SPATIAL PLANNING AND
FISCAL IMPACT ANALYSIS

Developing an understanding of spatial planning can help you better plan for land use in your community.

BY LINDA TOMASELLI

As part of a realistic long-range financial forecast, a finance director needs to estimate the impact of future land use—and this calls for a good picture of revenue and expenditure patterns by land use type. *Spatial Planning and Fiscal Impact Analysis Method: A Toolkit for Existing and Proposed Land Use* (Routledge, 2019) describes a way to link information from finance directors to planners who are using geographic information systems (GIS). It provides finance directors with information about where the revenues and expenditures in their cities are located on an annual basis, and which types of land uses generate surpluses or deficits. The planning and finance departments can also provide immediate fiscal impact information for a currently proposed development.

The concept upon which the Spatial Method is based is illustrated in Exhibit 1. Revenues and expenditures are spatial. Revenues come in from parcels, and expenditures go out to service parcels, as shown in the circles in the chart. Typical business processing systems (and perhaps local government processing systems) are based on data processing of transactions, as shown at the bottom of the chart's pyramid. These are summarized to make operational,

Exhibit 1: The Spatial Fiscal Impact Method Concept

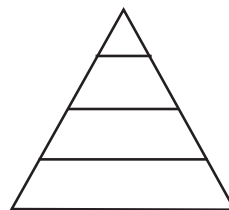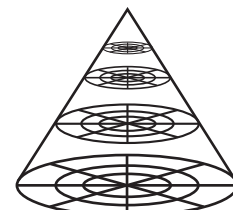## Revenues and Expenditures are Spacial

Revenues　　**Expenditures**

An ideal transaction processing system

Business Decisions

- Strategic
- Tactical
- Operational
- Data Processing (transactions)

Planning Decisions

- Spending and Capital Improvements
- Comprehensive Plan
- Land Use/ Neighborhood Analysis
- Parcel Level Analysis

tactical, and strategic decisions. In the case of local government systems, summary data for a year is summarized in the comprehensive annual financial report (CAFR), which provides the totals of revenues and expenditures by type. Under the spatial method, the factors that reflect city business operations turn the typical pyramid into a cone, with parcels located at the base. The planning department makes decisions based on parcel summaries by land use and/or neighborhood. This information also provides guidance in preparing the city's comprehensive plan, which guides the proposed spending for capital improvements. In an ideal world, the finance director would have a transaction processing system capable of locating where each dollar of revenue comes from and where each dollar of expenditure is spent. But this is not how financial systems are organized.

Revenues and expenditures are almost always spatially attributable to parcels and land uses, whether they are based on assessed and market values, police and fire/EMS calls, population, employment, locally maintained streets, parks, or other factors. All of these factors can be allocated to parcels in the city, thanks to the availability of the parcel map created by the surveyor. The assessor has also added many attributes such as owner names, addresses, housing types and sizes, and generalized land uses.

The objective is to estimate fiscal impact by land use. The map in Exhibit 2 shows the generalized land uses from the assessor for the City of Bloomington, Illinois (population 78,000). Bloomington is the case study city on which the book is based. The assessor and planner provided more detail on the land use categories, such as the breakdown of residential into apartments, duplexes, multi-family, single family, and townhouses. The administrative center of the city is located where the small parcels are clustered on the map.

Distribution Factors for Parcels

The Spatial Method requires that a parcel database be developed using GIS, including the factors listed below.

Direct distribution factors:
- Net assessed value and property taxes
- Police calls
- Fire calls
- Locally maintained road frontage

Indirect distribution factors:
- Population
- Employment
- Market value

Direct factors can be directly identified using GIS. Property taxes are already allocated by parcel, based on the assessor's data. Police and fire calls can be allocated to parcels using address matching or matching to streets. Locally maintained road frontage can also be directly assigned to parcels.

Indirect factors are used to allocate the revenues and expenditures to parcels that are not directly measurable by the city's transaction processing system. Market value is also directly available from the assessor, and it is a good representation of the intensity of the land use, whether it be commercial/industrial, residential, or tax-exempt. Population and employment can be estimated by parcel and also reflect revenue contributions or expenditure demands. These indirect factors can be given weights to estimate revenue and expenditure amounts in an attempt to model what would be the results of that ideal transaction processing system.

