *Yale Law Journal* 83.

Coughlin, Robert E., (1977), Memo on Oregon Land Conservation and Development Commission, RSRI.

Dideriksen, Ray (1976), "Potential Cropland: A Regional View," *Soil Conservation* 42, December: 5–9.

Dideriksen, Ray, and R. Neil Sampson (1976), "Important Farmlands—A National Viewpoint," *Journal of Soil and Water Conservation* 31.

Fellmeth, R. (1973), *The Politics of Land.* New York: Grossman.

Foster, John (1976), Changes in Agricultural Land Use in Massachusetts, 1951–1971. Massachusetts Agricultural Experiment Station, Amherst.

Fred F. French Investing Co. v. City of New York, 350 NE 2d 381.

Gloudemans, Robert (1974), *Use-Value Farmland Assessments, Theory, Practice, and Impact,* Chicago: International Association of Assessing Officers.

Gowen, Max, and Robert McKenzie (1975), "Sunderland: Preserving Prime Agricultural Land," in Lawrence Susskind, ed., *The Land Use Controversy in Massachusetts*, Cambridge, Mass.: MIT Press.

Gustafson, Gregory, and L. Wallace (1975), "Differential Assessment as Land Use Policy: The California Case," *Journal of the American Institute of Planners* 41, November: 379–389.

Hady, Thomas, and Ann Gordon Sibold (1974), *State Programs for the Differential Assessment of Farm and Open Space Land.* U.S. Dept. of Agriculture, Agricultural Economic Report No. 256, Economic Research Service.

Hansen, David, and Seymour Schwartz (1976), "Prime Land Preservation: The California Land Conservation Act," *Journal of Soil and Water Conservation* 31.

Harris, Curtis, and David Allee (1963), *Urbanization and Its Effects on Agriculture in Sacramento County, California.* California Agricultural Experiment Station.

Hart, John Fraser (1968), "Loss and Abandonment of Cleared Farmland in the Eastern United States," *Annals* of the Association of American Geographers 58.

Hart, John Fraser (1976), "Urban Encroachment on Rural Areas," *Geographical Review* 66.

Helb, John, Budd Chavooshian, and George Nieswand (1976), *Development Rights Bibliography.* Cooperative Extension Service, Cook College, Rutgers University, Leaflet 533.

Just v. Marinette County, 201 NW 2d 761.

Keene, John C., David Berry, Robert E. Coughlin, James Farnam, Eric Kelly, Thomas Plaut, and Ann Louise Strong (1976), *Untaxing Open Space*, Washington, D.C.: Council on Environmental Quality.

Locken, Gordon (1976), *Alternative Methods of Estimating the Use-Value of Farmland in New York.* Unpublished Masters Thesis, Cornell University.

MacConnell, William (1975), *Remote Sensing 20 Years of Change in Massachusetts, 1951–1971.* Massachusetts Agricultural Research Station, Amherst.

Miner, Dallas (1976), Farmland Retention in the Washington Metropolitan Area. Metropolitan Washington Council of Governments.

Myers, Phyllis (1976), *Zoning Hawaii*, Washington, D.C.: Conservation Foundation.

Nieswand, George et al (1976), *Transfer of Development Rights: A Demonstration.* Cook College—Rutgers University Extension Bulletin 419.

Pasour, E. C. (1975), The Capitalization of Real Property Taxes Levied on Farm Real Estate. *American Journal of Agricultural Economics,* 57.

Pennsylvania Coal Co. v. Mahon et al., 260 U.S. 393.

Plaut, Thomas (1976), "The Effects of Urbanization on the Loss of Farmland at the Rural-Urban Fringe: A National and Regional Perspective." Regional Science Research Institute Discussion Paper Series No. 94.

Plaut, Thomas (1977), "The Real Property Tax, Differential Assessment, and the Loss of Farmland on the Rural-Urban Fringe." Regional Science Research Institute Discussion Paper Series No. 97.

Raup, Philip (1976), "What is Prime Land?" *Journal of Soil and Water Conservation*, 31, Sept/Oct.
Saskatchewan Land Bank Commission. 1973–1976. *Annual Reports.*
Schneider, Stephen with Lynn Mesirow (1976), *The Genesis Strategy*. New York: Plenum.
Strong, Ann Louise (1975), *Private Property and the Public Interest: The Brandywine Experience.* Baltimore: Johns Hopkins.
U.S.D.A. Committee on Land Use (1975), *Perspectives on Prime Lands: Background Papers for Seminar on Retention of Prime Lands.*
U.S.D.A., Economic Research Service (1974), *Our Land and Water Resources: Current and Prospective Supplies and Uses.* Miscellaneous Publication No. 1290.
Vining, Daniel R. and Anne Strauss (1976), "A Demonstration That Current Deconcentration Trends Are A Clean Break With Past Trends," Regional Science Research Institute Discussion Paper No. 90.
Vogeler, Ingolf (1976), "The Effectiveness of Differential Assessment of Farmland in the Chicago Metropolitan Area." Department of Local Government Affairs, Office of Research and Planning, State of Illinois.
Woodbury, Steven (1975), "Transfer of Development Rights: A New Tool for Planners," *Journal of the American Institute of Planners* 41, January.
Zeimetz, Kathryn A., Elizabeth Dillon, Ernest E. Hardy and Robert C. Otte (1976), "Dynamics of Land Use in Fast Growth Areas." Agricultural Economics Report No. 325. Economic Research Service. U.S.D.A.