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**DYNAMICS OF LAND-USE CHANGE IN NORTH ALABAMA: IMPLICATIONS OF NEW
RESIDENTIAL DEVELOPMENT**

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DYNAMICS OF LAND-USE CHANGE IN NORTH ALABAMA: IMPLICATIONS OF NEW RESIDENTIAL DEVELOPMENT

ABSTRACT

Resisting pressure for converting viable agricultural lands to meet the ongoing demand for residential, commercial, industrial and other land uses is perhaps the greatest challenge facing urban planners and municipal decision makers. Like other regions across the nation, Alabama is experiencing the dominant pattern of urbanization, converting agricultural lands to residential and other commercial land uses. Like in any decision task, converting land from agricultural to other uses require measuring the direct impacts of the available options. This paper presents an analytical tool that could help in understanding the consequences of individual decisions associated with land use change by identifying their potential impacts to a community, county or region. The tool outlines the potential costs and benefits of land conversion activities to decision makers. By using a case study of Madison County, the estimated results show that the loss of agricultural lands erodes the county's ability to maintain revenue/cost equilibrium across the selected land use types, thus reducing the county's ability to provide current levels of service to residents.

I. INTRODUCTION

There are many factors that influence, directly or indirectly, the land allocation and land management decisions. Despite the complexity and variability of land use change, it is extremely important to get insight in possible trajectories of land use change and the driving factors behind these changes (Parker, et al., 2003). This explains the increasing research activities in the field of land use and land cover change (Veldkamp and Lambin, 2001; Lambin, et al., 2003; Waddell, 2002). Like other regions across the nation, Alabama is experiencing the dominant pattern of urbanization, converting agricultural lands to residential and other commercial land uses. The new land-use patterns in Alabama feature: single-family houses on large lots—anywhere from 1/4 acre to 5 acres; elaborate road networks to serve auto and truck travel; and huge shopping malls and

office parks. In any decision task, like converting lands to other uses, it becomes critical to measure the direct impacts of the available options.

The objective of this paper therefore, is to examine the cost and benefits of converting agricultural land to other land use options. Specifically, the paper uses a case study approach to determine how county land use affects county finances. The analysis determines the contribution of separate categories of land uses to overall county finances and allows the county to determine how conversion of agricultural land fiscally impacts the county. The benefit of this type of analysis is that it allows decision makers in a county to see what the local impacts of land conversion from agricultural to residential or commercial use would be on a parcel basis.

To examine the cost and benefit associated with the different land use types, the paper employs the Cost of Community Services (COCS) model developed by the American Farmland Trust (AFT, 2004). County expenditures and revenues derived from the COCS model for a given land type represent the costs and benefits, respectively associated with the land use type in question. The COCS model consists of three main components:

1. Determining how much of the County's revenue is derived from land uses associated with residential development versus commercial, industrial, and extraction activities, versus agricultural activities and open spaces.
2. Determining how much of the County's overall budget is expended on land uses associated with residential development versus commercial, industrial, and extraction activities versus agricultural and open space activities.
3. Comparing the revenues and expenditures associated with each of these land use types in order to derive a revenue/cost ratio for each.

The revenue/cost ratios derived from the COCS model are equivalent to the benefit/cost ratios from a typical cost-benefit analysis, and provides county decision makers with an additional tool for determining the fiscal impacts associated with accommodating growth within the county. The rest of the paper is organized in several additional sections presenting the overall methodology, the findings: attribution of the county's revenues and expenditures to the three land use categories, and determination of the revenue/cost ratios for each of the land use categories and the conclusions.

II. METHODOLOGY

Many land use change models have been developed, yet there is no clearly superior approach. This is felt to be due largely to the complexity of the land development process, and to differences in available data sets and modeling objectives (Parker, et al., 2003; Landis, 1995; Waddell, 2002). The COCS model used in this paper was established by AFT in 1993 and has been used in over 80 communities around the nation (Appendix). The model provides a quick and relatively straightforward method for determining the fiscal impacts of land development in a geographic area at a given point in time. It determines what portion of a community's revenues is derived from each type of land use and compares this with how much of the community's expenditures are spent providing services to each type of land use. The COCS model involves four simple steps as outlined below.

1. Defining the Land Use Categories

The first step in the COCS methodology is to define the land use categories that will be used in the analysis. Land use, in this case, refers to what human activities are or are not taking place on the land (e.g. growing corn versus raising a family). For the current analysis, all the various activities taking place are grouped into three major categories:

- *Residential*: Includes single family attached units, single family detached units, multi-family units, mobile homes, farm and ranch residences. Valuation includes all land, improvements, and personal property associated with these uses.
- *Commercial/Industrial*: Includes retail, lodging, office, industrial, utilities, and vacant parcels less than 35 acres with a commercial designation. Valuation includes all land, improvements, and personal property associated with these uses.
- *Agricultural/Open Space*: Private property used for farming, ranching, and forestry, as well as vacant lands. Includes all agriculturally zoned land, forestland, and vacant parcels greater than 35 acres.

2. Attributing Revenue to Land Uses (Where the Money Comes From)

The next step in the COCS process is to determine how much revenue each of these land uses generates for the county. Counties receive revenue from several sources, such as property taxes, fees for licenses and permits, charges for services, grants, and revenue from the state and federal governments. In some cases, attributing a revenue stream to a particular land use is relatively straightforward. For example, property taxes are derived from property ownership – county assessed value is associated with residential, commercial, and agricultural uses, so it is possible to determine who paid the taxes and in what proportion.

