



Build Up or Build Out:

Exploring the Fiscal Impacts of Compact Development
on Public Infrastructure in Madison, Wisconsin

Andrew Busker

University of Wisconsin–Madison Department of Planning and Landscape Architecture
MS Urban and Regional Planning Professional Project

April 2021

ABSTRACT

Municipalities can report residential property taxes in various ways to justify future development. This report compares two approaches to measuring the relationship between density and tax levies, and then applies these approaches to the context of local public infrastructure to discuss the advantages and disadvantages of using tax levies as the rationale for increasing residential density.

©2021 Board of Regents of the University of Wisconsin System

All rights reserved.

For an online copy, see <https://dpla.wisc.edu/ms-professional-project-archive/>

The Department of Planning and Landscape Architecture is a teaching and research department of the College of Letters and Science at the University of Wisconsin–Madison. The school takes no stand on policy issues; opinions expressed in these pages reflect the views of the authors.

The University of Wisconsin–Madison is an equal opportunity and affirmative-action educator and employer. We promote excellence through diversity in all programs.

Table of Contents

Acknowledgements.....	iii
Terms and Definitions.....	iv
Executive Summary.....	1
Introduction	2
Density Dilemma in Madison, WI.....	2
Expected Growth in the Coming Decades	2
Planning and Local Finance Implications	4
Density and Public Infrastructure	5
How to Measure the Costs of Density	7
Project Objectives	7
Analysis Methods.....	8
Data Collection and Initial Geographic Information Systems (GIS) Analysis	8
Parcel Data Analysis by Aldermanic District	9
Findings	11
Residential Composition and Parcel Sizes.....	11
Tax Levy per Acre	13
Tax Levy per Unit.....	14
Discussion.....	15
Advantages and Disadvantages of Density Justifications	15
Addressing Density in Planning and Local Finance	15
Limitations in Analysis.....	16
Data Challenges.....	16
Exclusion of Non-Residential Parcels	16
Exclusion of Mill Rates and Tax Credits.....	17
Conclusion.....	17
References	18

Acknowledgements

This report would not be possible without the continued patience of Dave Marcouiller and the critical perspectives of Kurt Paulsen. In addition, my appreciation extends to the many faculty in the Department of Planning and Landscape Architecture who invigorated my experience at UW–Madison, including Ken Genskow, Aslı Göçmen, Carey McAndrews, Brian Ohm, Revel Sims, and Jeff Sledge.

Terms and Definitions

Term	Definition
Activity Center	<p>“An Activity Center is an area that is more intensely developed than its surroundings and serves as the visual and/or functional center of a neighborhood, multiple neighborhoods, or a district. Activity Centers are typically mixed-use areas that contain some or all of the following uses: residential, retail, service, employment, civic, institutional, and parks or public space. The mix of uses in close proximity and the intensity of development, when paired with robust transit service, can combine to lessen car traffic and increase walking, bicycling, and transit use when compared to lower-intensity and/or single-use development.”</p> <p>(City of Madison Comprehensive Plan, p.36)</p>
Mill Rate	<p>The rate applied to a tax levy to generate tax revenue.</p> <p>1 Mill = 0.001</p>
Tax Levy	<p>The amount of property tax generated on a tax parcel based on the land value, building value, and any improvement value.</p>
Uniformity Clause	<p>Wisconsin State Statute bars properties that are among the same property type (residential, commercial, industrial, agricultural) from being taxed differently than other properties in that same type.</p>

Executive Summary

Projected population growth in Madison, Wisconsin exceeds the current housing stock, which is already highly competitive. This development pressure on the city creates an opportunity for the Madison Common Council to assess the advantages and disadvantages of development regulations. Since funding infrastructure is a primary responsibility of a municipality, considering the fiscal impacts of differing development approaches should lead to informed decision-making that reduces long-term fiscal burden.

This report takes two measurements of density, tax levy per acre and tax levy per unit, to show how the same tax parcel data can be used to justify either urban sprawl or compact development. However, each measurement values one type of infrastructure over another. Development justifications using tax levy per acre highlight the inefficient costs urban sprawl has on linear capital infrastructure. On the other hand, development justifications using tax levy per unit highlight the increased costs compact development has on service infrastructure. The tax parcel analysis reveals that the total amount of tax levy generated in aldermanic districts significantly varies depending on the measurement used.

The City of Madison relies upon zoning and ordinances for incentivizing compact development. A proposed ordinance change is being discussed by the Madison Common Council that may address the city's needs for increased compact development. Alternatively, a regional approach to housing development may reduce development pressures and infrastructure burden in Madison.

Introduction

Density Dilemma in Madison, WI

Expected Growth in the Coming Decades

According to the 2018 City of Madison Comprehensive Plan, the City is projecting to gain an additional 70,000 residents and 40,000 housing units by 2040. The comprehensive plan includes a section mapping where the city intends to focus this additional growth (Figure 1).

