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VON THÜNEN AND URBAN SPRAWL¹

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ABSTRACT. In explaining agricultural patterns near urban areas, Von Thünen's theory is generally applicable where the primary force determining the pattern is transport cost to the market. When this is the case, the pattern of agricultural land use is one of decreasing intensity with distance from the city. Von Thünen's theory still applies in underdeveloped parts of the world, but his basic premise has been outdated in more developed areas. In many advanced industrialized parts of the world, the basic forces determining agricultural land use near urban areas are associated with urban expansion. Where these forces are in operation, the agricultural pattern quite often is one of increasing intensity with distance from the city, quite the reverse of the pattern generalized by Von Thünen's theory. A theory is developed to explain the agricultural pattern near such modern urban areas, and empirical evidence related to this theory is examined.

THIS paper concerns agricultural land use patterns near present-day urban areas, and the forces which determine those patterns. Almost inevitably, the paper starts with the name J. Heinrich Von Thünen, whose celebrated treatise, *Der Isolierte Staat*, specifically dealt with this same topic.² Von Thünen's

work, one of the first to present a theory of agricultural land use, has been subjected to various interpretations and criticisms through the years.³ Subsequent workers have taken up his ideas and attempted to introduce elaborations, improvements, or greater precision.⁴

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¹ The ideas for this paper have evolved in the course of a number of years, in which the writer has been particularly interested in the nature, processes, and problems of urban expansion. Largely, the work reflects field observations made in the Midwest. Many concepts were derived from, or substantiated by, a study of the literature dealing with land uses in rural-urban fringe areas. The idea of relating present agricultural patterns to the theory of Von Thünen was first mentioned publicly by the writer in a lecture "Urban Expansion and its Problems in the United States," given in the Wirtschaftsgeographische Kolloquium of the Institute of Geography and Regional Planning of the Hochschule für Welthandel in Vienna, Austria, on May 6, 1964. An abridged version of the paper, titled "Von Thünen and Urban Sprawl" was read at the Geography Section of the Michigan Academy of Science, Arts and Letters in Ann Arbor, Michigan, on March 19, 1965. The author appreciates the interest and suggestions of colleagues in the Department of Geography at Wayne State University, particularly Lane J. Johnson, who devoted much time to critically appraising the initial drafts. The ideas and opinions expressed, however, are the responsibility of the author.

² J. H. Von Thünen, *Der Isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*, Part I (Hamburg: Perthes, 1826); 2nd ed. enlarged and improved (Rostock: Leopold, 1842). Parts I, II, and

III published together in Berlin (Weigandt, Hempel and Parey, 1875). There have been a number of subsequent editions. A recent work on the background of the book, and of Von Thünen himself is H. B. Johnson, "A Note on Thünen's Circles," *Annals, Association of American Geographers*, Vol. 52 (1962), pp. 213-20. This article contains a valuable list of references to literature, mainly in German, which Von Thünen inspired.

³ Reproductions of Von Thünen's agricultural land use pattern with interpretations and discussions appear in R. Krymowski, "Graphical Presentation of Thünen's Theory of Intensity," *Journal of Farm Economics*, Vol. 10 (1928), pp. 461-82; R. T. Ely and G. S. Wehrwein, *Land Economics* (New York: Macmillan, 1940), pp. 60-70; S. Daggett, *Principles of Inland Transportation*, 3rd ed. (New York: Harper Bros., 1941), pp. 453-57; G. S. Wehrwein, "The Rural-Urban Fringe," *Economic Geography*, Vol. 18 (1942), pp. 217-28; E. Otremba, *Allgemeine Agrar- und Wirtschaftsgeographie*, 2nd ed. (Stuttgart: Franck'sche Verlagshandlung, 1960), p. 125; A. Grotewald, "Von Thünen in Retrospect," *Economic Geography*, Vol. 35 (1959), pp. 346-55; and M. Chisholm, *Rural Settlement and Land Use* (London: Hutchinson University Library, 1962), pp. 21-35.

⁴ Important elaborations of the Von Thünen model are found in E. T. Benedict, H. Stippler, and M. R. Benedict, *Theodor Brinkman's Economics of the Farm Business* (Berkeley: Univ. of California Press, 1935), E. S. Dunn, Jr., *The Location of Agricultural Production* (Gainesville: University of Florida Press,

Other writers have tended to criticize his ideas because those ideas have little apparent application to modern situations. Nevertheless, Von Thünen's *Isolierte Staat* remains a classic in location theory. The work is still the base from which many agricultural land use studies are developed. The Von Thünen model is still the one against which patterns of agriculture around cities are compared.

The present study is no exception. The writer has based the first part of the study on a consideration of Von Thünen's work and an evaluation of its applicability to modern situations. In doing so, he feels at the outset that it is important to consider the theory's basic purpose, and the simple sequence of operations used in its development.

Von Thünen sought a theory to explain a pattern which he had discovered empirically, as a result of his observations and research.⁵ From his findings, he identified the basic forces determining the pattern. These basic forces became the key factors in the formulation of the theory. Essentially, therefore, the applicability of the theory depends upon the correct identification of the basic forces. Where these forces are operating, the theory provides a way of understanding the agricultural pattern, even though specific land uses might differ from those in Von Thünen's example. It is proposed in this study that those basic forces continue to operate in the less-developed parts of the world today, and that application of the theory can still be made in those areas.

On the other hand, where the basic forces identified by Von Thünen are not operating, his theory does not provide a way of understanding the agricultural pattern. This would seem to be the situation today in many advanced, industrialized parts of the world, where the basic agricultural pattern presented by Von Thünen has been outdated by changes in technology and human organization.

At the same time, the writer feels that con-

sistent land use patterns are being formed around urban areas in more industrialized parts of the world by forces other than those identified by Von Thünen. This paper identifies one of those new forces and, using it, presents a theoretical framework for understanding agricultural patterns in many present-day urbanized areas. The paper starts by outlining the main facts and logic of Von Thünen's thinking.

VON THÜNEN'S THEORY

Von Thünen's primary concern was to discover and examine the laws which governed the pattern of agricultural land use existing in his time and within his experience. He recognized that this land use pattern depended upon competition between various types of agriculture for the use of a particular piece of land. The controlling factor in this competition was Economic Rent, defined here as return from investment in the land.⁶ Stated briefly, that form of land use providing the greatest Economic Rent would make the highest bid for the land and displace all others. Von Thünen realized that transport costs were a primary factor determining Economic Rent. Moreover, because transport costs increased with distance, they imparted a spatial variation to Economic Rent. Hence, Economic Rent from any one land use can be expressed as a function of distance from the market, as is simply illustrated in Figure 1.⁷ As O , the market, is left, increasing transport costs cause the Rent per unit of land R to be diminished for each unit of distance. It is entirely absorbed at the X intercept.

This one land use, however, is competing with other land uses, which, according to their type of production, have different R -slopes. The competition between two types of land

1954), and A. Lösch, *The Economics of Location* (New Haven: Yale University Press, 1954).

⁵ Although Von Thünen's thinking was greatly influenced by Adam Smith and Albrecht Thaer, his work was based upon his own experience in the Hamburg region of North Germany, and particularly upon the scrupulous collection of data from his estate, Tellow, in Mecklenburg.

⁶ Von Thünen devoted a large section of his first volume to an explanation of Rent (*Landrente*). The simple definition given here is intended to convey the sense in which the term will be used throughout this paper. It obviously differs from the term rent in ordinary usage, which refers to payment made by a tenant for the use of property.

