Land Value Maps are Not New, But Their Utility Needs to be Re-Discovered

H. W. Batt
Central Research Group, Inc.
Albany, N.Y. 12204
UNITED STATES OF AMERICA
Tel.: + 518-462-5068
E-mail: hwatt@yahoom.com

Abstract

Central to the successful and accurate assessment of real property parcels, especially given their variation in urban settings, is the sound valuation of the land components. Since improvements depreciate – by one study at the rate of 1.5% yearly – it is the land values that are responsible for the rise in property values. Moreover, land values reflect a community’s economic productivity and vitality and not the activity of any single titleholder. It is therefore important to see land parcel values in relation to one another. A century ago when Henry George’s arguments for taxing only land values were better appreciated this was understood very well. Land value maps were regarded as sound practice and commonly used. However, because land and improvements have mostly been taxed at the same rate, and because the labor costs of creating land value maps were high, their use gradually fell into decline. Today the availability of geographic information systems (GIS) computer technology allows them to be created easily, cheaply and quickly. They can improve the accuracy of land valuation and easily show the soundness credibility of any given assessment. Furthermore, GIS land value maps, done routinely, would facilitate the wider implementation of land value taxation. Since taxing the stream of ground rent reflected in site values is by general acclaim the most ideal revenue stream, it can make easily feasible what has long been a technical and administrative obstacle.

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I. Introduction

Land value maps are an important and even necessary means of assuring that assessments are sound, however real property is taxed, either by the conventional or by the site value method. Such maps can portray the contours of location values simply and accurately, showing all the peaks and valleys reflecting the various economic focal points of market activity. Just as topographical survey maps clearly show land elevations – all the shapes of terrain covering the earth's surface – similar maps portray the basis of taxation reflecting economic activity.
Graphical portrayal of land ownership for purposes of titles and taxation goes back to ancient times. Cadasters, the name for records of ownership and use is less common. For most of our history, land parcel locations, dimensions, and ownership were almost the only data noted. When taxes were first applied, only parcel size, title and perhaps productivity had relevance. All this history has now been wonderfully recounted in the works of Professor Roger Kain, especially his book titled *The Cadastral Map in the Service of the State*.\(^1\) Yet only in the past century and a bit longer have cadastral maps regularly recorded the assessed market value (and therefore the taxable value) of parcel sites. *The Cadastral Map* touches on this growing practice but only in its final pages.

With the rise of industrial economies cities grew to a size where market centers and city edges came to have markedly different site values. Prior to such time, little account was taken of site values because land was not sold as a commodity and because what site rents were paid to landlords or royalty typically took the form of corvee labor and gifts. As parcels of land became a commodity, the duties of titleholders were paid in taxes, which required an assessment of their market value. British economist David Ricardo understood these values largely in terms of their agricultural productivity, and worked out formulas by which to understand site yields in terms of their ground rent. Rents could be collected either as they accrued, or capitalized whenever the parcels were exchanged on the market. With the rise of cities, however, the strategic access and location of parcel sites determined their rental value far more than farming productivity.

Today, urban land typically has market value many times that of farmland. This is because the agglomeration of economic activity creates a synergy that enhances the advantages that locations offer. All this was first worked out in detail by the early 19th century economic geographer Johann Heinrich von Thunen.\(^2\) Von Thunen developed the basics of the theory of marginal productivity in mathematical formulas that still hold. In fact this long obscure German landowner is today ranked on a level with Marx by noted historian Fernand Braudel. Locational value in economic modeling, and especially for applications in transportation, marketing, taxation, and other resource allocation studies has given renewed impetus to these formulas, especially now that computer programs can answer more complex and ever-challenging questions.

The market value of locations is now easily and quickly mapped too, largely on account of the development of computer maps, commonly known under the rubric of Geographical Information Systems (or GIS). Because parcel sites today are also often bought and sold as commodities, the price of places can be ascertained by using the records of sale. Mapping the value of sites, beyond simply their dimensions, use, and ownership, is a technology that has now come fully into its own, even though it had its origins over a century ago. The book mentioned earlier, *The Cadastral Map*, takes us to the point where real property maps were first being used in valuation. Technology continues to progress so rapidly now that dozens of books are specializing in various dimensions of spatial analysis, assessment and tax policy being one of many.\(^3\)

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2. See especially Wikipedia, and further discussion below.
Antecedent to the development of modern land value maps was often the creation of what have been called insurance atlases. Harvard University library has compiled and digitized several maps of historic Cambridge, some showing land ownership and others for insurance ratings, the earliest dating from 1873. David Cobb, the curator of the university's map collection notes that “the land ownership atlases, for example, reveal in tiny print just exactly who owned what properties and when. The digitized fire insurance maps are equally meticulous, revealing building infrastructure details otherwise lost to history. Since insurance companies used fire insurance atlases to quickly determine the cost of insuring a building against fire, they capture information like sprinkler systems, fire escapes, and types of construction. The latter is color-coded: yellow for wood, pink for brick, blue for stone. . . . If you’re familiar with these maps, with a glance you know just what kind of construction you’re looking at,” says Cobb. “You’ll see what kind of windows a building had and where they were, whether there was an elevator, how many stories the building had… You get a lot of details.”

Chicago also has a record of fire insurance maps, dating from roughly the same period. The earliest is Robinson's Atlas of the City of Chicago, published in 1886, annotated and corrected in later years. The fire districts are carefully demarcated and updated by amending older maps in view of the expense of their production.

II. Twentieth Century Land Value Mapping

With the rise of industrial cities, especially in late 19th century America and Britain, the first attempts at the valuation of parcel sites took form. Real property had long been taxed but logic and methodology were often wanting. Movements for reform in these areas were inspired by proponents of land value taxation, especially by adherents of the economic philosophy of American journalist and economist Henry George. George's book, *Progress and Poverty*, first published in 1879, had become a worldwide best seller by the turn of the 20th century, was published in several languages and inspired widespread discussion and debate. The earliest mappers of urban land configurations were for the most part Georgists. A few, particularly, deserve mention: Richard Hurd, William A. Somers, and Lawson Purdy.

Richard Hurd first published his book, *Principles of City Land Values*, in 1903, although he began looking into the subject as early as 1895. Hurd had been put in charge of the Mortgage Department of the U.S. Mortgage and Trust Company. Failing to find an adequate treatment of real estate valuation, especially of parcel sites, he eventually wrote his own treatise. He still later became president of the Lawyers Mortgage Insurance Company and was influential in the development of real estate appraisal methods, and introduced the concept of "highest and best use." He was responsible for what has come

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5 http://tigger.uic.edu/depts/ajaa/imagebase/firemaps
to be known as the "axial growth theory," where growth occurs first along transportation routes, with the resulting land use patterns resembling the spokes of a star.\footnote{Arthur M. Weimer and Homer Hoyt, \textit{Principles of Real Estate}. (New York: The Ronald Press, 1939, 1948, 1954, 1960), p. 349; Alfred A. Ring and James H. Boykin, \textit{The Valuation of Real Estate, Third Edition}. (Englewood Cliffs, New Jersey: Prentice Hall, 1986), p. 580.} \textit{Principles} was republished in 1924 to far greater acclaim, and served in significant part to influence the subsequent development of real estate valuation and taxation. This small book contains dozens of land value maps, tracking the market value of street frontage or area for several major American cities. He showed how dramatically the market value of sites declined as one moved from the central areas to sites even two and three blocks away.