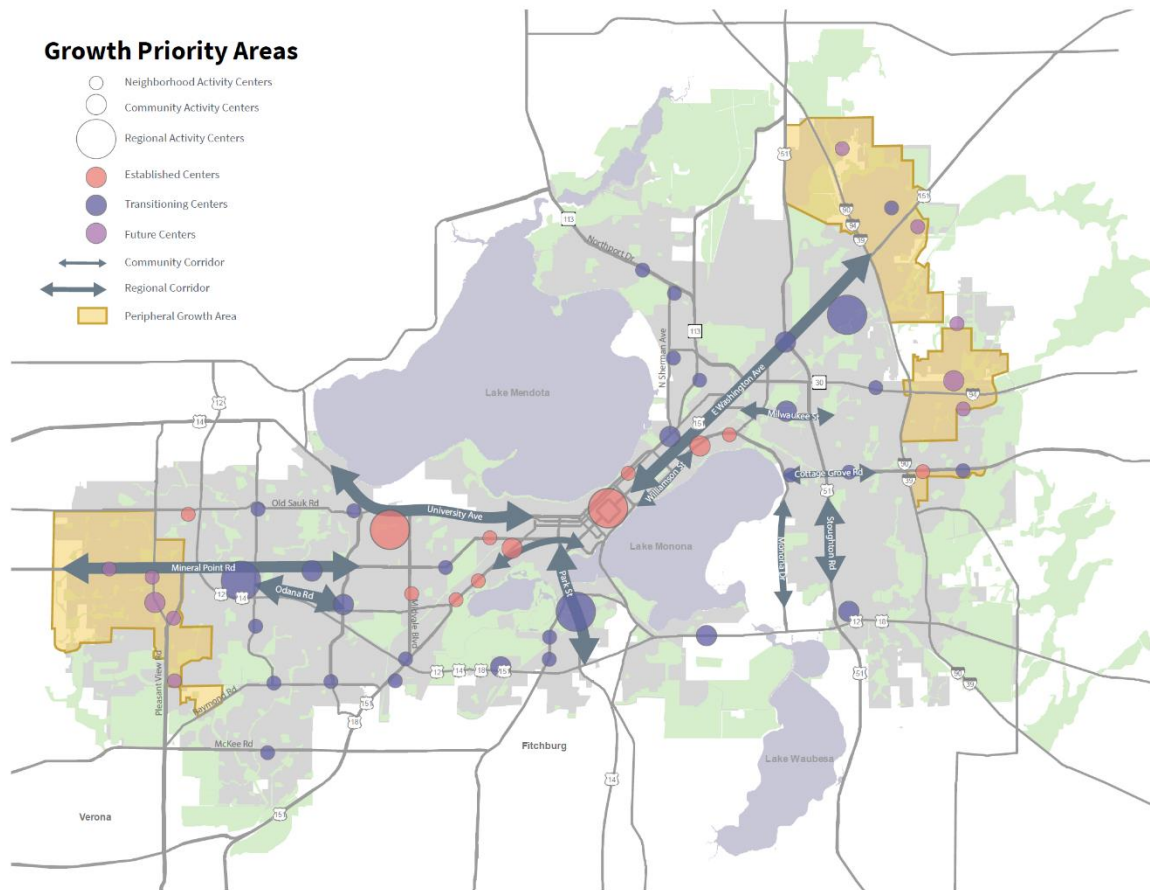


FIGURE 1: Targeted Development for 2040 Population Projection in Madison, WI

Source: City of Madison Comprehensive Plan, 2018

The Growth Framework section of the comprehensive plan identified 29 transitioning centers that are experiencing growth in addition to the 12 established centers and 10 additional centers of activity in future peripheral growth. Activity centers in Madison can be identified by their mixed-use development with robust, multi-modal transportation. The City of Madison anticipates future housing stock to development within these 41 centers, mostly in transitioning and future centers. When describing the peripheral growth on the western and northeastern municipal borders, the comprehensive plan states:

The City has an opportunity to capture the high regional demand for walkable living as part of newly developed Traditional Neighborhood Developments (TNDs) on the periphery. The smaller lots, gridded streets, and Activity Centers that are a part of TNDs not only aid in creating a strong sense of place, but also create high-value development and allow for more residents to be served with less infrastructure. When combined with continuing redevelopment, which tends to generate even more property value and occurs in areas where infrastructure and services are already present, the City's growth priorities will help contribute to long-term financial stability. (City of Madison 2018, p.15)

The comprehensive plan describes the TNDs as compact developments, instead of winding roads and large lots associated with urban sprawl. Further, these peripheral growth areas are divided into smaller neighborhood development plans and areas for future annexation (Figure 2).

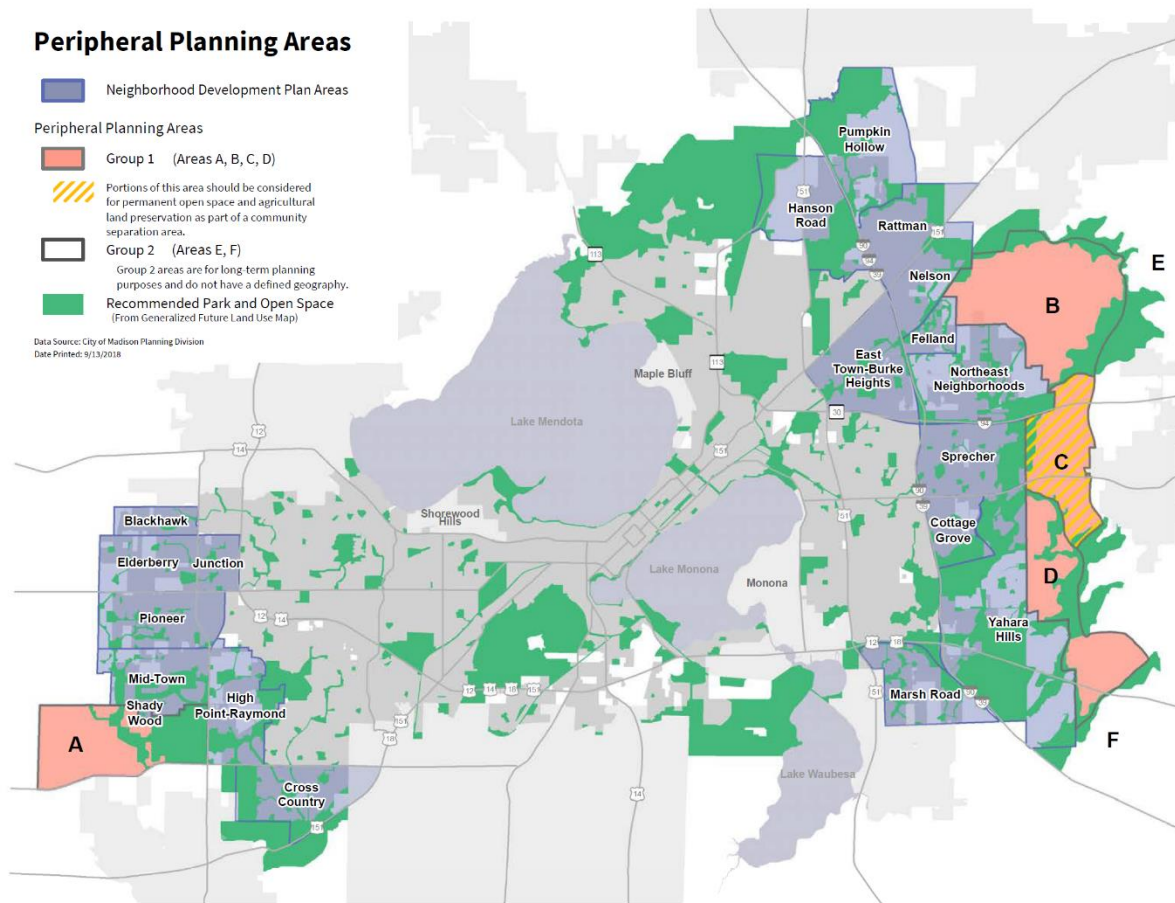


FIGURE 2: Future Development and Annexation in Madison, WI after 2040
Source: City of Madison Comprehensive Plan, 2018

The neighborhood development plans serve as specialized guides for developers that align with the goals described in the comprehensive plan. Group 1 indicates areas ready for development that have not yet undergone the neighborhood development planning process.