⁷ The diagrams used in Figures 1, 2, and 3 are not taken directly from Von Thünen's work. They are a commonly used form of presentation, however, similar to those found in Dunn, *op. cit.*, footnote 4, chapter 2; Chisholm, *op. cit.*, footnote 3, chapter 2; Grotewald, *op. cit.*, footnote 3, p. 351; and others.

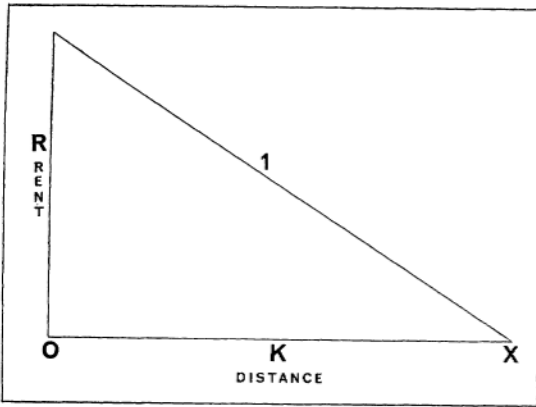


FIG. 1. Relationship of Economic Rent and distance from market.

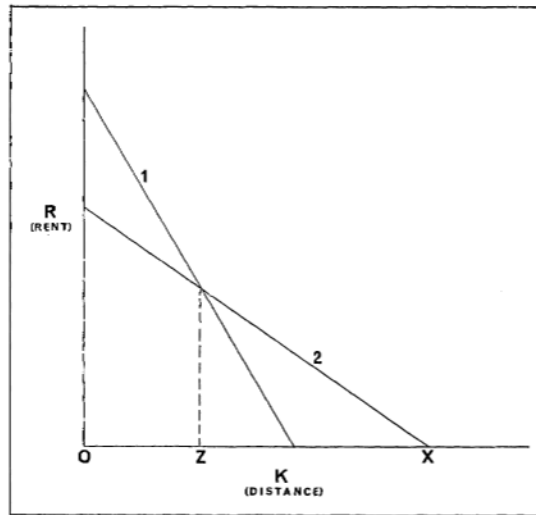


FIG. 2. Relationship of Economic Rent and distance from market for two competing land uses.

use is shown in Figure 2. Here, land use 1 yields a higher Economic Rent R close to the market, but because its slope is steeper than that for land use 2, its advantage ceases at point Z , at a distance of OZ from the market. From this point outward, land use 2 yields a higher Rent R until this is entirely absorbed at X , at a distance OX from the market. The fundamental factor governing the steepness of the R -slope is the relative ease with which the total production of a unit area can be transported. Commodities which yield a large bulk per hectare, e.g., potatoes or firewood, in Von Thünen's time, yield a high Rent close to the market, but because the transport cost per hectare is high, the Rent diminishes rapidly with distance from the market. Commodities which yield a lower bulk per hectare, e.g., grain, do not yield such a high Rent close to the market. However, because transport costs per hectare are relatively low, and the actual value per unit of weight is relatively high, Economic Rent diminishes much more slowly with distance from the market. In Figure 2, therefore, land use 1 might be potatoes, and land use 2 might be grain. One other factor influencing the steepness of the R -slope is the degree of perishability of the produce. Because of rapid deterioration, perishable commodities, e.g., milk, during Von Thünen's time, can only be produced close to the market. Hence their Economic Rent declines very rapidly with distance from the market.

Figure 2 does not only reflect the competition between particular crops. It can also refer to competition between two systems of growing the same crops. The per-hectare production of any crop can be increased by more intense application of labor or fertilizer. At the market, an extremely intensive use of land is desirable,⁸ because the resulting increased production pays off in higher Economic Rent. With greater distance from the market, such intensive land use becomes less feasible, because the advantages of increased per-hectare production are offset by increasing transport costs.⁹ A less intensive system becomes more desirable. In Figure 2, therefore, land use 1

⁸ Here, and throughout this paper, the words intensive and extensive are used in the strict, technical sense, and refer to amount of input into the land. Because input is generally related to production, the terms are frequently used quite loosely.

⁹ Two important points should be made here. First, the principle expressed is strengthened by the general operation of the law of diminishing returns. Because each successive input generally yields a smaller increment of output than the last, the desirability of a less intensive system at a distance from the market becomes even greater. This point is discussed in Chisholm, *op. cit.*, footnote 3, pp. 27-28. Second, the term transport costs refers not only to the costs of transporting products to the market, but also to the overall costs of distance (such as bringing manure and supplies to the farms). This more general concept of transport costs is assumed as the term is used in this paper.

might be an intensive crop rotation, whereas land use 2 might refer to a rotation system with considerable fallow land. There are two types of exceptions to this general rule. If a nonintensive method results in an extremely high per acre production of a low value product, e.g., wood, in Von Thünen's time, this less intensive land use can exist near the market. Secondly, if a relatively intensive land use results in a product of low bulk but high value, e.g., cheese, this land use can exist far from the market.

It should be noted that the concept of declining agricultural intensity has been the source of considerable controversy, and the concept can be regarded as a Von Thünen law only with the qualifications stated above.¹⁰ Moreover, subsequent writers have illustrated by analytic models that where more than one land use is involved, it is possible for a more extensive land use to exist closer to the market.¹¹ Nevertheless, the principle of declining intensity with increasing distance from the market is generally attributed to Von Thünen. The principle corresponded with the observed pattern of agriculture around market centers in Europe and elsewhere, and has come to be regarded as one of the basic contributions of the theory.

The competition between two land uses shown in Figure 2 can be expanded to include a number of land uses (Figure 3). In this case, land use 1 yields a greater Economic Rent in zone OZ, land use 2 in zone ZX, land use 3 in zone XW, and so on. Because O is the city, and the various land uses are found on all sides of the city, it is easy to take O as center, OZ, OX, OW, etc., as radii, and construct the famous Thünen rings. Such rings are the framework for the well-known pattern of land uses of *Der Isolierte Staat*, which Von Thünen conceived to illustrate the ideas which have been expressed.

¹⁰ Grotewald, *op. cit.*, footnote 3, p. 352, Chisholm, *op. cit.*, footnote 3, p. 28, and Daggett, *op. cit.*, footnote 3, p. 455, point out roughly the same qualifications as stated here.

¹¹ This is clearly stated and illustrated by Dunn, *op. cit.*, footnote 4, pp. 44-45. The same conclusion is reached by W. L. Garrison and D. F. Marble "The Spatial Structure of Agricultural Activities," *Annals, Association of American Geographers*, Vol. 47 (1957), p. 144.

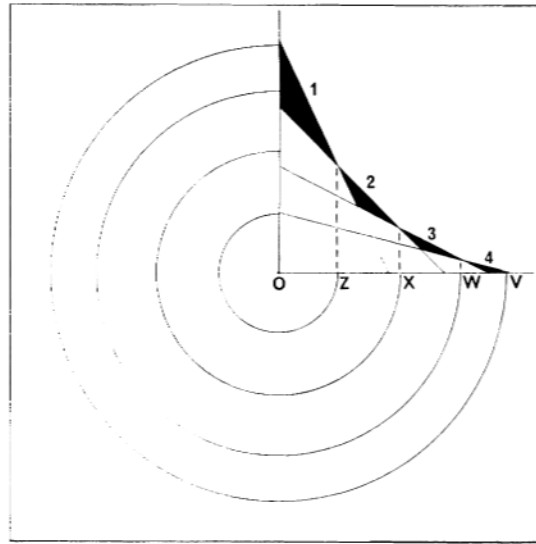


FIG. 3. Relationship of Economic Rent and distance from market for numerous competing land uses.