Exhibit 2: 2013 Generalized Land Use in Bloomington, Illinois

Generalized Land Use

- Commercial
- Industrial
- Institutional
- Recreation and Open Space
- Residential
- Transportation
- Vacant

Prepared by GISRDC

0   0.75   1.5   3 Miles

N
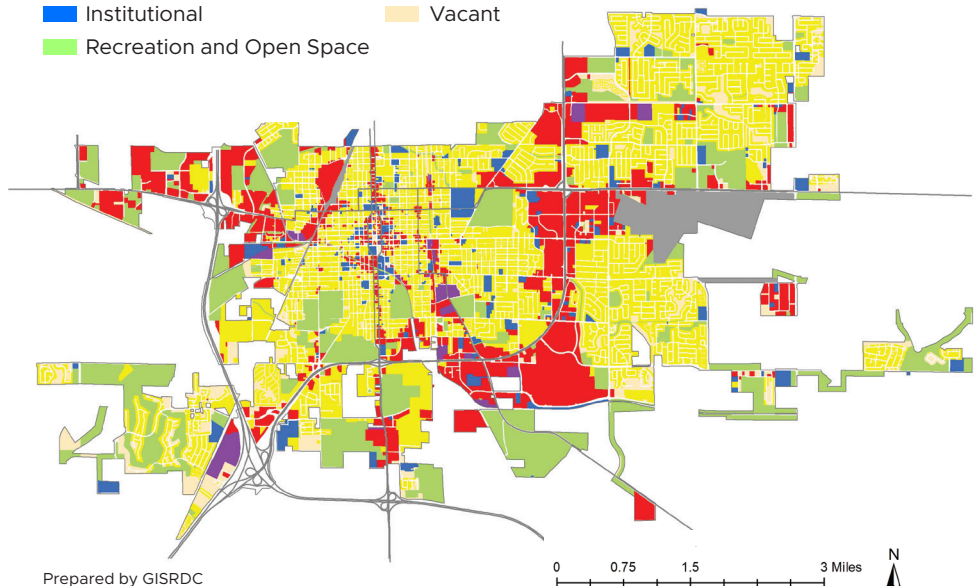
Direct Distribution Factor Example: Police Calls

Here is an example of how police call expenditures were allocated to parcels in Bloomington. The map in Exhibit 3 shows police calls to addresses and calls to streets. Police call time averaged 47 minutes (a call equivalent), and there were 74,548 police call equivalents to addresses and 22,411 to street locations. Call equivalents factor in the call time because some calls may simply have been a short 911 hang-up, while others may be for major incidents, taking hours to complete.

After consulting with the police department, the proportions of the annual police expenditures were categorized as (1) expense for call equivalents by type and (2) expense for patrolling, readiness, and administration. In Bloomington, 19 percent of police expenditures were estimated for police address calls, which amounted to $7,809,476. Dividing the expenditures by calls resulted in a multiplier of $104.76 per call equivalent. Then the address calls were address matched to parcels, and the call equivalents were calculated. Using the multiplier, police call expenditures were calculated for each affected parcel. A similar process was used to allocate street call equivalents to parcels by locating the calls on streets and then allocating them to nearby parcels using GIS.

Other Distribution Factor Examples:

The building market value, shown in Exhibit 4, reflects the intensity of the land use for each property, and was used as an indirect factor. Combined with land market values, the total was used by the assessor to calculate assessed values, which in turn determine property taxes, a direct distribution factor.

The population density is shown in Exhibit 5, expressed as persons per acre. Of course, one does not know the actual number of persons per housing unit, but it can be estimated using census block data and housing types and bedroom counts from the assessor.