Planning and Local Finance Implications

Mayor Satya Rhodes-Conway argues that adapting to the expected population growth and increasingly competitive housing market requires changes to zoning and permitting processes (Rhodes-Conway 2021). Ordinance changes under consideration by the Madison Common Council¹ allow for:

- increased density and the construction of multi-family developments by creating more multi-family residential districts that allow for large multi-family developments
- decreasing the conditional use thresholds for lot areas and usable open space across all residential development types
- removing dispersion requirements that have created barriers to developing two-unit and small multi-family developments (City of Madison 2021a; 2021c).

What might this ordinance change, and continued peripheral growth, mean for the City of Madison's finances?

Existing research on the effects of urban sprawl on municipal budgets could provide a clue. In Madison, property taxes fund the bulk of the city's services, followed by local revenues and federal/state aid (Figure 3). Research suggests that sprawl generates short-term municipal revenue and a long-term municipal deficit (Hortas-Rico 2011). State or federal grants and aids are used by local governments to help offset this long-term municipal deficit. Further, sprawl is suggested to increase direct taxation (e.g., property tax) and local revenues (e.g., building permits, stormwater utility) (Varela-Candamio, Rubiera Morollón, and Sedrakyan 2018). Besides sprawl, the geographical constraints of a municipality are closely related to direct taxation, while socioeconomic factors greatly influence local revenues. Additionally, other research suggests that, while per capita expenditures in dense, urban areas are marginally higher than in suburban areas, compact development reduces per capita expenditures in both urban and suburban areas (Goodman 2019).

¹ At the March 30, 2021 meeting, the Madison Common Council moved to discuss this proposed ordinance change at the May 18, 2021 Common Council meeting. Its fate remains unknown at the time of this report.

General Fund Budget by Funding Source

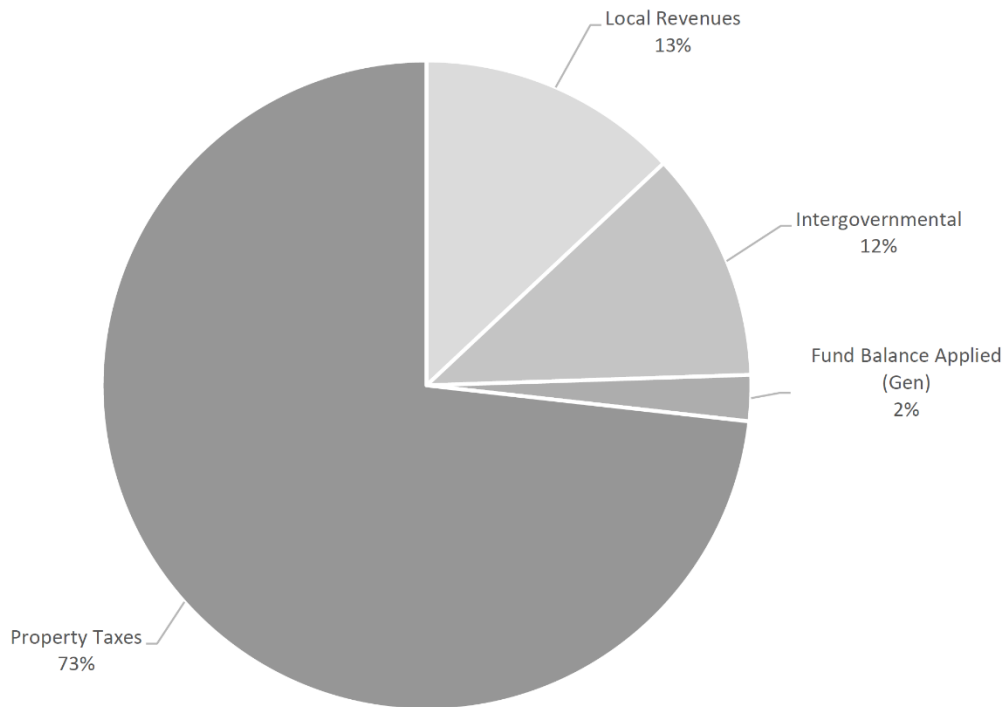


FIGURE 3: City of Madison General Fund Composition for 2021 Operating Budget

Source: City of Madison 2021 Operating Budget, 2020

Therefore, this proposed ordinance change for increasing residential density, the City of Madison is signaling to developers a priority for compact development and reducing the financial risk of inefficient development through sprawl.

Density and Public Infrastructure

The City of Madison is not the only public entity to utilize local property taxes (Figure 4). Area school districts collect the largest share of a household's property tax levy. Property taxes fund public entity operations as well as debt used to finance capital projects.