The earliest land value maps produced by governments that I have seen were done under the auspices of Lawson Purdy, Director of Taxation and Assessment in New York City. (See samples at the end of this monograph.) Purdy was the preeminent pioneer of property tax administration in his time.\footnote{The information that follows is taken from a collection of Essays in Honor of Lawson Purdy, LLD., On the Occasion of his Eighty-Sixth Birthday (October, 1949), published in the \textit{American Journal of Economics and Sociology}, Vol. 9, No. 1.} Born in 1863, he founded and led a very activist New York Tax Reform Association with Georgist colleague Thomas Shearman, and was then appointed to the position of President of the New York City Department of Taxes and Assessments in 1906. Many of the improvements in the administration of property taxation were due to his efforts; in fact his 1914 pamphlet on assessment methodology largely embodied his statement of principles published by the National Association of Assessing Officers (NAAO) in 1939.\footnote{Lawson Purdy, “The Assessment of Real Estate,” Technical Pamphlet Series No. 1, National Municipal League, New York, 1914.} The \textit{American Journal of Economics and Sociology} (AJES) printed a \textit{Festschrift} in honor of his life and work in 1949, and he continued to live another decade until August 30, 1959.\footnote{Essays in Honor of Lawson Purdy, LL.D., On the Occasion of his Eighty-Sixth Birthday, AJES, Vol. 9, No. 4 (October, 1949); and AJES, “in Memoriam: Lawson Purdy, 1863 – 1959,” Vi G. Peterson, pp. 16.} From 1890 when he first read \textit{Progress and Poverty}, he was an ardent Georgist, and was President of the Georgist-oriented Schalkenbach Foundation from 1937 until his death.
A small selection of Hurd’s work is revealing:

**Figure 1.** Selection of Hurd’s work.
New York 1900

Business Section Downtown
Wall St & Broadway ~$400 /square ft

Residential Section Uptown
along Broadway & Fifth Ave. ~$50 - $90 / square ft

New Orleans 1900

Business Section
Canal & Bourbon-Royal Sts. $3500 / front ft

Residential Section
~$100 / front ft on Charles Ave.
~$45 / front ft back two blocks
The history of property taxation in New York, and indeed in America, cannot be understood without an appreciation of Lawson Purdy's role. Practices first initiated and advocated by Purdy were gradually adopted by other states – the professionalization of assessment, the standardization of practices, the increased use of tax maps, and the frequency of revaluation. The formation of the NAAO in 1934, later to become the present international organization (IAAO), was in good part due to his efforts. He notes in one of his articles that the creation of land value maps began in 1890, although New York’s regular institution of the practice would come a decade later. He recognized that this would allow any taxpayer to better understand and accept valuation accuracy and legitimacy. In fact contemporaries later wrote that “Mr. Purdy was acutely conscious of the fact that a good job of assessing real estate could not be done without the aid of an accurate set of tax maps,” by which he also meant land value maps.11 These early land value maps later became models for other cities, and are found in many libraries and archives including that of the Schalkenbach Foundation.

Purdy was first and foremost a reformer and an administrator, but he formalized his ideas – indeed the state of the art – in a monograph published in 1919 by the National Municipal League, of which he was at that time the president. This short twenty-page brief, the forward written by noted economist and scholar Robert Murray Haig, set forth the technical, as well as logical, grounds of real estate assessment.12 A few passages are indicative of the degree to which the lessons and techniques for real estate assessment and taxation had been worked out:

The rule is practically universal that real estate shall be assessed at its market value. This idea is phrased in various ways in different statutes. One of the best phrases, perhaps, was formerly contained in the tax law of New York to the effect that real estate shall be assessed at “the sum for which it would be appraised in payment of a just debt of a solvent debtor.” . . .

The end and aim of real estate assessment is to secure such valuation of every parcel that the tax imposed upon it shall bear a proper relation in proportion to its value to the tax imposed on every other parcel within the tax district. To achieve this end an efficient administration is important, the employment of skilled assessors, and the use by the assessors of those methods and tools of their profession which experience has shown of value. The assessment should be made annually and the assessors should be busy every day of the year except for three weeks' vacation. . . .

Tax Maps

It is strange but true that a great many cities in the United States do not have maps to show the various parcels of real estate within the city. To make a fair assessment without a map is either impossible or the world

of a superlative genius. It is important that the tax map should be
accurate and show the dimensions of every separately assessed parcel
of real estate. A good many cities have no such map of their own and
use an insurance atlas which may be quite adequate for the purpose. A
city ought to have maps of its own. . . .

The tax maps should be the basis of the assessment of real estate and it
is necessary that if they are used as the basis they shall be accurate. The
law should prescribe that the assessment should be made against the
land itself and not against the owner. . . .

Land Value Maps

It will be found in practice that to create land value maps is not only a
very great help but almost an absolute essential to the orderly
assessment of real estate. Land value maps must not be confused with
tax maps. Land value maps do not show separate parcels of real estate,
but only the boundaries of blocks. . . .

The land value map is designed to show the value of the land per front
foot on every side of every square in the built-up portion of the city
and, on acreage tracts, the value per acre. As these front foot values are
called unit values, it is obvious that they must always refer to the same
thing. . . .

[A] land value unit relates only to lots unaffected by corner influence. It
relates only to lots assumed to be lying normally with reference to the
grade of the street. Under these circumstances, the unit of value means
the same thing everywhere. It is strictly a site value. . .

Relation of Assessors to the Public

If assessors are intelligent and industrious they have nothing to fear and
everything to gain by the utmost publicity as to both methods and
details. Owners of real property are apt to be timid and are easily
irritated. They are prone to assume that assessors merely guess at
values and are guilty of intentional favoritism. The only way to correct
these misapprehensions, if they are untrue, is by publicity. It is
desirable to get local papers to print descriptions of the methods of
assessment employed and, wherever possible, to reproduce land value
maps.

The monograph concludes with various approaches by which to assess the special
circumstances of corners and deep lots. Indeed one citation alludes to two sections of the
New York City Charter that provided for the creation of tax maps. Also referenced is the
New York State Conferences on Taxation, held in Utica in 1911 and in Buffalo in 1912,
both discussing the state of the art of taxation with numerous formal presentations.13
Following a presentation on tax maps by Edward Heydecker, Purdy’s Assistant Tax
Commissioner for the City of New York, the panel moderator opined that “Things are
very much changed from what they were twenty years ago.”14

13 Addresses and Proceedings, State Conference on Taxation, E.E. Woodbury, Chairman. 1911 and 1912.
According to Philip Cornick, Purdy's colleague of many years, the New York City land value maps were published and revised annually after 1911 on a continuing basis until the Second World War. The grounds for establishing site value, however, changed with the departure of Purdy. He invited Georgist and pioneering assessor William A. Somers to New York to define and refine further with him the source of urban land value. Somers came from St. Paul where he had instituted his new unit system, but he may well have gotten his start in Cleveland working for its Georgist Mayor Tom Johnson. Johnson, who had made his fortune as an industrialist, was Henry George’s strongest supporter and patron, even to paying for his funeral in 1897 and is today buried next to him in Brooklyn’s Greenwood Cemetery. Somers published a short monograph on land valuation in 1901, arguing that “the source of urban land value was accessibility, which extended to private land holdings abutting streets, the public or private improvements in, on, over, or under them, including sidewalks, paving, the sanitary and storm sewers, the water and gas mains, the conduits for telephone and power lines, and the rail lines for transporting passengers.” Somers was not only a strong advocate of land value maps but of their public availability and display as well.