Exhibit 3: 2013 Police Calls in Bloomington, Illinois

1 Dot = 5 Call Equivalents

- Calls to Parcels
- Calls to Streets

Prepared by GISRDC

0   0.75   1.5   3 Miles   N
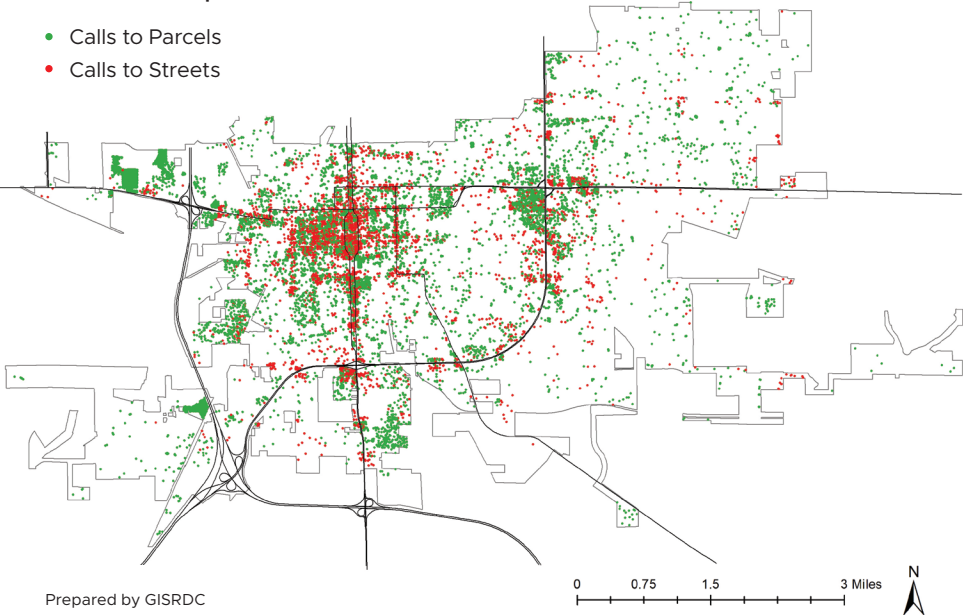
Exhibit 4: 2013 Market Value per Acre in Bloomington, Illinois

Market Value Per Acre

Less than $10,000 $200,000–$299,999
$10,000–$99,999 $300,000–$399,999
$100,000–$199,999   Greater than $400,000

Prepared by GISRDC

0   0.75   1.5   3 Miles   N
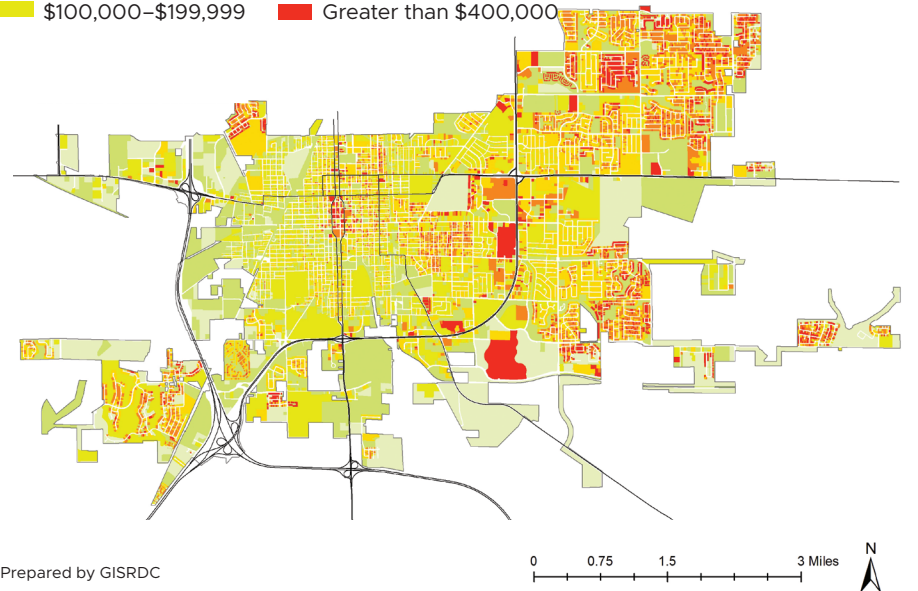
Other factors not shown here include fire/EMS calls, employment, local road frontage, and year built. Fire/EMS calls were allocated in the same manner as police calls. Employment was estimated from a business inventory. Road frontage was allocated to parcels by identifying the local frontage centerlines and then "buffering" them, using GIS to measure the amount of frontage for each affected parcel.
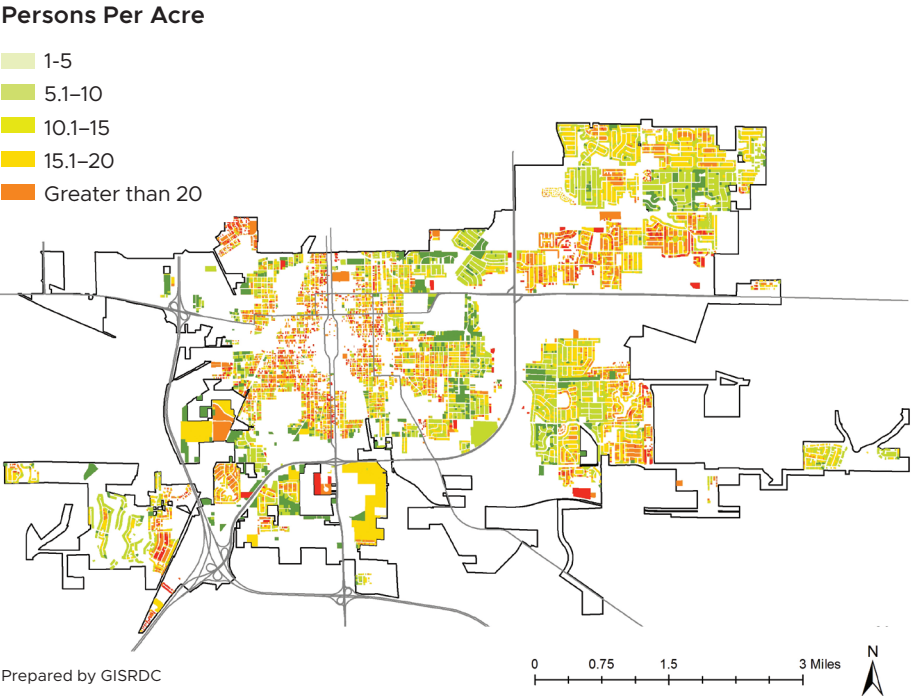
Distribution Factor Weights