Property Tax Levies

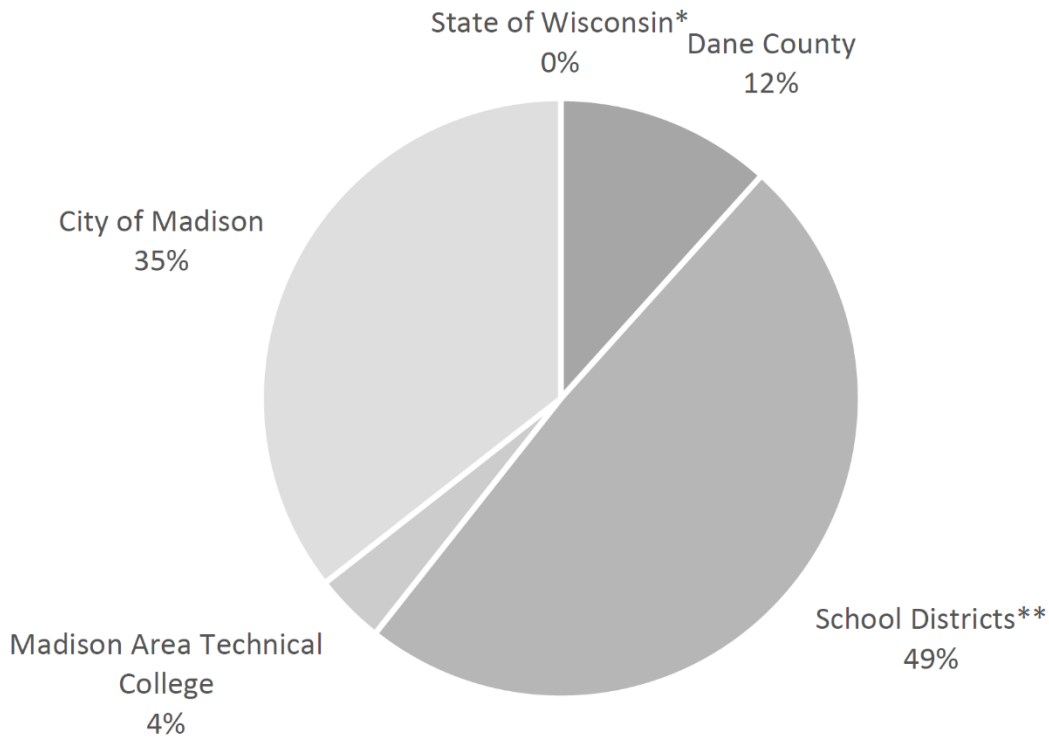


FIGURE 4: Distribution of Local Property Tax Levies in Madison, WI for 2021 Municipal Budgets

Source: City of Madison 2021 Operating Budget, 2020

Different local taxing entities are responsible for different public infrastructure investments and this public infrastructure can be divided into two categories (Table 1).

TABLE 1: Categories of Public Infrastructure and Examples

Linear Capital Infrastructure	Service Infrastructure
Fire Hydrants	Fire Stations
Local Roads	Libraries
Sanitary/Storm Sewers and Pump Stations	Police Stations
Streetlights	School Districts and Technical Colleges
Street Trees	Water Treatment Facilities
	Local Parks

Source: Author

Density impacts these two types of infrastructure in opposite ways. A new sprawling peripheral development creates additional burden on linear capital infrastructure because a neighborhood with single-family homes with large lots and long, winding roads increases the number of fire hydrants and

streetlights, and expands the sanitary sewer system, but generates less of an increase in school attendance or police calls. However, new compact urban development places additional burden on service infrastructure because a 100-unit multi-family infill development would increase school attendance, emergency calls, and local library use but create less of an increased burden on the existing linear capital infrastructure.

How to Measure the Costs of Density

Defining urban sprawl is complicated and is often considered to be the opposite of density or compact development (Wassmer 2000; Chin 2002) The costs of density could include balancing the fiscal impacts of development costs, individual costs, and communal costs (Deal and Schunk 2004). Alternatively, the costs of density can be measured by analyzing the relationship between how much urbanized land exists, property values, and how public infrastructure costs are shared among public entities (Carruthers and Ulfarsson 2003).

For the purposes of analyzing how density impacts property tax levy generation, two approaches to measuring the costs of density emerge. First, tax levy per acre measures the relationship between urbanized land and property tax. This measurement is used by researchers, planners, and public officials to argue against sprawl; the inefficient increase of unit costs for linear capital infrastructure advocates for more compact development (Gielen et al. 2019). This measure emphasizes the cost of linear infrastructure to the detriment of service infrastructure. Second, tax levy per unit measures the number of tax parcels located on a single site. This measurement could justify compact development for its tax-generating power because increasing density would have a higher number of tax parcels located on a single site. This measure reflects the number of households served by the municipality and emphasizes the cost of service infrastructure to the detriment of linear capital infrastructure.

Project Objectives

This analysis aims to determine if two approaches to measuring tax levy generation using differing density metrics will generate similar results. Based on this analysis, arguments can be made to support conflicting views of residential development and its effect on local public infrastructure.

Analysis Methods

Data Collection and Initial Geographic Information Systems (GIS) Analysis

To collect the data needed for this analysis, I obtained GIS shapefiles of the tax parcels that include the amount of tax levy raised by each tax parcel using the City Assessor's property information, as well as the aldermanic districts shapefile from City of Madison open data portal. I chose aldermanic districts because decisions regarding density is decided at the Common Council level. The extent to which a district is compact or sprawled may influence that alder on future ordinance changes. I input these shapefiles into *Esri ArcMap 10.7.3* and projected the layers using the projection established as the standard for analyses conducted in Dane County.

To determine the tax levy per acre, I first calculated the area in acres of each parcel using a standard tool in ArcMap and added this calculation as a new field in the parcel dataset. The "Total Taxes" field in the parcel data set represents the total tax levy for each tax parcel. I divided this field by the parcel's area in acres to find the tax levy per acre for each parcel and added this value as a new field in the dataset.

To isolate the aldermanic districts (Figure 5), I manipulated the aldermanic district shapefile to save each aldermanic district as its own shapefile. I then selected the parcels from the tax parcels shapefile to create smaller data sets within the individual district boundaries. These smaller tax parcel data sets were used to continue the analysis.