One or more copies of the map should be posted in the most public places within the district, several days before the meeting of the board of review, to give each citizen an opportunity to compare his assessment with every other assessment in the township. The assessor would be required to be in attendance at the meeting of the board of review with his complete reports, and if any citizen should be dissatisfied with his own or any other assessment, the board of review would have before it the report of the assessor as to the facts upon which the estimate is based, and with the owner present, an examination of the form filled out by the assessor would easily determine if there had been any mistakes made in the description of the land and improvements. If so, they could be corrected by further examination, or through the knowledge of those present.

The maps made in this manner and posted throughout the district would bring the work of the assessor before each property owner and the board of review so clearly and in so simple a form, that it would seem almost impossible for any errors of statement in the description of the land and improvements to escape detection. When it is considered that the assessor and all members of the board of review are citizens and members of the community, selected because of their knowledge of conditions and the confidence of the community in their judgment, it is safe to assume that the valuation as adopted will be an exact expression of the Community Opinion of value. (p. 17)

Somers' short monograph worked out formulas and tables for evaluating lot depths, land gradients radiating from urban centers, and the differential value of street-
corner lots. Somers’ work itself contained no illustrative land value maps, but the tables and graphs were sufficiently clear that there was little left to ambiguity. The last section of his work was a discussion of how improvements should be assessed, followed by others, given his stature in the assessment field, but the emphasis upon land value taxation itself was later diluted.

Somers work contained one particularly prescient observation that remains important even in contemporary contexts. Not by chance was it placed at the start of the book, and it is worth quoting at length:

The levy of taxes upon real estate being made in proportion to the assessed value, it is evident that if the assessed valuation gives to each piece of property the same relative proportion of the true value, it will result in an equitable distribution of the burden. The general knowledge of this fact, and the mistaken belief that the assessment is arrived at by taking a percentage of the true value of each piece of property, has led to the acceptance of the practice of using less than the full value in making assessments.

The valuation of real estate for the purposes of taxation is made by individual assessors in small districts, each one being entirely dependent of all others, and the assessment so made constitutes the basis for all general tax levies. The original assessment district, being the lowest political organization, say a township, first bears the necessary expenses of the town organization, then, being combined with other townships, villages and cities of the county, becomes the basis for the levy of county taxes. The combination of the counties forms the total assessment for the state, and on this the state taxes are levied.

The assessment changes from year to year with the different ideas of the successive assessors, but always falling further below the full value. The departure from the full value probably has its origin in an effort to place valuations low enough to protect taxpayers from paying more than a just proportion of taxes levied by the higher political organizations. When the departure is once made from the full value, the tendency is constantly downward, for the reason that the district assessments being made independently of each other, the districts which are assessed at a higher ratio of the true value than the average will be forced in the next assessment to a lower valuation in self protection. In cases of rapid changes in value – either advancing by reason of increase in population or business, or decreasing from any cause – the assessors will naturally try to protect the interests of their constituents by quickly recognizing any decrease in value, and by being correspondingly slow in recognizing an increase, and thus accelerate the downward tendency.

In any attempt to compare valuations of tracts, the further the general assessment is below the true value, the greater will be the distortion brought about by any inaccuracy in determining the ratio between the true value and the assessment. The inequalities in the actual payment of taxes will be increased by any variation from an exact ratio of the true value between tracts just in proportion as the general valuation of the district is below the true value. Consequently, this continual
lowering of the assessed value increases the inequalities and the
difficulty of equalization.

When the assessment districts are combined, the inequalities between
tracts are just as great with reference to all the higher levies, and the
inequalities between the districts themselves may be even greater. As a
result, the district may pay much more than its share of the taxes levied
by the higher political divisions, and there is no way of demonstrating
the discrepancy, because, there being no knowledge of the actual and
full cash value of all of the property of the district, it is impossible to
compare it with any other district.

When the inequalities become so great, and the injustice of the
distribution of the burden so glaring, that public opinion demands a
complete readjustment, it is attempted sometimes by making the laws
(which almost universally provide that the assessment be made at the
true and full cash value), more stringent, by stating specifically that no
lower value shall be used on account of the fact that the valuation is for
the purpose of taxation; or, as has been done in a few cases, providing
that after the assessment is made at the full value, a percentage of such
full value shall be used for the purpose of taxation.

Such attempted readjustment leaves the assessment subject to all the
influences which tend to originate and continue the downward
movement, and it is but a question of time when it will once more reach
the point where public opinion will demand readjustment. (pp. 3-5)

Further evidence of this dynamic is especially true in contemporary assessment
practices. That it should have been so apparent a tendency so early in the history of the
practice of real property assessment is telling, and there is more at work here than even
Somers fully recognized. The practice is explained in part by the fact that improvements
deteriorate and depreciate, whereas land, being of fixed supply, tends to increase in
market value. Moreover, there is good reason to believe that business and commercial
buildings in urban cores are overweighted relative to the land component by assessors
sympathetic to the real estate industry, thereby providing book depreciation on tax returns
far higher than is suitably warranted and shifting the tax burden to other parties.

Richard Hurd's 1903 Principles led to Somers' experience in Minnesota and
Cleveland to be momentarily cast aside. Philip Cornick traces the dilution of Georgist
thinking as it evolved in the aftermath of Purdy's tenure in the New York City Tax
Department. Successors to Purdy made real estate income the dominant factor in
establishing land value. With Georgist thought pushed somewhat to the edge, land
valuation came to be based on other criteria and influenced by competing factors.