Der Isolierte Staat was a finite area of flat, tillable land, uniform in physical characteristics and occupied by farmers who were entirely flexible in their land use practices. The farmers utilized a single form of transportation to carry their products to one market location, a centrally located city with equal access on all sides. Given these propositions, the pattern of land uses which would be found around this city is shown in Figure 4.¹²

Zone 1 in Figure 4 is devoted to the production of vegetables and fresh milk. Such items produced high yields per acre, were perishable under the transport conditions of Von Thünen's time, and city prices for them were so high that no other land use yielded a higher Economic Rent.

Zone 2 is forest land, producing firewood and lumber. The per-hectare yield of wood was high, and at the time Von Thünen wrote, city demand was great enough to produce the necessary high Rent. The high costs of transporting wood, however, meant that Economic Rent decreased rapidly with increasing distance from the city, so that the zone did not extend far from the city.

¹² Although the terms used by Von Thünen have no direct English translation, the names used in Figure 4 are the generally accepted definitions of his zones.

The next three zones are crop farming zones of gradually decreasing intensity. The decline in Economic Rent, owing to increasing transport costs, made it necessary to apply less and less capital and labor, until only the most extensive rotation system was possible. Thus, in zone 3, rye, the most valuable crop, accounted for one-third of the land and was alternated with other crops. There was no fallow land. In zone 4, rye occupied less land and crops were mixed with pasture and fallow land. In zone 5, the three-field system prevailed, with one-third of the land in crops, pasture, and fallow respectively.

In zone 6, distance from the market was too great for crop production, and only the most extensive grazing activities could be carried on profitably.

Von Thünen was consistently aware that the idealized conditions of the *Isolierte Staat* were nowhere duplicated in reality. Indeed, the latter part of his work is devoted to examining how other variables would influence the ideal pattern presented in the first part. For example, he showed diagrammatically how the presence of a navigable river and a small town, would influence the agricultural pattern. He recognized the variability in soil fertility, in production costs, and in the living standards of farmers. He considered such factors as trade restrictions and taxes. Those considerations modified the idealized land use pattern, but did not affect the basic principles underlying his theory.

VON THÜNEN'S THEORY AND REALITY

Von Thünen's theory has stood the test of time. It was quite applicable to reality throughout his lifetime and for many decades after his death. Indeed, until very recently, the basic pattern of agricultural land use around cities in Europe and North America was in keeping with that in the *Isolierte Staat* and presumably remnants of the pattern still exist in those areas. Moreover, it appears likely that in those parts of the world where transportation is less developed and modern refrigeration techniques nonexistent, Von Thünen principles still apply. Chisholm, in a comprehensive study of the literature on the subject, cites examples of Thünen-like zones near nucleated agricultural settlements in Southern Italy and the Spanish Meseta, agro-towns in Bulgaria,

rural parishes in Finland, towns in the Pakistan Punjab, villages in Nigeria and Ghana, and the settlements of shifting cultivators in Africa and South America.¹³ The general conformity of Von Thünen's model with reality, shown in these and other examples, indicates that the basic force upon which the model was based, namely the influence of transport costs (reflecting distance to the market) on agricultural land use, was the determining force for a long period of time in Europe and North America and remains the determining force today in much of the nonindustrialized world.

The situation is quite different today, however, in the highly industrialized parts of the world. The change has been brought about by the revolutionary developments of the last few decades in technology, in human organization, and in living habits. Developments in the field of transportation have had the greatest influence. Improved and more efficient means of transport have displaced former rudimentary methods. Costs of all types of transport have declined greatly in relation to most other agricultural production costs. Moreover, transport costs are not necessarily directly proportional to distance and bulk. Because of refrigeration and air-conditioning techniques, perishable commodities can be carried long distances without spoiling. An increasing amount of agricultural produce is processed before shipment. These new developments help to satiate the changing tastes of the modern city dweller, who demands a more varied and exotic diet than local agriculture can provide.

Related to these transport considerations are three other factors which have profoundly altered the agricultural pattern in modern industrial areas. First, modern organization favors large-scale production and mass transportation of agricultural produce. As a result, physical or other advantages of distant, specialized regions have become more important than in the past. Second, for these same reasons, there is rarely such a thing as a single local market, but rather a nationwide, or worldwide market. Third, the competition for

¹³ Chisholm, *op. cit.*, footnote 3, Chapter 4. Chisholm also indicated how Von Thünen principles can be applied to scales both smaller (on an individual farm) and greater (on a world scale) than that of urban areas.

land between various agricultural land uses is complicated by increasing competition from nonagricultural uses. The result of all these factors is that the agricultural land use pattern of Von Thünen's *Isolierte Staat* and the basic forces underlying this pattern, do not conform to the reality of today's industrialized society.

It is important to recognize that the outdated of the agricultural pattern in no way reflects upon the inherent logic and consistency of Von Thünen's theory.¹⁴ What has happened is simply that the empirical evidence collected by Von Thünen concerning the production and distribution of agricultural produce does not resemble the evidence of the present time. More significantly, the basic force upon which he developed his land use theory, namely transport cost to the market, is no longer the primary determining factor in the patterning of agricultural land uses around urban areas.

The questions now arise. Is there any consistency in the agricultural patterns near the more complicated urban areas of the present? If so, are there other basic forces underlying these patterns? Further, can these forces be the foundation of a general theory, which might aid in understanding the contemporary scene?

URBAN EXPANSION

One significant fact differentiates most modern urban areas from the cities of Von Thünen's

¹⁴ Indeed, it can be claimed that Von Thünen principles explain agricultural activities on a much broader scale than that of individual cities. As early as 1925, Jonasson characterized the agricultural zones of Europe as being in keeping with Von Thünen principles. O. Jonasson, "Agricultural Regions of Europe," *Economic Geography*, Vol. 2 (1925), pp. 277-314. Ohlin placed the movements of commodities in international trade within a Thünian framework. B. G. Ohlin, *Interregional and International Trade* (Cambridge: Harvard University Press, 1933). Moreover, it is probable that an inherent value of the Thünen model is its applicability to a variety of nonagricultural situations. For example, W. Isard considered the relationship of the theory to urban land uses in *Location and Space Economy* (New York: Wiley and Sons and Massachusetts Institute of Technology, Technology Press, 1956), Appendix to Chapter 8, pp. 200-06. W. Alonso utilized the Thünen model in developing a theory of residential land in *Location and Land Use* (Cambridge: Harvard University Press, 1964). A colleague of the writer, W. Bunge, suggests that the Thünen model can be applied to a great variety of human and physical situations where a zonation of phenomena occurs.

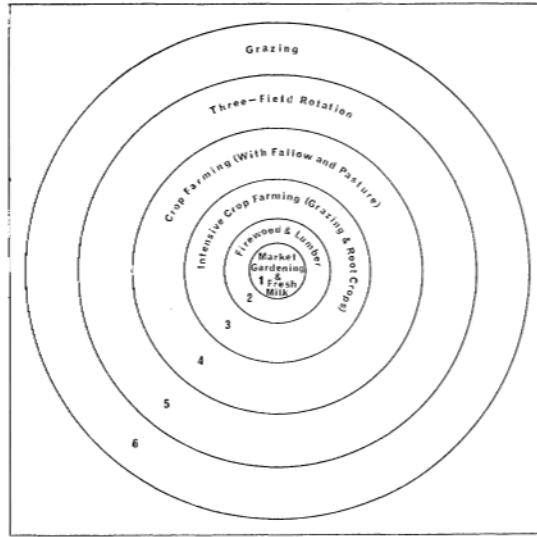


FIG. 4. Sequence of land uses in *Der Isolierte Staat*.

experience. Whereas Von Thünen envisaged a static city, with set boundaries, in most modern industrialized nations the theme is urban expansion, with population growth and constantly expanding areas of urban land use. The spreading urban region influences rural land use far in advance of the built-up area. This influence, however, has little to do with the market provided by the city, but is the result of the very nature of the expansion process. Although urban expansion is uneven and in many ways chaotic, there is evidence that it creates consistent agricultural land use patterns in the neighborhood of many of our cities. To explain why this is so, certain aspects of the process of urban expansion need to be understood.¹⁵

¹⁵ The following analysis of urban expansion is necessarily brief and limited to those aspects directly related to the theory of agricultural land use about to be presented. The literature, however, contains numerous studies dealing with particular aspects of the problem of urban expansion, or with particular areas. Probably the most comprehensive treatment of the topic is J. Gottman's *Megalopolis; The Urbanized Northeastern Seaboard of the United States* (New York: The Twentieth Century Fund Inc., 1961). Two of the most penetrating articles dealing with the process of urban sprawl are M. Clawson, "Urban Sprawl and Land Speculation," *Land Economics*, Vol. 38 (1962), pp. 99-111, and M. M. Gaffney, "Urban Expansion—Will It Ever Stop?" in U.S. Dept. of Agriculture, *Land*.