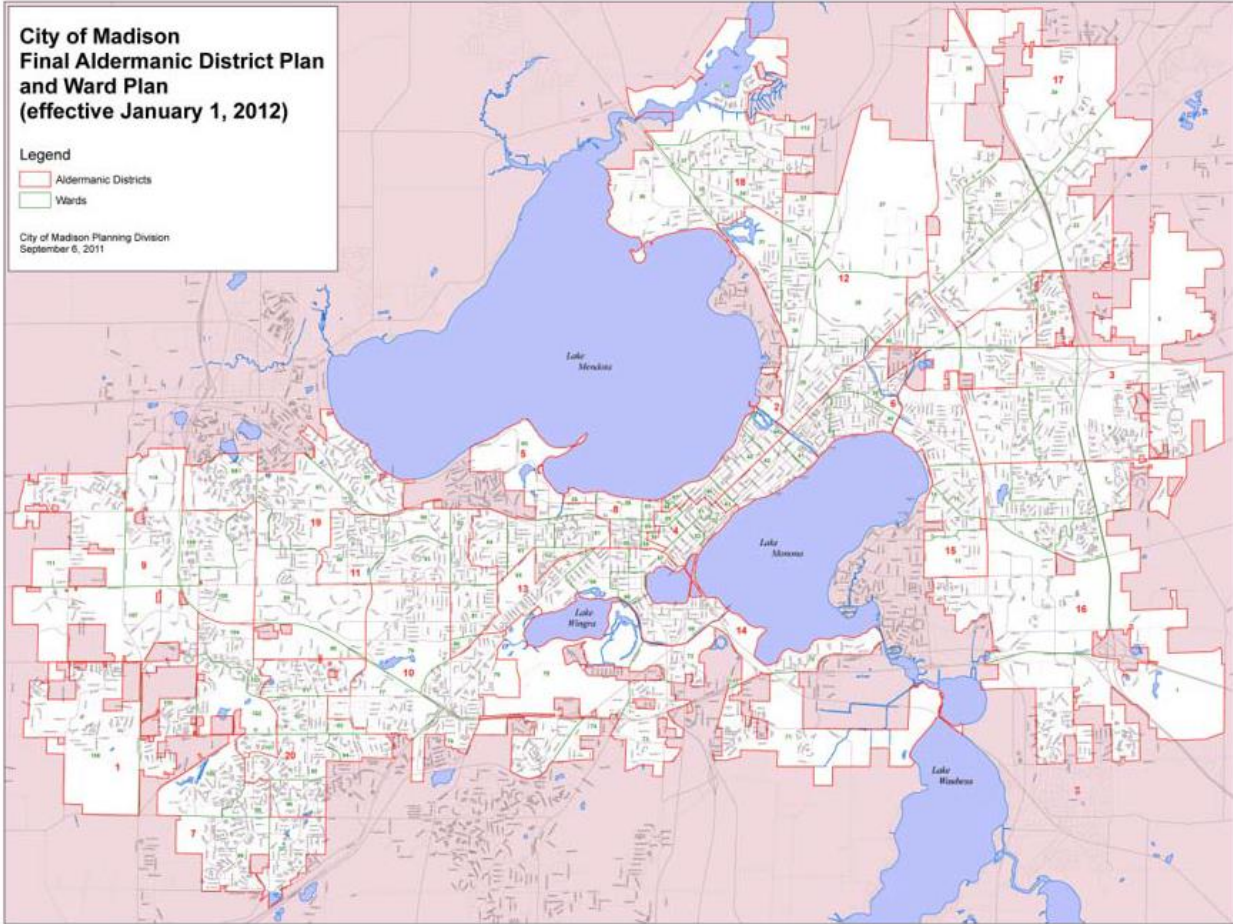


FIGURE 5: Aldermanic Districts of Madison, WI
 Source: City of Madison Code of Ordinances §15.01, 2011

Parcel Data Analysis by Aldermanic District

I transferred the aldermanic district tax parcel data from GIS to into *Excel*, where I calculated the compositions of districts by residential property type, parcel size, average tax levy per acre, and average tax levy per unit. First, I identified the data fields relevant for the analysis (Table 2) and generated a pivot table of the parcel data for each aldermanic district, isolating residential properties from agricultural, commercial, and industrial properties, and sorting the residential properties by type.

TABLE 2: Parcel Data Fields Included in Analysis

Parcel Data Field	Definition	Role in Analysis
XRefParcel	Land Parcel Number	Identification of the number of tax parcels (units) located on a land parcel
Address	Postal Address for each Tax Parcel	Identification of the number of tax parcels (units) located on a land parcel
PropertyCl	Property Class	Isolation of residential properties from commercial, industrial, and agricultural properties
PropertyUs	Property Use	Categorization of residential properties by type
TotalTaxes	Total Tax Levy for each Tax Parcel	Determination of tax levy per acre and tax levy per unit
Area	Area of a Tax Parcel in Acres	Created to determine tax levy per acre
ValAcre	Total Tax Levy divided by Area	Created to determine tax levy per acre

Source: City of Madison Tax Parcels (Property Assessor Information), 2021

Second, I used pivot table settings and the “AVERAGE” function in *Excel* to generate the arithmetic mean of parcel sizes and the arithmetic mean of tax levies per acre across all parcels in an aldermanic district. The parcel data divided the size of apartment developments as separate residential types. For the purposes of this analysis, all apartment residential types were aggregated into a single category.

Third, I used the land parcel numbers, addresses, and residential type to count the number of units on a parcel. The parcel data included duplicate land parcel numbers for condominiums since each unit in a condominium development is its own tax parcel. To count the number of units in a condominium development, I compared the tax parcel data to the corresponding land parcel number on the pivot table and counted the number of units with the same land parcel number. Most condominium developments included a line in the tax parcel data that was a placeholder for the entire development and these lines were subtracted from the total number of units for each land parcel. During this process, I calculated the average levy per unit for each land parcel by dividing the sum of the total tax levy by the number of units on that parcel. Once all the units were identified for the land parcels in an aldermanic district data set, I calculated the district’s average tax levy per unit by dividing the sum of the total tax levy by the total number of units in the aldermanic district.

Next, I calculated the percentage composition of residential types in an aldermanic district and the average parcel size, average tax levy per acre, and average tax levy per unit by residential type. The residential composition was determined by taking the number of units in a residential type divided by the total number of units in the aldermanic district. I utilized the “AVERAGE” function in *Excel* to find the arithmetic mean parcel sizes, tax levies per acre, and tax levies per unit for each residential type.

Finally, I repeated this process until all 20 aldermanic districts were analyzed.

Findings

Residential Composition and Parcel Sizes

Across the 20 aldermanic districts, most share similar residential composition (Table 3) and parcel sizes (Table 4). Most districts have similar compositions and parcel sizes, with a few notable exceptions.

TABLE 3: Residential Composition of Madison Aldermanic Districts

District	Residential Units	District Composition (Percent)				
		Single Family	Apartments	Condominiums	Vacant	Other
1	4,983	46.02	6.66	43.57	3.75	0
2	3,130	21.37	57.28	19.87	1.21	0.35
3	4,800	72.69	6.69	13.38	7.02	0.02
4	3,754	2.08	23.55	73.55	0.77	0.05
5	2,619	68.27	23.63	5.77	2.29	0.04
6	5,578	42.81	45.18	10.13	1.86	0.02
7	4,403	64.82	8.45	23.6	3.07	0.07
8	165	12.12	67.27	0	20	0.61
9	4,686	66.41	0.98	17.84	14.15	1.31
10	4,266	84.62	9.07	4.29	1.97	0.05
11	4,296	78.05	5.12	15.57	1.23	0.02
12	4,457	65.18	28.61	4.33	1.84	0.04
13	4,108	61.83	31.94	4.75	1.44	0.05
14	2,791	54.46	25.47	14.37	5.66	0.04
15	4,378	75.06	17.7	4.25	2.9	0.05
16	4,633	75.89	7.17	13.21	3.69	0.04
17	3,889	56.9	8.07	25.15	9.87	0
18	5,773	51.27	3.62	43.08	1.97	0.05
19	4,202	58.07	4.59	32.98	0.14	0.14
20	3,926	70.33	21.96	6.67	1.02	0.03

Source: City of Madison Tax Parcels (Property Assessor Information), 2021

The median number of residential units represented within a district is almost 4,300 units and nearly all the aldermanic districts have single family homes as the majority residential type. Districts 10, 15, 16 have the highest concentrations of single-family homes in their composition. A significant outlier among the aldermanic districts is District 8, which encompasses most of the University of Wisconsin–Madison campus. District 8 represents a miniscule portion of Madison tax parcels, only 0.2 percent, and has over two-thirds of its residential composition as apartments. District 4, located in the heart of downtown and includes the State Capitol Building, has few single-family homes and predominantly condominiums. District 9, located on the western fringe of Madison, has a large proportion of vacant parcels likely due to current residential development patterns.