Somers’ influence was reaffirmed in 1926 in the publication of a far more
expansive exposition by Walter William Pollock, the President of the Manufacturers’
Appraisal Company in Philadelphia, assisted in the effort by Karl W. H. Scholz,
Professor of Economics at the Wharton School of Finance and Commerce, University of
Pennsylvania. These authors spelled out Somers’ formulas and graphics in fuller form than Somers originally did himself, further translating his land rent gradients, corner and depth curves into elaborate schematics and tables that made clear that herein lay the origins of scientific assessment practices. Representative of these, the simplest, are his Corner Scale graphic:

Figure 2. Somers’ Corner Scale Graphic.

and his Depth Curve Graphic:

**Figure 3.** Somers’ Depth Curve Graphic.

From his formulas and tables, these being the most elementary, Somers assigned land values to urban land parcels. Pollock and Scholz begin their book by stating that they “believe that the Somers principles are sound, and that the Somers computation methods are far in advance of, and more complete than, any formulae so far devised by other students of land valuation.” (p. iv) But they also recognize that any land parcel site might have a “true value in money,” it is “like an abstract rule of morality. It tells you what to do, but it does not tell you how to do it.” (p.19) The theme runs through the entire book, i.e., that ascertaining in fact the market price of any piece of land for purpose of assessment and in the absence of an arm’s length sale is very much a matter of judgment and fraught with difficulty. This challenge leads them at a later point to endorse land value taxation in theory but question its technical and administrative feasibility in practice. Well into the book (p. 244 ff), the authors write that

. . . legal formulae are merely idealistic statements, which in no degree reach the dignity of practical standards that may be followed in actual valuation work. Henry George assumed that if the Single Tax should be established as the legal rule, there would be no difficulties encountered by Assessors in ascertaining the “selling value” of land, upon which taxes could be levied equitably and proportionally. Mr. George thus fell into an error of opinion which still prevails among legislators and
courts, as well as among administrators of taxation laws; namely, that the valuation of real estate for taxation may be equitably and fairly accomplished by easy processes, and without adequate analysis of land values aside from securing information concerning prices paid... The valuation of land as a basis for taxation they regard as a mere administrative detail to be left to development after the campaign for the adoption of the Single Tax had been won.

One wonders how Somers could have been any more specific. Yet the view that problems of site valuation are ultimately manageable has dogged proponents of land value taxation from the beginning, and for this reason most of all. What critics have often lost sight of are the difficulties, usually greater, of putting a market value on improvements. Moreover, the administrative and economic inefficiencies of alternative tax designs are even more daunting when set next to designs for taxing sites.

The attraction and advantages of taxing land values by themselves therefore continued to hold. To follow New York City's further experience with land value maps, a special Report to the Mayor decades later (1952) recommended that the practice of creating land value maps be resumed. It noted that “land value maps (not to be confused with the tax maps) were formerly published, but for some years publication has been discontinued. We recommend that publication be resumed, in the interest of assuring the public of fairness in assessment procedures.”

Although over two decades had passed since land value maps were issued on a regular basis, there still remained strong internal sentiment for their use. The Tax Department, however, opposed the recommendation; but one footnote reveals Purdy’s dissenting voice from the Report’s majority view:

The Tax Department raises three objections to this proposal: (1) maps are generally prepared far in advance of the publication date of tentative valuations, and rapid changes may destroy their validity; (2) a land-value factor can be only a least-common denominator of utility, and in a given block there may be as many land uses as there are plots; (3) publication of these maps may influence the Court in demanding rigid application of the given factors regardless of the possible justification for deviation. One of our special consultants, Mr. Lawson Purdy, who for many years was President of the Department of Taxes and Assessments, is not impressed by these objections and concurs in our recommendation regarding publication.

A quick perusal of the literature of city management and public administration shows that land value maps were widely valued and understood, and almost universally recommended, as a means both of checking the accuracy of the valuation of land sites and as a way of demonstrating to the public that the appraisal process is open and transparent. Professor Lent D. Upson, an eminent textbook author in the field of public administration in the early decades of the 20th century, made the following comment in a Survey Report to the leaders of Cincinnati and the larger Hamilton County, Ohio in 1924:

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As a result of the lack of a proper system of real estate assessment, the way has been left open for personal favoritism and for the circulation of rumors of favoritism even when there may have been none. The most effective defense against the criticism of "politics" and against the requests of individuals for favors is the establishment of a system of appraisement [sic] based on land value maps, unit food values, standard units of building value and full publicity.20

That early Survey listed numerous tables of real property aggregate value for several localities in the county, all separating both land and building value as well as by various property classes. The tables compared assessed values with sales records for the previous year, and revealed a substantial disparity. The aggregate proportion of land value for all of Hamilton County was 35.95 percent of the total. (p. 105) In the city of Cincinnati alone, the land value was $351 million out of a total value of $875 million, or 40.12 percent. The Survey went on to show numerous ways in which the assessment practices could be improved upon.

Dr. Upson continued to be interested in assessment practices for many years thereafter. In his 1926 textbook, *Practice of Municipal Administration*,21 he devoted approximately twenty pages to explaining how real property should be assessed. "The following features," he said,

are believed to present the chief elements of a modern and scientific assessing system: (1) assessment at true cash value, of both real and personal property; (2) separation of the assessment of land and improvements; (3) the district, block, and lot system of indexing property holdings and office records; (4) preparation and publication of a land value map of the entire city; (5) tax maps showing the metes and bounds of all property within the limits of a taxing district; (6) the adoption of the unit-foot as a standard of quantity; (7) the adoption of an approved depth rule, corner influence rule, plottage rule, and other minor rules as may be necessary; (8) adoption of a standard building classification, with unit factors of building value; (9) adoption of rules of economic and structural depreciation of buildings; (10) a file record of all improvements upon all each description; (11) collection and filing for current use of all pertinent information relative to property values, -- as sales, record of deeds filed, building permits issued, etc.; and (12) for personal property, a personal return form to be filled out by each taxpayer ...." He went on to say that properly speaking, "The assessment rolls are made up annually and should carry a description of the property assessed, the separate value of the land, and the separate value of the buildings located upon it. (p. 80)

On the following page, he wrote:

Essential to a complete assessing procedure are tax maps. A tax map is one showing the exact dimensions of every separately owned parcel of

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real estate in the city. In the thickly settled portions of the city where
parcels are small, such maps should be on a scale of fifty feet to the
inch; in other sections, the scale may be 200 feet to the inch. These
maps serve as the basis for the preparation of the assessment rolls for
the year, each separate parcel shown on the maps being checked with
the rolls to assure that all property within the city is on the books for
assessment, and that the dimensions of each item on the rolls are
collect. Also, the assessors need these maps in their field work of
examining property. They should be available for the entire city and be
kept current by the engineering department of the assessor’s office.
Many cities have no maps of their own and use an insurance atlas as a
rather unsatisfactory substitute.

To assist the property owners in understanding their land valuations
and to enable them to make comparisons with other parcels of land as
to uniformity and equity in assessment, a city should prepare land value
maps. These maps should not be confused with tax maps, as they do
not show the separate parcels of real estate, but only the boundaries of
blocks. The value of the land per front foot on every side of each block
is indicated, and in unplatted areas the value per acre. The front foot
values shown must refer to unit values uniformly, and it is generally
found expedient to use a depth of 100 feet as standard. These maps
should be open to public inspection at reasonable hours, and in large
cities are sometimes published in book form for distribution. The value
of such maps in promoting public understanding of and confidence in
the system of assessing is evident. Excellent examples of these maps
are to be found in New York City, Detroit, and Cleveland.

It is the equivalent assessment of land values that raises the greatest
difficulties for the taxation authorities. .... There are, of course, certain
factors inherent in real estate which assist in formulating judgment as to
value. These principal factors of value are location, utility, shape, and
size. As to location and utility, land is valuable in proportion to its
nearness to people who will pay to use it, and the most valuable lot in
any city is that lot which is located so as to be accessible to the greatest
number of people who will buy goods. the effects of shape and size are
apparent. To be of greatest value, a parcel of land must be of sufficient
size to meet business demands, and so shaped that it can be utilized
fully; and recognition of these features in assessing is called plottage.
There are other minor factors which help determine value, i.e.,
transportation facilities, sunshine, street conditions, character of
business done, social atmosphere, soil, grades, etc.... (p 83)

A few of his later observations should also be noted in view of his early interest:

Real market value, cash sale value, or fair cash value is the price
demanded when the buyer is willing, but not compelled, to buy, and the
seller is willing, but not compelled, to sell.