Some of Bloomington's expenditure categories and the distribution factors that were used to allocate the costs to parcels are shown in Exhibit 6. Each factor was given a weight by the local city staff, so in another city, the weights may be different. The finance director also provided specific data on charges for services.

Similar calculations were done for operating expenditures. Exhibit 7 shows some of Bloomington's expenditure categories and weights.

Exhibit 5: 2013 Population Density in Bloomington, Illinois

Persons Per Acre

- 1-5
- 5.1–10
- 10.1–15
- 15.1–20
- Greater than 20

Prepared by GISRDC

0   0.75   1.5   3 Miles   N

Exhibit 6: Examples of Operating Revenue Categories and Weights

Revenue Category	Distribution Factor	Weight
Charges for Services	Population	**45%**
	Employment	**10%**
	Police Calls	**6%**
	Fire Calls	**31%**
	Road Frontage	**8%**
Property Taxes	Net Assessed Value	**100%**
Sales Taxes	Population	**80%**
	Employment	**20%**
Commercial Taxes	Commercial MV	**100%**
Other Taxes	Net Assessed Value	**100%**
Income Taxes	Population	**100%**
Utility Taxes	Residential Bldg. Mkt. Val.	**100%**
Intergovernmental Revenue:		
– Parks	Population	**80%**
	Employment	**20%**
– Police	Police Calls	**100%**
– Fire	Fire Calls	**100%**
Investment Income	Net Assessed Value	**100%**
Licenses	Commercial Mkt. Val.	**100%**
Fines and Forfeits	Police Calls	**100%**
Other	Population	**64%**
	Employment	**20%**
	Police Calls	**10%**
	Fire Calls	**6%**

Exhibit 7: Examples of Operating Expenditure Categories and Weights

Operating Expense Category	Distribution Factor	Weight
General Government		**45%**
– Administration	Population	45%
	Total Building MV	10%
	Employment	100%
– Vehicle Costs	Distance Factor	100%
Streets	Local Frontage	70%
Culture/Recreation	Population	10%
	Population Distance	20%
	Employment	
Public Safety		**19%**
– Police and Fire	Police Call Equivalents	6%
	Street Call Equivalents	22%
	Fire Call Equivalents	
– Building Safety and Code Enforcement	Commercial/Industrial and Apartment MV	5%
– Patrolling and Readiness		
	Population	14%
	Total Building MV	15%
	Distance Factor	13%
	Employment	6%