TABLE 4: Parcel Size Comparison Across Madison Aldermanic Districts

District	District Average (Acre)	Average Parcel Size for All Residential Property Types (Acre)				
		Single Family	Apartments	Condominiums	Vacant	Other
1	0.67	0.27	0.29	9.57	2.33	0.00
2	0.17	0.11	0.11	0.93	1.62	0.28
3	0.34	0.22	0.30	1.15	1.49	0.16
4	0.17	0.08	0.10	0.59	0.97	0.62
5	0.40	0.16	0.14	0.53	8.59	0.01
6	0.14	0.11	0.12	0.38	1.01	1.14
7	0.38	0.22	0.30	1.38	3.40	2.21
8	1.90	0.12	0.09	0.00	4.90	0.10
9	0.37	0.23	0.30	2.44	0.92	0.21
10	0.35	0.26	0.23	1.01	4.27	0.36
11	0.29	0.23	0.25	0.89	3.77	0.17
12	0.53	0.15	0.16	0.93	16.08	0.75
13	0.21	0.13	0.14	0.64	4.23	0.32
14	1.24	0.27	0.27	0.95	12.18	4.28
15	0.33	0.21	0.24	0.49	3.46	5.97
16	0.57	0.27	0.32	1.70	6.58	0.34
17	0.50	0.23	0.30	3.09	2.00	0.00
18	0.64	0.27	0.31	7.64	9.33	16.76
19	0.55	0.36	0.31	2.77	2.69	0.55
20	0.32	0.28	0.28	0.67	3.47	3.47

Source: City of Madison Tax Parcels (Property Assessor Information), 2021

The parcel size analysis revealed that Madison is already a dense city. The parcels of single-family developments are mostly consistent across aldermanic districts, where properties in the fringe districts have lot sizes closer to 0.25 acres and properties closer to downtown have lot sizes closer to 0.15 acres. Only condominium, vacant, and other developments reach lot sizes larger than a half-acre. Significant variation exists across the parcel sizes of condominium developments. Districts 12, 14, and 18 have the largest average sizes for vacant tax parcels and these aldermanic districts are located on the fringes of Madison where new development is most likely to occur.

Tax Levy per Acre

The analysis created a ranking of tax levy generation for residential tax parcels in aldermanic districts across a uniform parcel size (Table 5). The 5 districts with the highest tax yield per acre for all residential types include the entire isthmus in downtown Madison and the breadth of the University of Wisconsin–Madison campus.

TABLE 5: Madison Aldermanic District Ranking by Tax Levy per Acre

District	District Average for All Residential Types (\$)	Average Levy per Acre by Occupied Residential Type (\$)			
		Single Family	Apartment	Condominium	Other
4	146,800	122,180	120,480	755,600	0
2	93,540	94,120	96,140	175,880	41,710
8	77,360	81,560	152,180	N/A	0
6	73,740	75,640	73,430	168,440	0
5	72,110	72,710	85,030	122,360	23,380
13	71,400	72,820	71,420	129,110	10,900
9	38,360	46,380	32,420	41,750	10
1	37,170	39,790	34,510	51,260	N/A
11	34,850	34,920	34,640	200,000	11,760
12	33,760	33,590	40,240	39,160	0
7	31,790	33,050	31,070	44,860	290
10	31,160	31,940	28,780	35,740	4,170
3	29,240	32,050	23,770	34,370	3,270
19	28,970	30,860	29,180	33,770	15,030
15	24,850	25,180	26,550	44,010	4,210
16	23,980	25,160	21,200	35,290	1,370
17	23,460	27,180	25,450	34,370	N/A
20	21,950	22,090	22,590	27,510	140
14	21,740	23,490	23,810	25,540	0
18	20,840	21,640	17,490	31,130	2,140

Source: City of Madison Tax Parcels (Property Assessor Information), 2021

Except for Districts 8 and 9, condominium developments generate a consistently higher tax levy per acre than single-family developments. District 11 contains the second highest tax levy per acre for condominium developments but the number of single-family homes and apartments in the district brings the average for all residential types to a near median ranking across aldermanic districts. Apartment developments generate a tax levy per acre that closely aligns with single-family developments; however, when observing outside of downtown Madison, the amount generated by apartment developments trends lower than single-family developments in the same district.

Tax Levy per Unit

The analysis created a ranking of tax levy generation for residential tax parcels in aldermanic districts based on the number of units in each district (Table 6). The 8 districts with the highest tax levy per unit for all residential types are located on the west side of Madison.

TABLE 6: Madison Aldermanic District Ranking by Tax Levy per Unit

District	District Average for all Residential Types (\$)	Average Levy per Unit by Occupied Residential Type (\$)			
		Single Family	Apartment	Condominium	Other
5	8,260	10,440	3,720	5,590	160
13	6,820	8,830	3,730	5,140	1,440
19	6,740	9,330	4,020	4,180	3,120
10	6,600	7,480	2,060	2,350	1,230
9	6,560	8,480	4,680	5,610	0
11	6,520	7,510	3,220	4,060	1,990
1	5,800	8,810	3,490	4,680	N/A
7	5,420	6,580	3,270	3,960	160
3	5,040	5,780	3,090	3,930	520
6	5,040	7,470	3,280	4,860	0
16	4,980	5,550	2,990	4,430	710
20	4,850	5,800	2,610	3,220	0
2	4,480	8,560	3,360	8,110	2,170
14	4,160	5,940	2,320	2,630	0
15	4,010	4,560	2,430	4,720	840
17	3,960	5,450	2,730	3,030	N/A
4	3,790	7,430	3,720	4,640	0
12	3,650	4,460	2,290	3,180	0
18	3,580	5,360	1,890	3,100	630
8	3,540	5,620	4,230	N/A	0

Source: City of Madison Tax Parcels (Property Assessor Information), 2021

The tax levy per unit for single-family developments is consistently higher than all other residential types across all aldermanic districts. Except for District 8, where the tax levy per acre for single-family parcels and apartments are similar, apartment developments tend to generate approximately half as much tax levy per unit than the single-family developments in the same district. This anomaly in District 8 could be a result of the concentration in student housing in this area. Nearly all condominium developments generate more tax levy per unit than apartments but less tax levy per unit than single-family developments. District 15 is the only aldermanic district where condominiums generate a higher tax levy per unit than single-family developments.