The nature of urban expansion is determined by many forces, among which the most basic are

- 1) urban and rural land price differences,
- 2) the flexibility offered all land users by modern automobile transportation, and
- 3) the whims and judgments of human beings.

Of these three, the first is most important in this analysis. Urban land today is much more valuable than rural land, so that where there is direct competition between urban and rural land uses, urban uses generally take over. Further, land where urbanization is expected also is more valuable than rural land. Such land rises in value, and either is purchased from the original owner by developers and speculators, or held by the original owner as a speculation. Finally, land which the owner thinks might become urban land at some vague future date changes in value. It does not generally change hands, but the owner carries out his activities, or changes his activities, with the feeling that something is going to happen. In short, there is an air of anticipation associated with rural land near modern urbanized areas.

It is worthwhile to digress at this point to make clear that what is taking place is quite in keeping with Von Thünen's theory of Economic Rent. That land use providing the greatest return is making the highest bid for the land and is displacing other land uses. In this case, the land use providing the highest Rent is urban land use, and it is displacing

rural land uses. Moreover, if the speculative value of land is taken into consideration, land where urbanization is anticipated provides greater Rent than purely rural land uses. Thus, Economic Rent still declines with distance from the city and the Von Thünen concept illustrated in Figures 1-3 still holds. However, when Economic Rent is translated into patterns of land use, particularly agricultural land use, the conformity with Von Thünen's theory vanishes. This is seen as the analysis of urban expansion continues.

It has been pointed out that land near urban areas is subject to an air of anticipation of urban encroachment. The degree of this anticipation has a direct influence upon agricultural land use practices, particularly upon the intensity of agriculture. For, obviously, the greater the chances of urban land uses taking over, the less practical it becomes for the owner to invest highly in capital and labor for agricultural purposes. The degree of anticipation declines with distance from the encroaching city. Hence, distance from the city again becomes the factor which determines the agricultural land use pattern. However, whereas in Von Thünen's *Isolierte Staat* distance was meaningful in terms of transport costs to the market, it is here meaningful in terms of anticipation of urban encroachment.

The effect of distance from the city thus is expressed in the following simple relationship: As the urbanized area is approached from a distance, the degree of anticipation of urbanization increases. As this happens, the ratio of urban to rural land values increases. Hence, although the absolute value of the land increases, the relative value for agricultural utilization decreases. Consequently, the capital and labor investment in agriculture, i.e., the intensity of agricultural land use, decreases. The result of this process is a basic agricultural land use pattern which is the reverse of that found in Von Thünen's time.¹⁶

¹⁶ The phenomenon of an inverse relationship between land value and quality of land use suggested in this analysis is not a unique one. Students of urban land use and human ecology will have noticed a close similarity between the process described here and that producing the concentric zone pattern of city residential neighborhoods. R. E. Park and E. W. Burgess, *The City* (Chicago: Univ. of Chicago Press, 1925), p. 203. The relationship is described by A. H. Hawley, *Human Ecology* (New York: Roland Press, 1950), pp.

The 1958 Yearbook of Agriculture (Washington, D.C.: Govt. Printing Office, 1958), pp. 503-22. An attempt at a precise definition of urban sprawl is found in a more recent article: R. O. Harvey and W. A. V. Clark, "The Nature and Economics of Urban Sprawl," *Land Economics*, Vol. 41 (1965), pp. 1-9. Probably the most widely known article is W. H. Whyte's "Urban Sprawl" in *The Expanding Metropolis* (Garden City, New York: Doubleday & Co., 1958). Earlier, but still pertinent studies are those of G. S. Wehrwein, "The Rural-Urban Fringe," *Economic Geography*, Vol. 18 (1952), pp. 217-28, W. Firey, "Ecological Considerations in Planning for Rurban Fringes," *American Sociological Review*, Vol. 11 (1946), pp. 411-23, and W. T. Martin, *The Rural-Urban Fringe: A Study of Adjustment to Residence Location* (Eugene, Oregon: University of Oregon Press, 1953). Of the many studies of urbanization in particular areas, that of H. Gregor "Urban Pressures on Californian Land," *Land Economics*, Vol. 33 (1957), pp. 311-25 is of particular value.

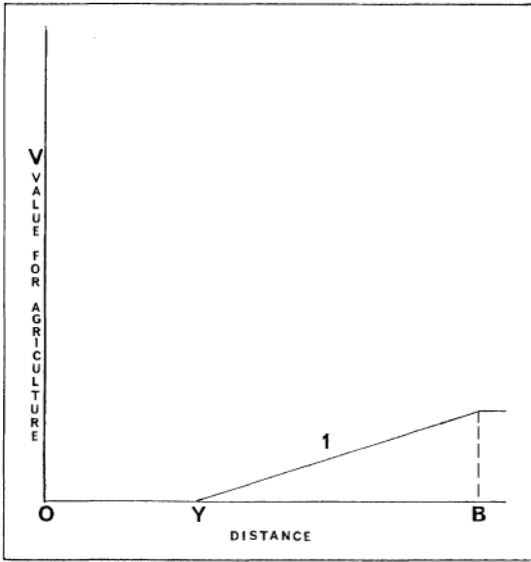


FIG. 5. Relationship of Value for Agriculture and distance from urban area.

This relationship between distance and land use can be expressed in diagrammatical form.¹⁷ In Figure 5, a single type of agricul-

280-81: "The residential property on high priced land is usually in a deteriorated condition, for since it is close to business and industrial areas it is being held speculatively in anticipation of its acquisition by more intensive and, therefore, more remunerative land use. In view of that probability, owners of such property are not disposed to spend heavily for maintenance or to engage in new residential construction." The same inverse relationship underlies Firey's "Theory of Social Utility" as applied to fringe areas. The relationship is expressed as follows in Firey, *op. cit.*, footnote 15, p. 142: "Between Rent and social utility there is an undoubted correlation, but only within a limited range of values of the two variables. Beyond that range the relationship becomes inverse. Thus up to a certain point the progressive subdividing of vacant lands around a city will entail both increased Economic Rent and increased social utility. But beyond that point a continuation of the subdividing process, while further increasing the land's Economic Rent, will entail diminished social utility to the community. This will manifest itself in high fire insurance rates, new health and sanitation problems arising out of inadequate water and sewerage facilities, a decreased tax base attendant upon population outflow, and diminished civic participation on the part of suburban dwellers."