It is possible to approximate the value of certain parcels of land
throughout a city, and this information may be used to allocate values
to neighboring parcels.

Undeveloped territory is usually valued by the acre; industrial sites by
the square foot; and residential and business property by the unit foot,
i.e., one foot front by the usual depth of properties in any particular city, often one foot by one hundred or one hundred and twenty feet, located in the center of a block. (p 84)

Upson alludes to several other assessment books, revealing that techniques of valuation were widely discussed and fairly well worked out by the time this book was written. Measures in later appraisal books are seen here as well (p 85):

The 4-3-2-1 rule is to the effect that the first, or street, frontage to a depth of twenty-five feet of a lot 100 feet deep is worth forty percent of the whole; the second twenty-five feet, thirty percent of the whole; the third twenty-five feet twenty percent of the whole; and the rear twenty-five feet, ten percent of the whole. According to the Hoffman rule, the street-half of a lot 200 feet deep is worth two-thirds of the value of the whole lot and the Hoffman-Neill rule works out the relative value of the intermediate depths. [Several other rules also named after various people are then mentioned.]

It is difficult to formulate a rule for measuring corner influence, because of its lack of uniformity and there is wide discrepancy in the rules adopted by various cities.

He even gave attention on following pages to matters of irregular parcels, triangular parcels, plottage, and (the influence of) alleys. And he discussed matters of building depreciation in detail. While Dr. Upson mentioned New York, Cleveland and Detroit as having the land value maps of most exemplary character in 1924, other cities were well established in making progress. Pollock and Scholz (p.175 ff) note the growing interest in the Somers system in “Baltimore, Boston, Buffalo, Milwaukee and other cities.” Chicago, beginning in 1910, came to lead others beginning with the work of George C. Olcott, also inspired also by the work of Somers. Philadelphia’s progress, beginning in 1910, was led by the Wharton School of Finance and Commerce of the University of Pennsylvania. (p.189 ff) Interest Pennsylvania would shortly lead, beginning in 1914 to the taxation of land sites at a higher rate than on improvements on “second class cities” (Pittsburgh and Scranton) in what was called the “Graded Tax Law.” Although Pollock and Scholz (p.242.ff) insist that there was no necessary relationship between the Somers system and the tax ideas of Henry George, there is little doubt that the concerted interest in land assessments was strong among his Georgists. References follow to several other cities where interest in land taxation and the Somers system was strong: Houston, Texas and Pueblo Colorado particularly. Meanwhile, growing interest in other nations, particularly in New Zealand, Australia, Canada, and South Africa also led to the need for land value maps.

A 1929 issue of the National Municipal Review carried another article by one Hazel C. Pratt, on "The Assessment of Real Estate and Buildings in Rochester, NY." In referring to the "new procedure," a land value map figured centrally.

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22 Vol. XVIII, No.2, February, 1929, pp. 87-93.
A detailed description of each structure assessed and all calculations leading to either land or building assessments is kept for each property on a card known as a data card. Every taxpayer is privileged to examine these cards and to see exactly how his assessments and the assessments of his neighbors were determined. (p 87)

Her article later notes that "the tax map is kept constantly up to date and no effort is spared to keep it accurate," and that "the tax map provides the city with the first complete, reliable, and up-to-date record of lot dimensions." (p 89) The whole city of Rochester was recorded on 33 land value maps, and "a complete field survey is made every five or ten years. In the meantime, the majority of structures are continued on the rolls without change in assessment except as may be allowed for depreciation, obsolescence, or appreciation. New constructions are inspected and appraised each year as these are built." The subtitle of the article states that "the adoption of up-to-date methods has given Rochester a scientific and equitable assessment system." (p 91)

Land value maps received still greater recognition in 1933. In 1929 President Herbert Hoover had established the President's Research Committee on Social Trends, with research funding granted by the Rockefeller Foundation. An expert staff was recruited from universities and scientific institutions nationwide, largely supervised by the Social Science Research Council. A series of studies was embarked upon in early 1930 and concluded in 1932. One volume, The Metropolitan Community, was authored by University of Michigan Professor of Sociology Roderick D. McKenzie. Like the slightly later Encyclopedia of Social Sciences, the President's Committee Report was valuable benchmark of the social sciences and trends of that period.

It is significant, therefore, that Chapter XVII in McKenzie's study was devoted entirely to land value mapping: "The Economic Topography of the City: Urban Land Values." The first paragraph contained the observation that "a land-value map of a city at any given time affords an important index of the internal organization of the community. And by comparing such maps for different periods it is possible to ascertain the trend in the city's structural development." (p 226) The chapter relied especially on what at that time was the most advanced work of its kind in the country, Olcott's Blue Book of Land Values, which later were relied upon as well by Homer Hoyt's pioneering study, One Hundred Years of Land Values in Chicago. McKenzie charted changes in the patterns of land and their value for fifteen larger cities in the US, from 1902 to 1925. Data for the city of Detroit allowed tracking from 1896 to 1930. Special attention was given to the value of land, and the proportion of land value relative to the value of buildings. All this was linked to the growth in population, concluding that there was "a tendency for land values to increase in proportion only to the increase in population and not to the square of the population." McKenzie further noted that "If [land] values were charted in topographical fashion, the chart would represent high peaks and low valleys." (p 232) Even for that early period when motor vehicle transportation could not have accounted for most of the changes, he noted that

24 Pp. 226-239.
1. There has been an exodus of population from the central portions of the city. This exodus is caused in small measure by an increase in the size of central areas utilized for business purposes, but much more largely by the progressive deterioration of structures in large portions of the central areas. The effect of this deterioration is a creeping paralysis, commonly referred to as "blight."

2. The exodus of population from the central areas together with the settlement of new population in suburban areas has caused a drift of the masses of the population outward radially. Much of this drift is due to the promotional and sales efforts which have been made in connection with the development of new suburban areas.

3. With the outward radial drift of population, has come a recentralization of outlying-district business centers, sometimes reaching the proportion of satellite business communities.

4. The provision of rapid-transit facilities has tended to aggravate further the decline of the central area by providing non-stop express service through such areas and non-stop highways for automobile traffic.