Exhibit 8: Examples of Multipliers by Distribution Factor

Distribution Factor	Total Revenue	Total Expenditures	Description
Population	**$485.57000**	**$326.85000**	Per Capita
Employment	**$114.69000**	**$117.62000**	Per Employee
Assessed Value	**$0.01488**		Per $1,000
Market Values:			
– Commercial/Industrial/ Apartment Building		**$0.00426**	Per $1,000
– Residential Building	$0.00601		Per $1,000
– Commercial Building	$0.02403		Per $1,000
– Total Building MV	$0.00043	$0.00724	Per $1,000
– TIF Building MV	$0.01703	$0.04195	Per $1,000
Fire Calls	$295.23000	$774.32000	Per Call
Police Calls	29.08400	$106.37000	Per Call
Street Police and Fire Calls		$114.32000	Per Street Call
Road Frontage:			Per Front Foot
– Local Frontage	$0.28000	$2.66000	Per Front Foot
– Dilapidated Streets		$2.87000	Per Front Foot
Low and Moderate Income Index	$4.92000	$0.01495	Market Value Index

Distribution Factor Multipliers

Multipliers for each distribution factor were calculated by dividing the distribution amount by the total distribution factor. For example, total charges for services from the comprehensive annual financial report (CAFR) was $11,431,189, and 45 percent was estimated to be collected based on population, or $5,144,035. The total population in the city was 77,680; dividing it into the population amount resulted in a multiplier of $66.22 per capita.

Not shown here were revenues and expenditures that were for capital items or for special land uses in the city. These were treated separately because they could vary significantly from one year to the next or should be allocated only to the affected parcels. The distribution factors and weights to be used to allocate them were treated separately. An example would be revenues and expenditures for tax-increment financing (TIF) projects. Another would be state revenue to fix dilapidated streets. Yet another would be Community Development Block Grant revenue to upgrade areas with low-income housing.

Exhibit 8 summarizes some of the total multipliers for each of the key distribution factors, including both operating and capital.
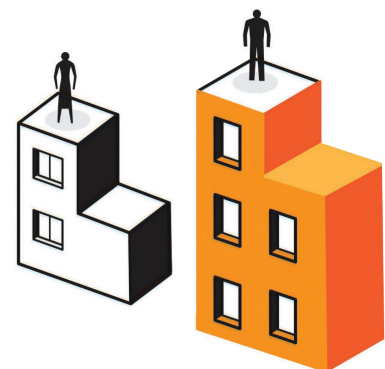
Exhibit 9: Example of Fiscal Impact (Surplus or Deficit) for a Residential Parcel

Distribution Factor	Parcel Factors	Revenue	Expenditures	Surplus or Deficit
Population	3.00	$1,456.71	$980.55	$476.16
Assessed Value	$100,000.00	$1,488.00	$0.00	$1,488.00
Market Values:				
– Residential Building Market Value	$120,000.00	$721.20	$0.00	$721.20
– Total Building Market Value	$120,000.00	$51.60	$868.80	-$817.20
Police Calls	1.00	$29.08	$106.37	-$77.29
Road Frontage:				
– Local Frontage	80.00	$22.40	$212.80	-$190.40
Totals	NA	$3,768.99	$2,168.52	$1,600.47

Exhibit 10: Fiscal Impact by Land Use

General Land Use and Tax Status	Number of Parcels	Acres	Preliminary Fiscal Impact	Net Taxable Fiscal Impact	
			$ Amount	$ Amount	$ Per Acre
Taxable					
Commercial	1,544	2,723	6,095,865	4,135,003	1,519
Industrial	29	220	225,357	169,260	770
Institutional	4	1	-1,192	-1,858	-1,445
Recreation and Open Space	92	1,583	-675,163	-775,107	-490
Residential	22,012	5,662	3,681,568	-2,870,390	-507
Transportation	4	350	-134,508	-202,155	-578
Vacant	1,147	545	-377,610	-454,723	-834
Subtotal	24,832	11,084	8,814,317	0	0
Tax-Exempt					
Commercial	7	17	-47,854	0	0
Institutional	307	681	-3,140,193	0	0
Recreation and Open Space	155	1,592	-1,883,461	0	0
Residential	181	147	-644,761	0	0
Transportation	15	285	-294,220	0	0
Vacant	335	475	-648,722	0	0
Subtotal	1,000	3,197	-6,659,212	0	0
Totals	**25,832**	**14,281**	**2,155,154**	**0**	**0**

Calculations for an example parcel are shown in Exhibit 9, assuming that it had a population of three, an assessed value of $100,000, a market value of $120,000, one police call equivalent, and was located on a local street.