¹⁷ It should be made clear that Figures 5, 6, and 7 are not Economic Rent models and that the slope V does not represent the same as slope R in Figures 1, 2, and 3. It is conceivable that this diagram could be

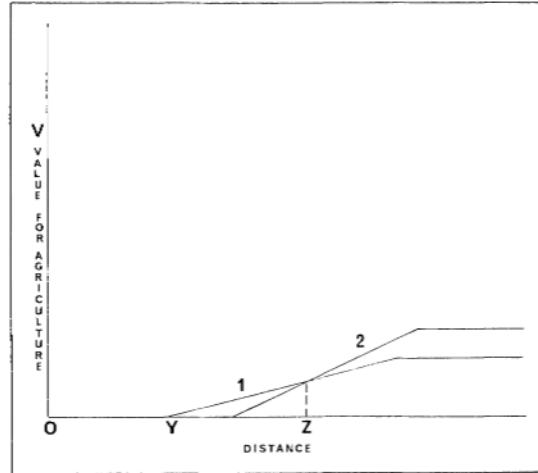


FIG. 6. Relationship of Value for Agriculture and distance from urban area for two competing land uses.

tural land use is measured in terms of V , defined as the value of carrying out this type of agriculture. As O (the urbanized area) is approached, V decreases because the probability of urbanization increases. V is entirely absorbed at the Y intercept. With increasing distance from O , V increases until it levels off at point B , where there is no more anticipation of urban land prices.

This one land use, however, is competing with other land uses, each with different V -slopes. The competition between two types of land use is shown in Figure 6. Here, land use 1 prevails in zone YZ , but because its V -slope is less steep than that of land use 2, its advantage ceases at point Z . From this point outward, land use 2 takes over. The factor governing the steepness of the V -slope is the intensity of the agricultural investment.¹⁸ Land use 2 is the more intensive type of agriculture, which pays off in greater agricultural returns at a distance from the city. As the city is approached and the likelihood of urbanization increases, the value of such intensive invest-

correlated with an Economic Rent model of urban and speculative land, as explained above. However, it is felt that the present diagram expresses more directly the operation of urban expansion upon agricultural land use.

¹⁸ In certain cases, intensity of agricultural investment might better be expressed as length of time of agricultural investment. The relationship between the two concepts is discussed on a later page in this paper.

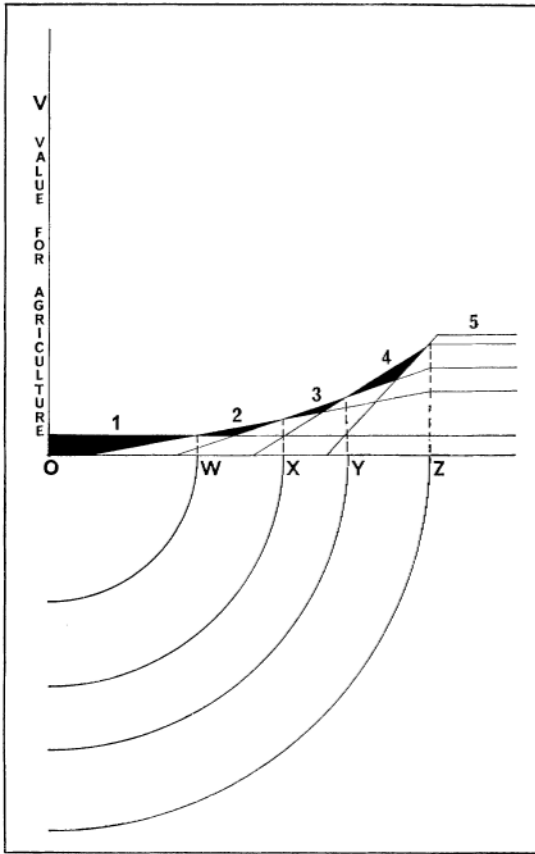


FIG. 7. Relationship of Value for Agriculture and distance from urban area for numerous competing land uses.

ment in farming declines rapidly. At point Z, it does not pay to carry out this type of farming, although it is still feasible to carry out a type of agriculture which requires a smaller investment (land use 1).

The concept can be extended to include various intensities of land use (Fig. 7). Here land use 1 (the least intensive) will prevail in zone OW, land use 2 (more intensive) in zone WX, land use 3 in zone XY, and so on. Land use 5 extends to an undetermined distance N from the city, because this land use is outside of the area where urban land prices can be anticipated. It is the regional type of agriculture, governed by factors other than the direct influence of the urbanized area. With O as center and OW, OX, OY, etc. as radii, a series of rings, corresponding to Von Thünen rings, can be drawn.

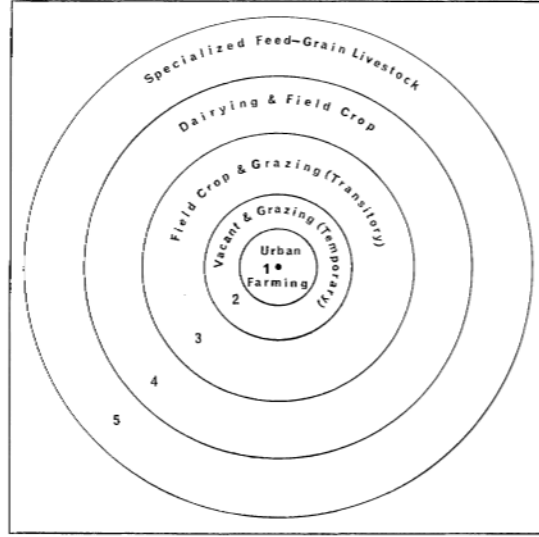


FIG. 8. Theoretical sequence of land uses around expanding metropolitan area.

A THEORETICAL PATTERN OF AGRICULTURE

Utilizing this theory, let us examine the type of agricultural land use pattern which might evolve today in an area with an advanced industrialized economy. Assume a large agricultural region of specialized feed-grain livestock economy in the United States Midwest. The region is uniform in its productivity, in the type of farming which has developed through time, and in its access to a nationwide market. Assume that the farmers throughout the region are flexible in their farming activities and shrewd enough to take advantage of changing opportunities. At one side of this agricultural region, assume a large metropolitan area, growing in population and steadily engulfing the rural land around it. Assume, finally, that the forces connected with urban expansion influence agricultural practices evenly on all sides of the urbanized area. Given these propositions, the pattern of agricultural land use around the metropolitan edges would be as shown in Figure 8.¹⁹

In zone 1, at the edges of the built-up area, land is either changing to urban uses, is being subdivided, or is being held by speculators or

¹⁹ Although the land use pattern described in the following section is a theoretical one, general ideas for its construction were derived from the findings of field studies.

developers for early development. Some farmers, for various reasons, might not wish to sell their land in spite of the high prices they are offered. They are exceptions, however, and are generally forced out of farming by high urban taxes, zoning practices, or by the nuisances associated with urban living.²⁰ One or two types of agriculture might still be pursued in an otherwise suburbanized environment. These are activities, such as poultry-keeping, greenhouses, or mushroom growing, which generally take place in buildings, quite often multi-storied buildings. Such activities do not correspond to the market-gardening and dairying found in zone 1 of Von Thünen's *Isolierte Staat*. They are, rather, farm factories, and are really industrial, as much as rural, forms of land use. Even these land uses are generally destined for early disappearance.²¹

Zone 2 is mainly a zone of vacant land, where urban subdivision is not yet taking place, but where farming, in general, is no longer carried on. This zone is characterized by broad expanses of barren, unused land, owned by speculators, or farmers who intend to sell the land at the most profitable time. The uncertainty as to when that time will come means that the farmer has no guarantee of continuous farming operation. Generally, he does not farm at all. Sometimes, he rents his land to urban groups for recreational purposes. Any farming activities which do take place in this zone are short-lived and extensive, as where land is leased to some farmer in a more distant zone for the grazing of his animals, or crops of hay are grown with the primary object of keeping down weeds.