... The degree of concentration of value in the centralized and intensively developed financial and central retail area is striking in every city. The relative smallness of the area characterized by intensive uses and high values, however, is not generally appreciated. Land value reaches its highest peak in most cities at fairly accurately ascertainable points. The high values are found distributed along a principal street, falling off abruptly on each side of the street and rapidly, but less abruptly, along the street itself." (p 232-233)

Empirical studies bear out these formulas quite simply. McKenzie's data in Figure 29 shows the dramatic decline in land values as one moves from the highest points in each of four cities – New York, Chicago, Detroit, and Cleveland – in the late 1920s. His Figure 31 shows the land value along a single vector in Chicago as it changed throughout the 1920s on State Street, showing the Michigan Boulevard development. (Note especially that the values are plotted on logarithmic scales.)
Noting the slope of land values away from the points of highest activity, the author observed, "the lines shown in the chart indicate the percentage of the maximum value represented by land values at half-mile intervals from the point of maximum value in both directions. The shape of the curves indicates the rapidity with which land values decline as the distance from the point of maximum value increases." (p 235)
In concluding that section McKenzie saw the following trends were apparent:

1. The highest value area evidences a high degree of stability but a smaller percentage increases in value than those which occur in outlying areas.

2. Peak-value areas tend to fall at fairly regular intervals along radial arteries, reaching from the central into the suburban area.

3. The influence of transit facilities, particularly street-car service, upon the geographical distribution of subcenter high-value locations is very pronounced.

4. The uniform tendency for subcenter values to increase at a more rapid rate than the central area probably is a permanent tendency and reflects the influence of the drift of population outward from the central area.

5. The permanent and far-reaching effects of public improvements upon the distribution of land value are also indicated. (p 239)

III. Fast forward to the 21st Century

Somehow, during and after the Second War, it seems, land value maps tended to drop out of use. Why is it, some eight decades later, that land value maps have not returned and are today almost unused and unknown in the assessment profession? Mason Gaffney mentions in his 1970 TRED article that he made a land value map of Milwaukee County based on earlier maps and data compiled during the tenure of Mayor Dan Hoan and Frank Zeidler. Professor Gaffney’s maps were done with the compiled records of sales of bare land from 1958 to 1962.26 His is no small effort given the lack of attention to record keeping. Until very recently, on-line searches and indexes in books on assessment do not cite many instances of land value maps at all. One can only wonder in puzzlement given that GIS technology is now widely available to make them more easily, more reliable, and more useful than ever.

One can speculate on at least two reasons that seem common in the contemporary assessment environment. The first plausible reason is that the logic and virtue of taxing the value of land by itself is less well appreciated today than it was in the early 20th century. At that time, the ideas of Henry George were widely known and understood. Furthermore, a good part of the assessment community, as well as the political community, counted themselves as Georgists. Today, the name of Henry George is almost unknown, even among economists and tax experts. In the immediate decades after Henry George died in 1897, the eminent American and world leaders who were active Georgists included Leo Tolstoy, Winston Churchill, Sun Yat Sen, John Dewey,

George Bernard Shaw, Teddy Roosevelt, and Clarence Darrow, Louis Post, Andrew Carnegie, Henry Ford, Joseph Fels, Louis Brandeis, Paul Douglas and countless others.27

The second plausible reason is the continuing claim of many assessors that it is impossible to separately and accurately assess the land value of parcels that have been improved. In an intensive workshop on the feasibility of a land value tax sponsored by the Lincoln Institute in 1998, property tax expert Edwin Mills of Northwestern University put the practical challenge squarely:

The Most Serious Problem in Implementing an MSA Land Tax is Assessment of Land Values on Developed Properties.

One must start with an understanding that assessment of real property for tax purposes is the most arbitrary part of our extremely cumbersome system of federal, state, and local taxation. In the urban parts of MSAs, nearly all taxable sites are developed. . . .

An obvious suggestion as to the valuation of land for tax purposes is the cost-of-production approach to property appraisal. . . .

The cost of production approach can be a tolerably accurate basis for appraisal of property values. But when used to estimate land values, all of the errors in estimating market value and production cost are thrown into the estimate of land value. Land value is the relatively small difference between the two much larger values, and estimation errors would be enormous. A variant on this approach is to ask, in stead of the cost of producing the existing building, the cost of producing the building most appropriate for the site if the site were clear. . . .

In principle, hedonic analysis is the only other way to make separate estimates of site and structure values of developed properties. . . .

There is no prospect of a hedonic equation that would be adequate to assess site values of developed residential properties, and much less prospect of an equation that could assess site values of developed commercial property; and there is simply no other way to estimate site values of developed properties.

My reluctant conclusion is that a site tax, substantially substituted for the existing property tax, is theoretically extremely attractive but practically worthless.28

This claim has been repeated by many property tax and land use experts, especially those associated with the Lincoln Institute of Land Policy, which is widely recognized as a far-reaching forum for discussion of the property tax, and indeed professes to being Georgist. The fact that assessors are typically not well trained, and

27 An extensive list of eminent adherents of Georgist economic philosophy is available at www.cooperativeindividualism.com/authors.
have no incentive to value land in an accurate and reliable manner, means that assertions regarding its difficulty become self-fulfilling prophecies.

That land sites can't be adequately and accurately valued is a paradoxical claim. Other nations that employ land value taxation have no problem in assessing land values according to their market price; indeed many assessors argue that land is far easier to value than improvements. As will be more apparent in the discussion below, modern computer technology makes possible the assessment of land far easier than ever before, because computer application of triangulation algorithms, regressions, and factor analysis facilitate the use of sales records in a relatively foolproof manner.

Much of the difficulty seems to be explained by the inertia of the economics applied to taxation approaches and to the fact that sales records contain the price of land and improvements totaled together. Since improved parcels are sold far more frequently than other real estate parcels, these have become the benchmark of valuation quality. Residential parcels change ownership as often as once every five years, whereas industrial, commercial, and agricultural parcels tend to have very stable ownership. Therefore the standard of valuation for non-residential parcels is far more relaxed. The official handbook of The International Association of Assessing Officers (IAAO) states that "the chief measure of uniformity [in aggregate analysis] is the coefficient of dispersion (COD), which, depending on the nature of the properties involved, should not exceed 10.0-15.0 for residential properties, 15.0-20.0 for commercial properties, and 20.0 for vacant [i.e., rural] land." So wide a tolerance does not speak well of the assessment profession, especially in view of the power of computers to aggregate and analyze data.

Municipalities have been loath to perform revaluations as often as is properly called for because of the expense involved. Decades have sometimes passed without any more attention to parcel values than by statistical adjustments in the aggregate. According to the New York State Office of Real Property Services, the costs per parcel in the year 2000 for a complete revaluation are anywhere from $65 (upstate) to $100 (downstate), this perhaps accounting for the fact that the City of Troy, New York, is contemplating a reassessment currently, for the first time in twenty nine years. The neighboring city of Albany was compelled finally to reassess parcels in the mid-1990s after neglecting the task since 1939. In recent years the State government has offered incentives to get municipalities to perform updates, but the 2008 crash in the real estate price bubble has already distorted the accuracy and reliability of the results. Moreover, investigations by this writer show that the assessment of the land component of property parcels still leaves much to be desired. This failing is most easily and amply demonstrated by drawing GIS

30 See the work of Assessor Ted Gwartney, especially at www.progress.org, and other places searchable using his name at www.askhenry.com.
32 The author’s personal communication with the Director of Policy Analysis, New York State Office of Real Property Services.
maps of assessed land values, even when the conventional sales ratios studies show valuations to be satisfactory.\textsuperscript{33}