Fiscal Impact by Land Use

Each parcel had a land use (with the rare exception of multiple uses), and therefore the revenues and expenditures were summarized to estimate surpluses or deficits by parcel and by land use. The objective was not to single out individual parcels, but rather to aggregate the results by groups of parcels. Using the aggregate amounts, a financial planner could forecast the fiscal impact results of a proposed land use plan. Areas with significant deficits could also be studied further and may indicate areas for redevelopment and perhaps TIF districts.

The summaries of fiscal impacts by land use are shown in Exhibit 10. Note that all parcels were given a preliminary fiscal impact, including tax-exempt ones. However, tax-exempt uses are always supported by the taxable land uses, and so the negative fiscal impact of the tax-exempt land uses were allocated to the taxable uses to derive the net taxable fiscal impact. Note that the city had an annual surplus of $2,155,154, as shown at the bottom of the table, which is consistent with what was shown in the CAFR.

The net total fiscal impact for the parcels is shown in Exhibit 11. Note that the central city area had many parcels with deficits, due to the structure ages and lower assessed values, as compared to the newer development to the northeast of the city. Detail regarding the areas with deficits provided the basis for the establishment of a new TIF district in Bloomington.

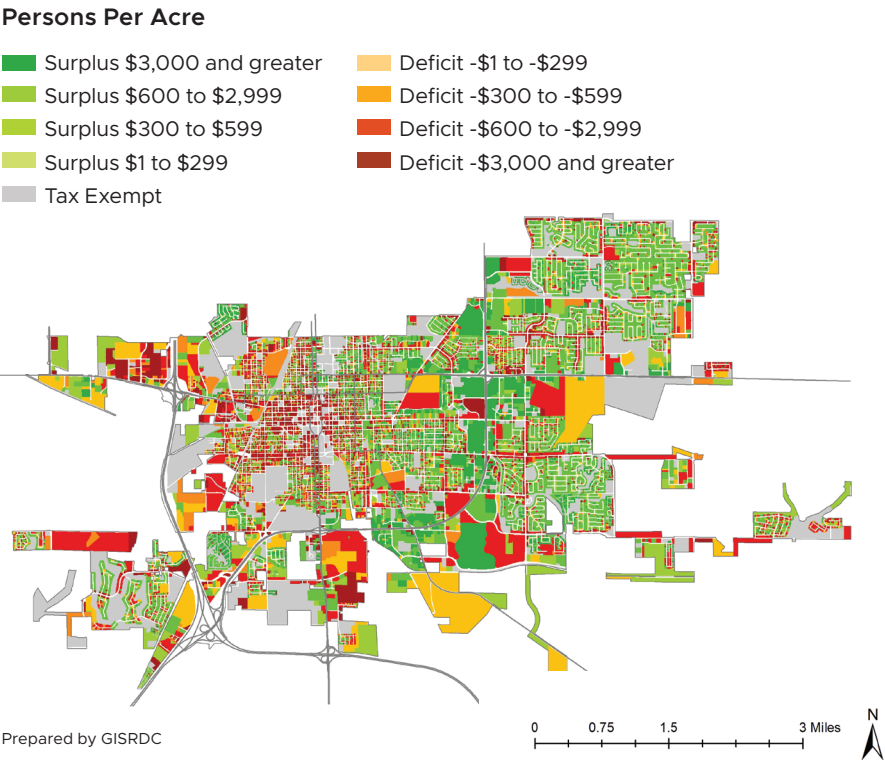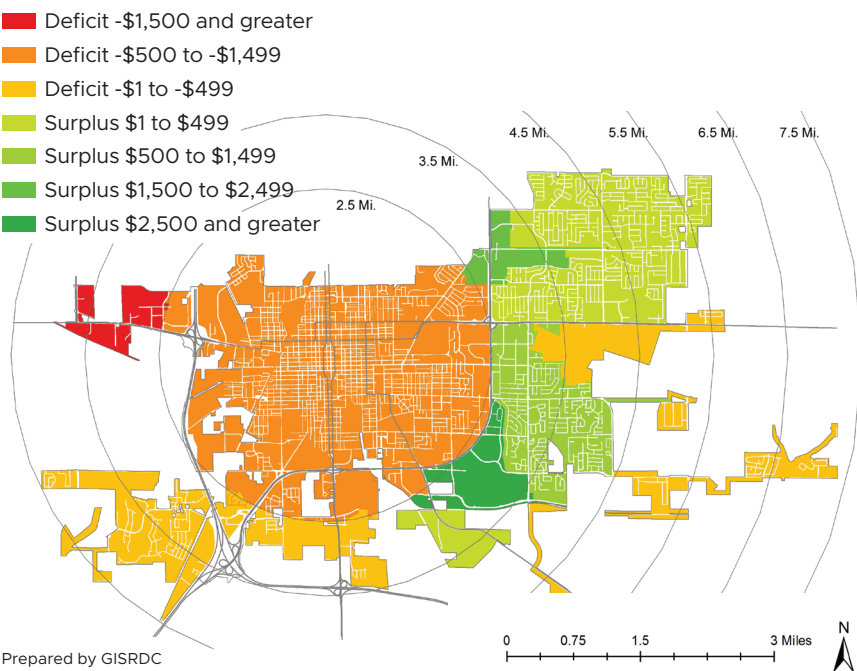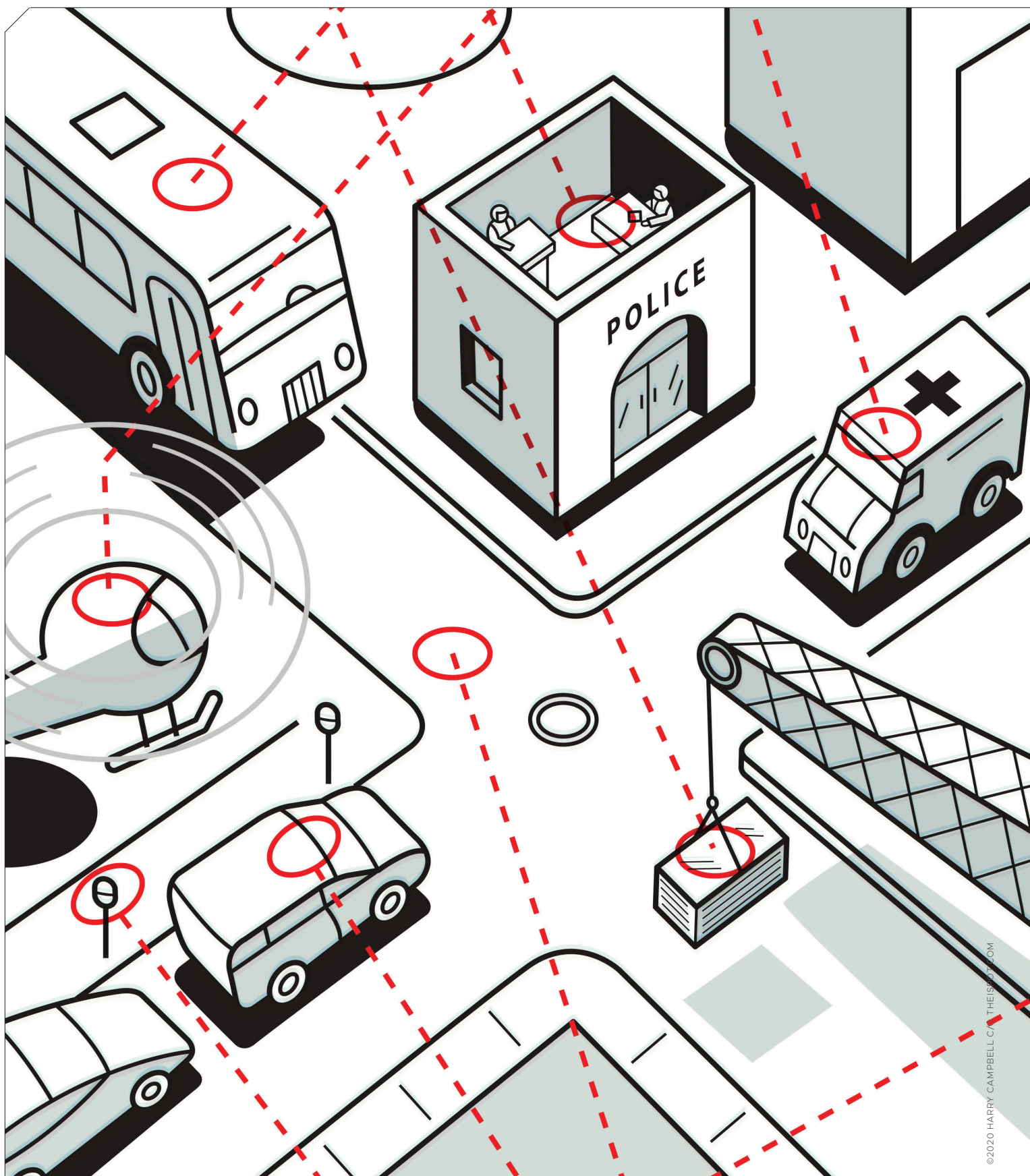**Exhibit 11:** 2013 Net Taxable Fiscal Impact per Acre