Zone 3 is a field crop and grazing zone. It is an area of transitory agriculture, where farming activities are carried on, but with the anticipation of urbanization at some future date.

²⁰ These nuisances are many and varied. Suburban children steal fruit, tramp through grainfields, and frighten livestock. The increasing spread of concrete interrupts the water table, causing flooding or drainage problems in the farmer's fields. Careless urbanites use the fields to deposit bottles and other trash. Ironically, the farmer is often considered the intruder who causes dust and smells in new residential suburbs. He is often subject to discrimination and social ostracism. Even planners often seem to be unable or unwilling to understand the farmer's viewpoint.

²¹ Generally, strong and constant pressure is put on zoning boards by newly formed communities to zone out such obnoxious land uses.

The farmer does not wish to invest capital. Hired labor is too expensive, and it is more profitable for members of his family to find employment in the city than to work on the farm. Frequently, the marketing and supply services so necessary to modern agriculture have moved out of the immediate area, further hampering farming activities. Farming, therefore, tends to be quite extensive. Cash crops have taken over land where more intensive animal husbandry once prevailed. Quite often the land is rented to outside operators who grow winter wheat, corn, or hay, or use the land for pasture.²² Former goals, such as high productivity per acre, or maintaining land fertility, are no longer present. Over-all, agriculture is steadily becoming less intensive.

Zone 4 is a broad zone of dairying and field crops. At the inner margins of the zone, where there is some anticipation of future urban encroachment, farmers are shifting from dairying to less intensive and less confining cash cropping. Elsewhere, however, the zone is outside the price mechanism of the city in terms of land use being influenced by anticipated urbanization. On the other hand, it is still within the city's influence in a marketing sense because it constitutes the major part of the fresh milkshed of the metropolitan area.²³ Dairying is the main activity, whereas field crops and meat livestock are found near the zone's outer boundary.

Finally, in zone 5 is found the specialized feed-grain livestock of the Corn Belt. The economy is not under the influence of the metropolitan area in any direct way. It con-

²² Farmers have often been able to obtain an income by putting land in the government soil bank program, a practice which obviously results in even more extensive rural land use.

²³ Even the presence of this milkshed is to some degree artificial in that it is held there partially by health regulations which prohibit the importation of milk from more distant regions. In essence, the milkshed is an area licensed and inspected by a city or state government to produce milk for the consumption of a city. See A. C. Dahlberg and H. S. Adams, *Sanitary Milk and Ice Cream Legislation in the United States*, Bulletin of the National Research Council, No. 121 (Washington, D.C.: National Academy of Sciences-National Research Council, July, 1950). Also L. Durand, Jr., "The Major Milksheds of the Northeastern Quarter of the United States," *Economic Geography*, Vol. 40 (1964), pp. 9-33.

tinues to serve, and be influenced by, a nationwide market.²⁴

In brief, given the stated assumptions of a uniform farming region, flexible farmers, and an orderly influence of the expanding city's price mechanism, the agricultural land use pattern would show zones of gradually increasing intensity from the built-up edges of the metropolitan area to where the city has no direct influence upon agricultural practices.²⁵

FACTORS WHICH MIGHT MODIFY THE PATTERN

It is not surprising that the theoretical pattern presented in this paper is seldom duplicated in reality. The idealized circular pattern of agricultural activities is disrupted by many factors, in some respects more so than the idealized pattern of Von Thünen's *Isolierte Staat* was disrupted by factors present during his lifetime.

First, the stated assumptions of uniformity and simplicity are never found. Agricultural regions are uniform neither in type of farming nor in productivity. Farmers do have individual whims and prejudices. A road and settlement pattern is already in existence. Furthermore, the presence of a single metropolitan area, isolated from other metropolitan areas, is probably the exception rather than the rule.

Second, urban sprawl tends to be somewhat chaotic. Expansion of urban land uses proceeds in an uneven, and often apparently aimless, pattern. It extends along transportation arteries. It develops around certain nodes on these arteries. It concentrates around other nodes (factories or shopping districts) at some distance from the main urbanized area. It leapfrogs over intervening rural areas. It is often affected by, or dominated by, planned public developments (military establishments and air bases). Finally, it coalesces with the spread of other cities encroaching from other directions. The pattern of agriculture associated with urban expansion is affected by all the variations and irregularities in the path of this expansion and the concept of a ringed

pattern is somewhat unreal. In this respect, however, the model presented in Figure 7, like the model illustrating Von Thünen's theory in Figure 3, need not have been converted into rings. The model could be considered rather as a zonal arrangement, which can extend out from any original shape.

Third, the uneven nature of growth depicted above not only can affect the shape of the agricultural pattern, but can lead to the elimination of zones within the pattern, particularly the outer zones. This happens when urban encroachment from one direction merges with that from another direction, either in the case of two different metropolitan areas, or two sections of the same metropolitan area. The coalescing inner zones can squeeze out the outer zones entirely. An interesting example of this process has been observed by the writer in southern Macomb County, Michigan, an area dominated by two finger-like projections of urbanization, extending from the city of Detroit. The characteristic sequence of agricultural zones extends laterally from both these urbanized arteries into the intervening sector of land. In the period of the author's experience there has not been evidence of zone 5 in this area, but the land use of zone 4 was once prevalent in the central section, farthest from the two urbanized fingers.²⁶ Zone 4, however, has disappeared in recent years. It is to be found farther north in the county, where distance from Detroit is greater, and the space between the two fingers is larger. The large areas of vacant land which commonly extend uninterrupted between two cities or between two built-up parts of a metropolitan region, might often indicate that all but zones 1 and 2 of the former agricultural pattern have been eliminated.

Fourth, by reason of its very causation, the pattern of agriculture here presented is a dynamic one. In an area where there is steady urban expansion, therefore, the agricultural zones are constantly shifting outward, the land uses of zone 1 taking over zone 2, those of

²⁴ It will be recognized that in this present example, zone 5 has a less intensive type of agriculture than zone 4. Theoretically, because zone 5 is not directly affected by the urbanized area, it can be either more or less intensive than zone 4, depending upon the general nature of the regional agriculture.

²⁵ With the possible exception noted in footnote 24.

²⁶ This fact is substantiated in a detailed land use study made in 1948 along the western margin of the area in question. See F. A. Stilgenbauer, "Settlement Expansion across Detroit's Northern Metropolitan Rim into Southwest Macomb County," *Papers of the Michigan Academy of Science, Arts, and Letters*, Vol. XXXV (1949), pp. 219-34.

zone 2 taking over zone 3 and so on. Steady expansion, however, is the exception rather than the rule. Urban expansion fluctuates greatly in space and in time. For various reasons, such as the extension of a water or sewage system, one portion of a suburban region might be rapidly urbanized as an adjacent portion lies stagnant.²⁷ Similarly, an area might participate in rapid urban growth for a short period, and then wait for a long period before growth again occurs. Often a new growth period never comes. During the nongrowth period, the agricultural pattern may be stabilized for a long period of time.

The stabilization of the agricultural pattern is a phenomenon of great significance and some paradox. For theoretically, because the pattern is brought about by the dynamic quality of the expansion process itself, one might expect the pattern to be disrupted when that process stops. Instead, the pattern tends to be stabilized. This phenomenon reflects the fact that, although urban expansion itself has ceased, the commitments and uncertainties connected with the anticipation of urban expansion, remain. Some land is already in the hands of speculators. Other land has begun to deteriorate. Farmers have reduced their overhead. Some may have invested already in other land far from the urban areas. Services for agriculture have gone. The anticipation that another period of urban expansion will take place is maintained. Hence, the pattern remains. Moreover, it is unlikely that an inward shifting of agricultural zones would ever take place, although it is possible that isolated land uses from an outer zone might eventually move into one of the inner zones.