Maintaining assessment of parcels commensurate with market prices is very difficult because of the number of variables affecting their value. To start with, one must appreciate that the worth of real estate parcels is typically the sum of both their land values and their improvement values. Improvements – buildings, that is – depreciate in market value just as do computers, cars and refrigerators; indeed a recent Federal Reserve Board study calculated that the rate of depreciation is roughly 1.5 percent annually.\textsuperscript{34} This means that in the course of the lifetime of a typical mortgage, the market value of a building will likely decline by roughly two thirds. Land values, in contrast, increase in market price at a typical rate at least equal to the rate of inflation and usually far greater. This has long been understood, and is dealt with at length by Pollock and Scholz. (p.233 ff) A new home with a market price of $200,000 might have a land value of $80,000 and a structural value of $120,000. After thirty years, given the parameters just posited and without taking inflation into account, the home will have depreciated to about $80,000, but the land value will likely have doubled its worth to $160,000 at the least, for a total value of $240,000. The fact that real estate investments are such an attractive venue for speculators means furthermore that they are subject to cyclical bubbles, making it all the more difficult to assess their market values except for short time periods. Land use configurations in urban localities tend to change their market values at different rates as well, so that assessment adjustments cannot be imposed across the board. They are, rather, far more idiosyncratic.

\textbf{IV. Developing land value assessment technology}

The problematic nature of assessing improvements for purposes of property taxation has led many experts to recommend that the tax imposed on them should be eliminated entirely, by being gradually phased out on an established schedule as the tax rates on land sites are increased. When this is done in a revenue neutral way and with a predictable program, it not only makes assessment easier but leads to greater conformity to all the principles of sound tax theory.\textsuperscript{35} Penalties now imposed on titleholders, who might improve their properties and then see their taxes go up, are then able to undertake such investments without fear. Developers who might have had to settle for suboptimal locations because they found it prohibitively expensive to build on sites of their first choice, are now able to do so, because the carrying costs of those primary sites now make it worthwhile for their owners to seek a return. The centrifugal forces of sprawl configurations, which now cause underused parcels to be held off the market, are reversed so that the increased carrying cost of sites leads to their highest and best use.

\begin{itemize}
\item \textsuperscript{33} See this author's account at http://www.urbantools.org/news/gis-nys, and to GIS land value maps on that website.
\item \textsuperscript{35} For further discussion of the textbook principles of sound tax theory as they have evolved over the years, see http://www.progress.org/cg/battprincip02.htm.
\end{itemize}
Many other economic, environmental, and social advantages are to be had by a shift of tax burdens off improvements and onto land sites alone.\(^{36}\)

This brings us back to Heinrich von Thunen. His book, *The Isolated State*, first published in 1826, proposed that the marginal productivity of land could be measured using the following formula: \(R = Y(p - c) - YFm\), where \(R\) = land rent; \(Y\) = yield per unit of land; \(c\) = production expenses per unit of commodity; \(p\) = market price per unit of commodity; \(F\) = freight rate; and \(m\) = distance to market. The major variables were the costs of land sites (measured in economic rent) and the costs of transportation to markets. These variables were, in essence, reciprocal, as site rent could be interpreted as capitalized transportation cost. Land with the highest rental value was to be found in market centers, quickly dropping as one moved to peripheral regions. Assuming transportation costs were constant, one could easily calculate the relative site value by knowing its distance from urban cores. In today's world, the cross subsidies for transportation make the cost calculations a bit more complex, but they continue to hold true in principle. A graphical illustration of von Thunen's spatial relationships shows how steeply land values decline as one travels out from the center of urban areas.

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All this seems so transparently obvious that one would think such analysis would be *de rigeur* in every city. A study done for the 1968 Douglas Commission Report, The National Commission on Urban Problems, done in the wake of the urban riots of the period, made the obvious point that implicit within land value theory is the differentiation of value by location of land, with variable rents explained as a tendency toward obtaining a balance between costs of location at a central point of activity and costs of location at a less desirable site plus transportation costs to the center. By definition, the point of highest values and greatest activity is the central business district. With the spreading of residential settlement and nodal points of activity throughout the region facilitated first by mass transit and currently by the automobile, there has been a tendency to expand the definition of “accessibility” to take cognizance of the effects of contrary pulls from other localities than the center, which have reduced, even though they may not yet have eliminated, the dominance of the CBD. The utility of private space per se has also been recognized, and the final choice of location is seen as the result of accessibility, amount of space, and rent.\(^{37}\)

The study's “major point” is that all this should be easily plotted and would be extremely useful to planners, but that, lamentably, “the surprising lack of detailed, solid information about land values . . . [and the] shortage of good modern data and theory is a severe handicap to anybody who tries to take a fresh look at urban land policies.”\(^{38}\) The


\(^{38}\) Ibid., Forward, p. iii.
Principal author attempted to compile land value data and various changes but it is revealing that her findings were so limited.39

A quick search of the words “land value map” on line shows that the greatest number of hits come from studies outside of the US. While there are several citations for articles done many years ago, especially in the Georgist-oriented American Journal of Economics and Sociology, there are few others in more recent years. Only a few recent American articles come up, one by Florenz Plassman and Nicolaus Tideman.40 But looking to Europe, Asia, and Africa, for example, one finds several.41 Ironically, one study even emerges based on cities that lack land markets.42 It would appear, as Tony Vickers notes, in his several papers, that land value maps are indeed “the next utility.”43

A fleeting inquiry of colleagues indicates that Australia, New Zealand, The Netherlands,44 Britain and Denmark have the greatest current experience with land value maps. A 1980 relatively scarce monograph surveys their use at that time, revealing that there did not appear to be much method standardization.45 In its ample documentation, the writer found some fourteen nations that had experimented with land value maps in any way at all. While in every case the efforts were undertaken in conjunction with practices of taxation, they were not widely known, and in some cases appear to have been lost. The Danes’ experience with land value mapping goes back decades, as they early on adopted the principles of Henry George to tax land values. The attached series of maps

43 For more references to the work of Tony Vickers, see www.landvaluescape.org.
44 Especially the work of Professor Piet Eichholtz at Maastricht University.
for urban Copenhagen from 1950 through 1981 show the continuity of land value shifts over the course of three decades.\textsuperscript{46} With the help of a team of Danish assessors,\textsuperscript{47} Estonia has instituted a nationwide land value tax, and has a collection of land value maps to support it.\textsuperscript{48}

A recent paper produced by the Research and Statistics Group of the Federal Reserve Bank of New York portrayed the land values of Metropolitan New York based on sales data, showing that they can reach the staggering level of over $12,600 per square foot. Anecdotal stories cited similar values in Tokyo during the 1980s, but the New York study is the first empirical study of how high land values can be.\textsuperscript{49} Studies elsewhere, some done by this author, have portrayed land values graphically based on assessment data,\textsuperscript{50} but given the tendency by assessors to undervalue the land component, the FED study offers the most telling corrective. The graphic of the FED researchers' findings, enhanced and used with its permission, is included below to show the potential of such work. The GIS plotting used parcel centroids rather than parcel polygons, but it is nonetheless clear enough to make the points.