Discussion

Advantages and Disadvantages of Density Justifications

Measuring density using tax levy per acre inflates the value of a tax parcel in a multi-family development, especially condominiums, because of the inclusion of urbanized land into the measurement. This approach supports arguments that compact development improves linear capital infrastructure but ignores increased costs to service infrastructure. Multi-family developments are constrained to some degree in Madison due to current zoning and height restrictions.

Measuring density using tax levy per unit reflects a household's tax bill and indicates that single-family developments generate more tax. This approach supports increased urban sprawl and produces less fiscal burden to social infrastructure despite an increase in linear capital infrastructure cost. Single-family developments are constrained to the fringes of Madison.

Alternatively, a common approach to measuring density is by determining the number of people per a unit of area. Combining a population per acre with an infrastructure cost per capita might be useful to address compact development goals without being limited to residential type.

Addressing Density in Planning and Local Finance

Since a relationship between property tax and sprawl exists, the City of Madison could consider property tax reforms. Further, evidence suggests that tax reforms could rebalance uneven development because urban sprawl is encouraged when the ratio between fringe development taxes and city center taxes favors fringe development (Song and Zenou 2008). One option could be an increase in property tax mill rates across all residential property types to encourage more compact development (Song and Zenou 2006). This action could generate more multi-family developments and less single-family developments because apartments and condominiums are more affordable according to their tax levy per unit. A more radical approach to property tax reform could include adjusting tax assessments to increase the valuation of land such that single-family lots would be valued higher than other residential property types because of the extent of urbanized land occupied by these tax parcels. This action could also generate more multi-family developments because the tax levy of single-family homes would increase without affecting the other residential property types. However, such a property tax reform violates the uniformity clause in the Wisconsin Constitution, which prevents the targeting of any specific property type through property taxes in order to facilitate a desired development outcome (Ardon, 2021a).

In the absence of strategic property tax applications on residential units, the City of Madison must resort to zoning and development incentives or barriers to facilitate compact development. Development incentives that use tax dollars for service infrastructure is a more efficient way to spend tax revenue. If local planning is intended to be a tool for serving the needs of growth, the City of Madison should implement policies that encourage efficient infill development before risking inefficient, unsustainable development on the urban fringe (Tian et al. 2017; Goodman 2019). One method to increase density through infill development is through Tax Increment Financing (TIF), which is a core economic development tool in Wisconsin. The state allows a municipality to extend the life of their TIF district if a portion of the funds will improve the community's affordable housing stock (Horton 2021). However, a

body of research suggests that TIF is not very effective in redeveloping an area (Hanson 2019). Considering fringe development, the only strategies that remain are changes to existing zoning and ordinances or the creation of additional zones and ordinances to facilitate compact development, such as the proposed ordinance change currently under consideration by the Madison Common Council (City of Madison 2021a; 2021c). Lowering the lot size threshold for conditional use permits creates neighborhoods with a smaller extent of urbanized land and establishes an administrative barrier for any new construction of larger residential lots that previously did not require such a process. Additionally, the changes to zoning create opportunities to develop a greater variety of multi-family housing stock throughout the city.

Instead of approaching compact development locally, the challenge of housing and infrastructure could be addressed regionally. As the City of Madison increases its housing stock, or in the rare case the city overdevelops the amount of housing it needs, the available housing could encourage residents of Madison's suburbs to move into the city. Exodus from the suburbs would cause the suburbs to initially lose their tax base while maintaining their existing infrastructure demands. Regional development authorities could better address urban density, housing, and infrastructure challenges than any individual municipality.

Limitations in Analysis

Data Challenges

A few parcels in the GIS shapefiles are missing from the aldermanic district data sets because of challenges with selecting parcels within the boundaries of the aldermanic district shapefile. These select few parcels were on the edges of the aldermanic district where the two shapefile boundaries may not be identical. A future analysis could modify the aldermanic district boundaries to ensure parcels are not excluded.

Some parcels were listed as "3 to 7 unit" apartments in the Property Use field of the tax parcel data instead of identifying the specific number of units. When calculating the tax levy per unit and residential composition, I coded these parcels as containing 5 units.

Additionally, the tax parcel data does not specify the residential type for vacant tax parcels; vacant parcels could include existing vacant units and units currently under construction that already have tax parcels assigned. One could cross-reference the land parcel numbers to include vacant tax parcels in condominiums, but that approach may not yield effective results when assigning vacant parcels to the other residential types.

Finally, the metadata for the City of Madison tax parcels contained no description or examples for the kinds of properties that fit within the "Other" residential type found in the Property Use field.

Exclusion of Non-Residential Parcels

This analysis did not include the levy valuations for commercial, industrial, and agricultural properties in the City of Madison. Non-residential tax parcels were excluded from the analysis because they comprise of only 9 percent of all tax parcels in Madison. A future study could include commercial and industrial tax parcels to better incorporate mixed-use development into the analysis.

Exclusion of Mill Rates and Tax Credits

This analysis did not include the mill rate or tax credits applied to property tax levies. Tax credits would reduce the total tax levy for each tax parcel. Mill rates are adjusted annually by the governing bodies of local governments that leverage property taxes and are therefore an additional variable that must be considered when estimating property tax revenue. One would need to multiply the levies in this report by the relevant mill rates for school districts, municipal, county, and technical colleges and then subtract any tax credits from these new values to determine real tax revenue (Ardon 2021b).

Conclusion

The City of Madison expects a significant increase in population and jobs by 2040 that requires the city to increase its housing stock. How this stock is developed will impact property taxes and the costs of infrastructure. This analysis determined that measuring density according to tax levy per acre inflates the value of multi-family developments. Current property tax levies for City of Madison residents incentivize more single-family developments, and thus risk additional urban sprawl, when measuring density according to tax levy per unit. However, tax levy per acre is more reflective of the overall costs of local infrastructure. Since the State of Wisconsin requires uniformity among property tax assessments, the City of Madison is limited to encouraging compact development through zoning and ordinances or by participating in a regional approach to compact development and infrastructure management.