Finally, the general process by which the forces of urbanization influence agricultural land use patterns can be interrupted by various public policies. For example, in many areas, particularly in California, increasing consideration is being given to exclusive agricultural zoning of Class 1 land.²⁸ In some instances,

²⁷ For an analysis of the forces leading to the development and nondevelopment of certain suburban land, see Clawson, *op. cit.*, footnote 15, pp. 104-06.

²⁸ For different viewpoints on agricultural zoning, see J. Lessinger, "Exclusive Agricultural Zoning; An Appraisal," *Land Economics*, Vol. 34 (1958), Part I: "Agricultural Shortages," on pp. 149-60 and Part II: "Comparative Advantage," on pp. 255-62; Gregor,

farmers have even incorporated to protect their land.²⁹ Whereas it is generally admitted that such measures can have only temporary and limited success, they do cause variations in the land use pattern in and around metropolitan areas.

The variations which have been discussed disrupt substantially the idealized land use model which has been presented, and in some cases allow for striking exceptions to the theoretical pattern. As such, they may be considered distracting variables. These variables do not, however, affect the validity of the principles underlying the theory, which is believed to bring order to agricultural land use patterns near many modern urban areas.

APPLICABILITY OF THE THESIS

Before discussing the applicability of the thesis which has been presented, it is important to point out the bases upon which its main ideas rest. The thesis is not a pure economic model, in that it is not based upon measured economic costs, such as transport costs in the Von Thünen model.³⁰ It is rather a theoretical construct based upon an analysis of the contemporary urbanization process. This analysis provided insights into the basic forces determining agricultural patterns, and hence allowed the logical derivation of a theoretical pattern. The specific make-up of the model is founded empirically upon observations in the vicinity of urban areas in the Midwest, and more particularly upon field investigations conducted in the Dayton-Cincinnati and Detroit regions. Indeed, the existence of patterns similar to the theoretical one is borne out by observations in the areas of the Midwest with which the writer is most familiar.

If the thesis is valid, however, it should be more widely applicable. For the motivating

op. cit., footnote 15, p. 324; J. Gillies and F. Mittelbach, "Urban Pressures on Californian Land—Comment," *Land Economics*, Vol. 34 (1958), pp. 80-83; Whyte, *op. cit.*, footnote 15, pp. 131-39, and D. Solberg, *Rural Zoning in the United States*, U.S. Dept. of Agriculture, Agricultural Information Bulletin No. 59, 1952.

²⁹ G. J. Fielding, "Dairying in Cities Designed to Keep People Out," *Professional Geography*, Vol. XIV (1962), pp. 12-17.

³⁰ The thesis can, however, be related to the Von Thünen model, as noted in footnote 17.

force of the theory, namely the influence of anticipated urbanization upon the agricultural use of the land, operates in many parts of the Western world. For this reason, the writer has searched the literature for evidence of the processes and patterns outlined in this paper. As might be expected, material is not presented in a manner which precisely documents a theoretical pattern. Moreover, alternative explanations are possible in most cases. However, many studies do provide cases which logically can be associated with the thesis presented here.

One of the most complete discussions of rural land uses in a metropolitan environment is found in Gottman's chapters.³¹ Throughout these chapters, a dominant theme is the high proportion of unused, forested land found in Megalopolis. This forested land appears to result from those same factors which account for the large acreages of vacant land characterizing zone 2 (vacant and temporary grazing) of Figure 8. Gottman states the situation as follows:³²

This predominance of woodland results from the imbalance between expanding urbanization and shrinking agricultural lands. More formerly tilled farm acreage is being abandoned and is reverting to wooded growth than is being consumed by urban and related special uses, and this has been true for some time.

Considerable space in *Megalopolis* also is devoted to discussion of part-time and estate farms operated nonintensively by wealthy owners whose main income is derived from the city.³³ Such farms might be considered a special form of the low-intensity land use found in zones 2 and 3 (vacant and transitory farming zones respectively) of Figure 8. Finally, *Megalopolis* contains many examples of factory farms which were designated the only type of farm able to survive in the Urban Farming zone (zone 1) Figure 8.³⁴

³¹ Gottman, *op. cit.*, footnote 15, Ch. 5, "The Symbiosis of Urban and Rural;" Ch. 6, "Megalopolitan Agriculture," by Edward Higbee; Ch. 7, "The Woodlands, Their Uses and Wildlife."

³² Gottman, *op. cit.*, footnote 15, p. 342.

³³ See discussion of Estate Farms, pp. 314-19 and Fig. 100 of Gottman, *op. cit.*, footnote 15.

³⁴ References to these factory farms are found throughout Chapter 6 of *Megalopolis*. Their nature is summed up in the following: "Dairy cattle and poultry may be kept profitably in urban areas only

A specific study of how suburbanization affects agricultural land use was conducted by Moore and Barlowe in two areas near Lansing, Michigan.³⁵ Both areas are in a region where dairying has traditionally been the most profitable farm enterprise. Both areas have experienced a shift from dairying to cash crops. Moreover, closer to the suburban area, a preponderance of the cropland was found to be idle or in relatively extensive use through rental to nearby farmers for pasture, hayland, or grain fields. In the same area:³⁶

much of the land was planted to wheat, grass, or corn; but not all of it was harvested. Many residents grew a crop on their land to keep down the weeds.

Many farmers in both areas felt that advancing suburbanization resulted in poorer farming practices. Fewer livestock were kept. Less attention was paid to good cultural and soil conservation practices. Cash cropping, rather than regular fertility-building rotation, was common. Mining the soil apparently was related to the imminence of platting for nonfarm uses. These practices were in many cases associated with an increase in part-time farming:³⁷

The shift from full-time farming has often resulted in less intensive and less efficient farming operations. For most of the farms in the two areas, dairying probably represents the most profitable enterprise. Yet most of the part-time farmers and even some of the full-time operators have shifted to cash crops or to livestock enterprises of a less confining nature than dairying. It is hard to gauge the full effect of this shift in terms of reduced total production. However, it is more or less obvious that much agricultural land is now used somewhat less

if they are as compactly housed as people and maintained in the same way, with feed brought to them from cheaper land. Agriculture must become a factory culture if it is to survive in the heart of Megalopolis." p. 320. Similar striking examples of zone 1 factory farming are illustrated in various recent studies of "Industrialized Drylot Dairying." See H. Gregor, "Industrialized Drylot Farming; An Overview," *Economic Geography*, Vol. 39 (1963), pp. 299-318; Fielding, *op. cit.*, footnote 29, pp. 12-17; and L. Durand, Jr., "The Dairy Industry of the Hawaiian Islands," *Economic Geography*, Vol. 35 (1959), pp. 228-46.

³⁵ E. H. Moore and R. Barlowe, *Effects of Suburbanization Upon Rural Land Use*. Michigan State University Agricultural Experiment Station, Technical Bulletin 253 (September, 1955).

³⁶ Moore and Barlowe, *op. cit.*, footnote 35, p. 15.

³⁷ Moore and Barlowe, *op. cit.*, footnote 35, pp. 30-31.

intensively than it would be if the owners were primarily dependent upon farming for a living.

In a similar study of urban fringe areas near Milwaukee, Wisconsin, Walruth found great variation in the responses to different stages of urbanization.³⁸ Some areas were changing to less intensive land uses, whereas some dairy farmers were farming more intensively. Walruth, however, found an interesting relationship between the new growth of suburban areas and the acreage of tame hay which seems to reflect the operation of the forces described in this paper:³⁹

Hay acreage in some sections was expanded because of the acquisition of farmland by persons whose only interest in farming is to keep weeds down by cutting hay or by selling the standing crop. In other sections, with only a slightly different ownership pattern, these acreages would be untended and considered to be idle.