Land value maps can be an important tool to highlight anomalies and errors in land assessment, something that is only beginning to be realized. One instance of a recent city revaluation that could have profited handsomely from a review of its land value assignments is this author's own city of Albany, New York. An illustration of a far better instance of land assessment that had the benefit of a land value map to check assigned valuations is one for Greenwich, Connecticut.\textsuperscript{51} There is no necessary agreed-upon style or standard format to portray land value. In some instances it is based on land value per acre (especially in rural areas); in other instances the measure used is the value per square foot. Ideally one might want to closely link the data to sales of vacant parcels. However, most land value maps rely on the judgment of the assessors, whose analysis secondarily depends upon sales data.

\section*{V. Portraying Land Use Efficiency and Configurations}

Beyond the ability of land value maps to show how well land is assessed is the capacity to show how well it is used relative to its value. The relationship between land value, in

\textsuperscript{46} Thanks for these is due to the generosity of Ole Lefman of the Henry George Foundation in London.
\textsuperscript{50} Land Value Maps/Scapes \texttt{www.urbantools.org/research-and-studies/imaging-the-land-value-tax/land-value-maps-scapes}
\textsuperscript{51} This writer has overseen a collection of several land value maps of small cities in upstate New York starting with the year 2008, which generally reveal the dearth of attention given to the assessment of land values. See \texttt{http://www.urbantools.org/research-and-studies/imaging-the-land-value-tax}.\textsuperscript{51}
the form of capitalized rent, and transportation costs is a close one, as von Thunen was able to show. The greater the expenditure on site rent, the more accessible a location is – as site rent is the price of accessibility. The more remote a site, the lower its cost (either in the form of site rent or in its capitalized market price); but the greater its transportation expenditure, regardless whether it is shouldered by the titleholder or tenant directly or is assumed – as is often the case – by society.

From the standpoint of society, however, the costs expended on transportation (in time, energy and in other resources) means less wealth available for other purposes. It is this factor which is prompting America to consider the liabilities of sprawl land use configurations. These are the criteria that need to be taken into account in evaluating the performance efficiencies of our settlement patterns. That we have, for all practical purposes, created a double set of infrastructure investments in the U.S. – one set for commerce and service, and another set for residential living – has meant that our total capital investments are far larger, but so also is the cost of their maintenance. If competitive advantages cross nationally are taken into account, land use patterns are a major consideration. One 1993 study calculated that the total costs of motor vehicle transportation to our society equal approximately a fourth of our gross domestic product. Japan, by way of contrast, spends about ten percent.52

The relationship between transportation costs and land values can be made even clearer by empirical study of how land values increase as one moves toward the center of the city. In an investigation for the Urban Land Institute, the author concluded that, for Portland, Oregon, each additional mile [traveled] translated into slightly more than $5,000 in housing costs; closer-in locations command a premium, those farther out save money. A ten-mile difference, all other things being equal, would amount to about $56,000 in new home value. For a household in which one worker drives downtown (or at least to a more central location) to work, that ten-mile difference may amount to 4,600 miles annually, assuming 230 days of commuting and a round-trip of 20 miles each day. Moreover, if non-work trips to the central area and elsewhere doubled that amount, the tradeoff would be about 9,000 miles annually, which could mean a higher/lower driving cost of $3,000 annually, not counting the time saved/spent.53 Other studies indicate gradients based upon the availability of transit and/or highway services, geographical constraints to spreading development, and, of course, the influences of taxation.

The increased dependency upon motor vehicle transportation has certainly made peripheral regions and localities more accessible than was earlier true. Whether that has changed urban land value gradients remains a question –one could argue the case both ways. Evidence rests on assessment data, which, in addition to its random errors and

systemic shifts, has been demonstrated to have a general bias favoring high value areas.\textsuperscript{54} Lent Upson's study of Cincinnati in 1924, echoing Somers, showed the same bias:

The low valued property is assessed for more nearly its full value than is the high valued property, though the lowest assessment ratio does not appear to be the highest valued property, but an intermediate group.

The old parts of the city are assessed at a higher ratio than any other section, while the lowest ratio is in the outlying residential developments.\textsuperscript{55}

Land value maps are capable of demonstrating the economic efficiency of development patterns by portraying the ratios of building to land value (or any similar ratio), as this author did for Tompkins County (Ithaca), New York. The assessment of land and improvements was reasonably good, making it possible to perform such an operation satisfactorily. As is clear in other instances, the results might not be so good.

All this makes clear that land value gradients are very important, not only in appreciating the land use configurations and efficiencies of settlement patterns, but also for purposes of transportation costs, development strategies, and general livability. Von Thunen's modeling and formulas are portrayed and validated using the land assessment data from a few others municipalities. Particularly interesting are the three-dimensional presentations for Philadelphia and Portland. The portrayals of Johannesburg done by Godfrey Dunkley required the use of a vertical scale be a log scale, – i.e. 1; 10; 100; 1000; 10 000 etc. – to adequately demonstrate the extent of the differentials.\textsuperscript{56} Further work on land value gradients, especially in view of the projected changes in transportation costs in the next decade and after, suggests that the more flattened slopes that have appeared with the advent of motor vehicle transportation may likely again become steeper as one approaches urban cores.

References


\textsuperscript{54} See the author's testimony before the New York State Assembly Committee on Real Property, “Equity in Assessment Practices,” February 6, 2007, at \url{www.cooperativeindividualism.org/batt-h-william_on-equity-in-assessment-practices.html} and \url{http://www.wealthandwant.com/docs/Batt_Assessment.htm}.

\textsuperscript{55} Upson, Hamilton County, 1924, p. 101.

\textsuperscript{56} Personal communication, Godfrey Dunkley, Capetown, S.A., December, 2008.


Appendix:

<TENTATIVE LAND VALUE MAPS of the City of New York FOR 1922
Prepared by The Department of Taxes and Assessments

COMMISSIONERS HENRY M. GOLDFACR, President RICHARD H. WILLIAMS ARTHUR H. MURPHY GEORGE HENRY PAYNE C. ROCKLAND TYNG, Secretary FRANK J. BEIL, Chief Deputy, Real Estate Bureau JOSEPH F. O'GRADY JAMES J. SECTON LEVI M. PRAYE HENRY W. VIGEL, Surveyor

New York, October 1, 1921>
New York City Land Value Map, 1921: The Bowery & Battery Park
Land Value Map of Mid-Town Manhattan, 1921
Copenhagen, 1960
Copenhagen, 1973
Copenhagen, 1977
Copenhagen, 1981
Land Values in Philadelphia are High in the Core, Near Transport

Portland Oregon LandValueScape
San Luis Obispo County, California, Land Value Per Acre
(from University of California, Santa Barbara
School of Environmental Science & Management, March, 2002)

[Map of San Luis Obispo County land values]
Land Value Map of Downtown Albany, New York, 2008
Based on 2007 Assessments
Bob Breglio, Central Research Group, Inc.
Location and Price of Land Transactions in the New York Metro Area, 1999 through Mid-2006


Note: The New York metro area considered is four boroughs of New York City—the Bronx, Brooklyn, Manhattan, and Queens—and ten counties in northern and central New Jersey. Staten Island, the fifth New York City borough, is excluded because transaction data are unavailable.
Assessed Land Value of Tompkins County, New York