References

- Ardon, Noga. 2021a. "Property Tax Administration." *Wisconsin Legislative Fiscal Bureau*, no. 16: 1–35. <http://lrbdigital.legis.wisconsin.gov/digital/collection/p16831coll3/id/1783>.
- . 2021b. "Property Tax Level in Wisconsin." *Wisconsin Legislative Fiscal Bureau*, no. 15: 1–9. <http://lrbdigital.legis.wisconsin.gov/digital/collection/p16831coll3/id/1805>.
- Carruthers, John I, and Gudmundur F Ulfarsson. 2003. "Urban Sprawl and the Cost of Public Services." *Environment and Planning B: Planning and Design* 30 (4): 503–22. <https://doi.org/10.1068/b12847>.
- Chin, Nancy. 2002. "Unearthing the Roots of Urban Sprawl: A Critical Analysis of Form, Function and Methodology." *Centre for Advanced Spatial Analysis*, no. 47: 1–23.
- City of Madison. 2011. "Code of Ordinances §15.01: City Boundaries." https://library.municode.com/wi/madison/codes/code_of_ordinances?nodeId=COORMAWIV0II CH11--19_CH15ALDIWA_15.01CIBO.
- . 2017. "Aldermanic Districts." *City of Madison Open Data*. <https://data-cityofmadison.opendata.arcgis.com/datasets/aldermanic-districts?geometry=-89.930%2C42.997%2C-88.887%2C43.173>.
- . 2018. "Comprehensive Plan." https://www.cityofmadison.com/dpced/planning/documents/Part1_ComprehensivePlan.pdf.
- . 2020a. "2021 Operating Budget Summary: General Fund Funding Source by Major Category." <https://www.cityofmadison.com/finance/documents/budget/2021/operating/adopted/FundingSourceMajor.pdf>.
- . 2020b. "2021 Operating Budget Summary: Summary of Local Property Tax Levies." <https://www.cityofmadison.com/finance/documents/budget/2021/operating/adopted/SummLocalPropTaxLevies.pdf>.
- . 2021a. "Proposed Ordinance File #63902: Conditional Use Thresholds." <https://madison.legistar.com/LegislationDetail.aspx?ID=4890162&GUID=3F58D716-A6CB-4633-84F2-D3C5CB937A2E&Options=ID%7cText%7c&Search=63902>.
- . 2021b. "Tax Parcels (Assessor Property Information)." *City of Madison Open Data*. https://data-cityofmadison.opendata.arcgis.com/datasets/0338b0638e4749c395f8d38b39a5c466_7?geometry=-89.928%2C42.997%2C-88.885%2C43.173.
- . 2021c. "Zoning Text Amendment." City of Madison Planning Division. <https://madison.legistar.com/View.ashx?M=F&ID=9262681&GUID=0439AB7A-C653-478A-9D1C-765D8F097372>.
- Deal, Brian, and Daniel Schunk. 2004. "Spatial Dynamic Modeling and Urban Land Use Transformation: A Simulation Approach to Assessing the Costs of Urban Sprawl." *Ecological Economics* 51 (1-2): 79–95. <https://doi.org/10.1016/j.ecolecon.2004.04.008>.

- Gielen, Eric, Gabriel Riutort-Mayol, José Luis Miralles i Garcia, and José Sergio Palencia Jiménez. 2019. "Cost Assessment of Urban Sprawl on Municipal Services Using Hierarchical Regression." *Environment and Planning B: Urban Analytics and City Science* 48 (2): 280–97. <https://doi.org/10.1177/2399808319869345>.
- Goodman, Christopher B. 2019. "The Fiscal Impacts of Urban Sprawl: Evidence from U.S. County Areas." *Public Budgeting & Finance* 39 (4): 3–27. <https://doi.org/10.1111/pbaf.12239>.
- Hanson, Andrew. 2019. "Taxes and Economic Development: An Update on the State of the Economics Literature." *Lincoln Institute of Land Policy*, 1–35.
- Hortas-Rico, Miriam. 2013. "Urban Sprawl and Municipal Budgets in Spain: A Dynamic Panel Data Analysis." *Papers in Regional Science* 93 (4): 843–64. <https://doi.org/10.1111/pirs.12022>.
- Horton, Ryan. 2021. "Tax Increment Financing." Wisconsin *Legislative Fiscal Bureau*, no. 20: 1–24. <http://lrbdigital.legis.wisconsin.gov/digital/collection/p16831coll3/id/1775>.
- Rhodes-Conway, Satya. 2021. "Satya Rhodes-Conway: Madison Needs More Housing — Our Zoning Should Support That Goal." *The Cap Times*, March 25, 2021. https://madison.com/ct/opinion/column/satya-rhodes-conway-madison-needs-more-housing-our-zoning-should-support-that-goal/article_037a0075-b157-5334-8b70-842f62008e53.html.
- Song, Yan, and Yves Zenou. 2006. "Property Tax and Urban Sprawl: Theory and Implications for US Cities." *Journal of Urban Economics* 60 (3): 519–34. <https://doi.org/10.1016/j.jue.2006.05.001>.
- . 2008. "How Differences in Property Taxes within Cities Affect Urban Sprawl?" *Research Institute of Industrial Economics*, no. 754. <https://doi.org/10.2139/ssrn.1708267>.
- Tian, Li, Yongfu Li, Yaqi Yan, and Boyi Wang. 2017. "Measuring Urban Sprawl and Exploring the Role Planning Plays: A Shanghai Case Study." *Land Use Policy* 67 (2017): 426–35. <https://doi.org/10.1016/j.landusepol.2017.06.002>.
- Varela-Candamio, Laura, Fernando Rubiera Morollón, and Gohar Sedrakyan. 2018. "Urban Sprawl and Local Fiscal Burden: Analysing the Spanish Case." *Empirica* 46 (1): 177–203. <https://doi.org/10.1007/s10663-018-9421-y>.
- Wassmer, Robert W. 2000. "Urban Sprawl in a U.S. Metropolitan Area: Ways to Measure and a Comparison of the Sacramento Area to Similar Metropolitan Areas in California and the U.S." *Lincoln Institute of Land Policy*. <https://doi.org/10.2139/ssrn.241975>.