In the same article, Walruth considered the effect of zoning upon land uses in fringe areas. He concluded that zoning had but slight control over agricultural land use changes.

Grotewald, in a study of changes in land use and agricultural production near Kansas City and St. Louis, noticed:⁴⁰

a general decline in the cultivation of perishable and bulky commodities and a decline in intensive types of farming.

Further, Grotewald stated that he found basically the same trends in the Chicago area.

Honzatko, in a statistical survey of agriculture in the Detroit metropolitan area, was surprised to find a prevalence of nonintensive field cropping at the southern edges of the Detroit urbanized area in Monroe County, Michigan.⁴¹

The studies described thus far, though undertaken in a variety of farming regions, have certain characteristics in common. In general,

they took place in regions where agriculture was diversified, involved livestock raising, and was relatively intensive. In these situations, the forces associated with urban expansion led to agricultural practices which were simpler, less confining, and less intensive. Agricultural zones could be identified with those of the model outlined in this paper. It would appear that in such areas the proposed theoretical framework is most directly applicable.

A study involving urban expansion in an entirely different environment is Lessinger's analysis of agriculture in the San Jose area of California.⁴² By analyzing the age and bearing conditions of fruit orchards in different zones around the city, he discovered that the amount of deterioration of the orchards was closely related to the degree of anticipation of urban demand as reflected in land prices. Since allowing fruit trees to deteriorate is essentially a way of using the land less intensively, the pattern found by Lessinger would seem to correspond very closely to tenets proposed in this paper.

Krueger found a similar situation in the Niagara fruit belt of Ontario, where⁴³

when urban development is approaching, there is reluctance to plant new orchards which would take at least five years to mature.

Krueger also discussed how short-term leases (in areas at the urbanized margins) lead to a decrease in farming intensity and farm productivity.

Gregor, in a study of urban pressures on California land, presented evidence which seems to contradict parts of the theory proposed in this paper.⁴⁴ It was pointed out, for example, that there is much less vacant land close to urban areas in California than in other parts of the country:⁴⁵

³⁸ Study quoted in H. A. Johnson, "Planning for the New Land Frontier" in U.S. Dept. of Agriculture, *Land. The 1958 Yearbook of Agriculture* (Washington, D.C.: Govt. Printing Office, 1958), p. 577.

³⁹ Johnson, *op. cit.*, footnote 38, p. 578.

⁴⁰ Grotewald, *op. cit.*, footnote 3, p. 347. Indeed, Grotewald indicates on page 348 that it was mainly these discoveries which led him to analyze and re-evaluate Von Thünen's theory.

⁴¹ G. Honzatko, *Agriculture in the Detroit Region* (Detroit: Detroit Metropolitan Area Regional Planning Commission, January, 1960).

⁴² J. Lessinger, *The Determination of Land Use in Rural Urban Transition Areas: A Case Study in Northern Santa Clara Valley, California*: Unpublished Ph.D. Dissertation, Dept. of Agricultural Economics, Univ. of California, Berkeley, California, 1956. Also quoted at length in Gaffney, *op. cit.*, footnote 15, pp. 503-22.

⁴³ R. Krueger, "The Disappearing Niagara Fruit Belt," *Canadian Geographical Journal*, Vol. LVIII (1959), pp. 102-14.

⁴⁴ Gregor, *op. cit.*, footnote 15, pp. 319-20.

⁴⁵ Gregor, *op. cit.*, footnote 15, p. 320.

Agricultural productivity, while beginning to decline, is still often comparatively high at the time of urban absorption. If cropping ceases, it is usually of short duration.

Gregor also found that small vegetable farms tend to take over cropland nearest the built-up area, crowding out the other farms (fruit farms, and large specialized vegetable farms) which previously had been dominant. It is possible that this zone of market gardening corresponds to zone 1 of the Von Thünen pattern shown in Figure 4. The explanation for this phenomenon, however, could be quite different. Small-scale vegetable farming, intensive as it might be, represents a short-term investment, with relatively quick returns, when compared to the agriculture which is being displaced. In other words, vegetable farming is an interim type of farming which produces relatively large, but short-lived, returns from land vacated by other types of agriculture until urban uses actually take over the land. Viewed in this way, the zone is not out of keeping with the theoretical pattern described in this paper.

These examples from fruit and vegetable areas introduce a concept which might be considered a corollary to the proposed theory. It appears that agricultural activities involving long-term investment are more directly affected by the anticipation of urbanization than those involving short-term investment. Hence, activities with a short-term investment are found closer to the city and those with a long-term investment become more common with distance from the city. Although length of investment time might not always correspond to degree of agricultural intensity, the two are related and the basic principle is the same.

Extensive field observations in still a different agricultural environment indicate that there are farming regions where there is no marked zonation of agriculture at the margins of expanding cities.⁴⁶ These are primarily specialized regions of one-crop agriculture (such as parts of the cash grain region) where urbanization brings no noticeable change in the type of agriculture and where indeed "bulldozing often awaits the harvesting of the

⁴⁶ Suggestions made by several geographers who have read initial drafts of this paper.

current crop."⁴⁷ The absence of agricultural zonation in such regions is contrary to the concept of pattern assumed throughout this paper. However, the lack of zonation does not necessarily contradict the basic principles which have been advanced. For in these specialized regions, the overall type of agriculture is nonintensive, or involves short-term investment. Hence there is no clearly advantageous, less intensive, or shorter-term adjustment possible, except to stop farming completely. Because of the relatively simple and generally large-scale nature of farm operations, farming can be carried on until the land is taken over for nonagricultural purposes, even though the value and ownership of the land has changed.

This consideration of specialized farming areas introduces a second corollary to the proposed theory. In the case of specialized agricultural activities which are already nonintensive, involve a short-term investment, and require relatively simple farming procedures, urban expansion does not necessarily bring about the distinct zonation of agriculture found in more diversified farming areas.

In total, many studies indicate that the frame of reference presented in this paper can be applied to nonurban land near many urban areas. In certain situations, intensity of land use might better be expressed as length of agricultural investment, quality of farming, or amount of deterioration, but the concept is the same. In specialized farming regions, there is often an absence of agricultural zonation, but this too can be explained within the logic of the theory. In sum, although no study has documented in detail the theory of zonal land use presented here, the concept of agricultural land use increasing in intensity and quality with distance from the encroaching city seems widely applicable. Further, the principles underlying the proposed theory appear to constitute an approximate explanation for this phenomenon.

CONCLUSION

The concern of this paper has been agricultural patterns near urban areas and the forces

⁴⁷ Phrase suggested by the referee to whom this paper was sent by the Editor of the *Annals*. The writer is grateful to the referee for his valuable suggestions, several of which have been incorporated into the latter part of this paper.

which determine these patterns. I suggest that the basic forces identified by Von Thünen are still important in less developed parts of the world, and that in these areas Von Thünen's theory can still be applied as the basic explanation of agricultural land use patterns. In more advanced industrialized parts of the world, however, evidence for Von Thünen's theory no longer appears to dominate the agricultural scene, and the basic forces identified by Von Thünen no longer are the primary de-

terminants of agricultural patterns around cities. The theory presented here is based more firmly upon evidence from the present scene. It incorporates motivating forces which were not of major significance during Von Thünen's time and provides a logical framework of agricultural zonation based upon those forces. It is felt that the theory can be applied to many contemporary conditions and hence provides a meaningful way of looking at agriculture around today's metropolitan centers.