Persons Per Acre

- Surplus $3,000 and greater
- Surplus $600 to $2,999
- Surplus $300 to $599
- Surplus $1 to $299
- Tax Exempt
- Deficit -$1 to -$299
- Deficit -$300 to -$599
- Deficit -$600 to -$2,999
- Deficit -$3,000 and greater

Prepared by GISRDC

0   0.75   1.5   3 Miles   N

Exhibit 12: 2013 Neighborhood Net Taxable Fiscal Impact per Acre

- Deficit -$1,500 and greater
- Deficit -$500 to -$1,499
- Deficit -$1 to -$499
- Surplus $1 to $499
- Surplus $500 to $1,499
- Surplus $1,500 to $2,499
- Surplus $2,500 and greater

Prepared by GISRDC

0   0.75   1.5   3 Miles   N

POLICE

Linking city finance and planning using GIS can be very beneficial for long-term financial planning.

Fiscal Impact Decision Making

The Bloomington project was aimed at showing the areas that had significant deficits as well as significant surpluses as a guide for future development decisions.

The map shows areas that sprawl out from the major portion of the city, which also had significant deficits, while areas that were compact and contiguous to the city had significant surpluses. When aggregated by neighborhood, as shown in Exhibit 12, the deficits become more apparent.

The maps of parcels and neighborhood summaries provided city officials with a clear picture of past mistakes in extending sewer and water into the outlying areas to promote development. For the area to the southwest, developed more than 20 years before, the city had only recouped 20 percent of the infrastructure spending. The area to the southeast, developed 10 years before, had only recouped 10 percent of the cost. Furthermore, the development required the building of a new elementary school

by the school district. After seeing this pattern, the city decided not to allow the extension of more infrastructure into the new areas until the sewer and water capacities were significantly used up for these two areas.

Another area to the northwest had a significant deficit, based on its agreement to provide police safety service time to commercial developments in the area, which was surprising to city officials. This knowledge should help in making these kinds of service commitments in the future.

On a positive note, extending services to compact and contiguous areas, as shown in the north and east, was strongly evident to city officials and a guide for future development of the areas with excess capacity.

Conclusions

Spatial Planning and Fiscal Impact Analysis shows that linking city finance and planning using GIS can be very beneficial for long-term financial planning. The book was written to help city staff undertake a study like Bloomington's, although if a city lacks the capability to perform the tasks, it can hire a consultant. The book helps finance directors understand which land uses produce surpluses and which create deficits. It also helps planners understand the impact of their planning recommendations, which can be provided to city engineers to help make prudent proposals for extending infrastructure in the future. Decision makers can easily see the patterns of city operations, whether for specific departments, such as police and fire/EMS, or for the parcel or neighborhood fiscal impacts. As they say, a picture is worth a thousand words. ▣
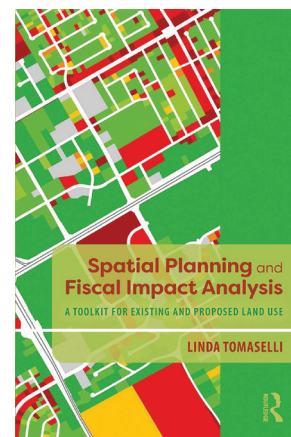
Spatial Planning and Fiscal Impact Analysis provides an overview of the history of fiscal analysis, and demonstrates the advantages of the Spatial Method to other methods, taking the reader step by step through the process, from analyzing city financial reports, determining and developing the factors that are needed to model the flows of revenues and expenditures, and then estimating fiscal impact at the parcel level. The result is a summary that will be invaluable to city planners and public administration officials everywhere.

Linda Tomaselli, PhD, *is the owner of GIS Research and Development Consultants (GISRDC). She provides fiscal impact analysis, planning and GIS assistance to local government and specializes in fiscal impact analysis. For more details, visit Anoka-Fiscal-Impact.com and www.Bloomington-Fiscal-Impact.com.*