In some cases, attributing a revenue stream to a particular land use is more difficult. For example, the records associated with fees collected from building and construction permits do not allow for simply summing up the total fees paid for residential, commercial, and agricultural construction within the county during the year. However, the records do show how many permits were issued for commercial, residential, and agricultural construction during the year. So, while the distribution of permits is not precisely the same as the distribution of fees, it does provide the

proportion of construction activity associated with each land use. These proportions can then be used to estimate the portion of the collected fees associated with each land use. In some cases, attributing a revenue stream to a particular land use is impossible. For example, the interest collected on delinquent taxes in various fund accounts cannot be attributed to any source other than the county as a whole. When this happens, the COCS model calls for the use of fallback percentages. These percentages are based on the share of total assessed value attributable to each land use category within the county. Returning to the example of delinquent taxes, the use of fallback percentages assumes that no one type of land use is delinquent more than another.

3. Allocating Expenses to Land Uses (Where the Money Goes)

The next step in the COCS process is to determine what it costs the county to provide services to each of the land uses. Like county revenues, expenditures are allocated to land uses using a variety of methods that range from the straightforward, such as allocating all education expenditures to residential land uses; to estimations, such as using the number of commercial garbage haulers to estimate the percentage of a land fill's budget that is attributable to commercial uses. As with attributing revenues to land use type, it is sometimes impossible to definitively attribute certain expenses to a specific land use. For example, the county manager's office is responsible for overseeing numerous aspects of county government operations and there are no fees or permits associated with these day-to-day activities that might serve as a record of who or what is benefiting at any given time. For this reason, the COCS model again calls for the use of fallback percentages to allocate this type of indeterminable expense. It should be noted that in such cases revenues and expenditures are allocated using the same fallback percentages, so the effect on the final revenue/cost ratio is neutral.

4. Computing the Revenue/Cost Ratios (Finding Out Who’s “Paying Their Own Way”)

The final step in the COCS analysis is to compute ratios comparing how much revenue the county receives from a given land use category with how much it expends providing services to that land use. These ratios are derived by dividing the total revenues attributed to a land use by the total expenses allocated to it. A land use in fiscal equilibrium will have a \$1: \$1 ratio, meaning that for every dollar the county received from the land use, it spent a dollar providing services to it. A land use running a fiscal deficit will incur more expenditures than it generates in revenue (e.g., \$1: \$2) and a land use running a fiscal surplus will contribute more revenue than is required to provide services (e.g., \$1: \$0.50).

CASE STUDY: LAND USE IN MADISON COUNTY, ALABAMA

This section presents the results of the Madison County COCS analysis. As outlined in the methodology section, the first step in the COCS analysis for Madison County is to determine how much of the county is devoted to residential, commercial, and agricultural land uses. This is accomplished by determining the number of taxable parcels associated with each land use and determining the total assessed value associated with those uses. Table 1 presents this information for Madison County in 2004.

Table 1: Parcels and Assessed Valuation by Land Use Type in 2004

	Residential	Commercial and Industrial	Agricultural and Open Space	Total
Number of Parcels	29,607	5,143	104,250	139,000
Percent of Total Parcels	21.3%	3.7%	75%	100%
Total Assessed Value	40,485,950	28,769,385	46,750,251	116,005,586
Percent of Total Value	34.9%	24.8%	40.3%	100%

Source: Annual Report of Madison County 10/1/2003 through 9/31/2004

Both percentages listed in Table 1 inform the COCS analysis and both are used as fallback percentages. The percentage of total parcels associated with each land use type is an indicator of how much general government activity is created by each of the land uses. For example, the county treasurer is charged with billing and collecting all of the county's property tax. Since 21.3-percent of those bills will go to owners of residential parcels, it is assumed that 21.3-percent of the treasurer's time is spent serving residential land uses. Since property tax is the single largest source of revenue generated by county residents, the percentage of the county's total assessed value associated with a particular land use is directly related to how much revenue each land use contributes. Simply put, since residential land accounted for 34.9-percent of the county's taxable assessed value in 2004, residential landowners paid 34.9-percent of the property taxes collected in that year.

Revenue Sources

The second step in the COCS analysis is to attribute county revenue to the land uses from which they are derived. Madison County receives revenue in a variety of forms. Table 2 presents County revenues in 2004 listed by source.

Table 2: Madison County 2004 Revenues by Source

Category	Amount	Percentage
Taxes	\$35,538,328	44.5%
Licenses and Permits	\$1,529,727	1.9%
Intergovernmental	\$12,992,968	16.3%
Charges for Services	\$26,307,532	32.9%
Fines & Forfeits	\$28,093	0.03%
Miscellaneous	\$3,455,721	4.3%
Total Revenue as of September 30, 2004	\$79,852,372	100%

Source: Annual Report of Madison County 10/1/2003 through 9/31/2004

County revenues are tracked in seven separate funds, including the county’s General Fund and six special revenue funds: Road & Bridge, Social Services, Nursing Services, Library, Conservation Trust, and Tourism. To attribute these revenues to land use categories for the COCS analysis, we reviewed the county’s 2004 Financial Report by line item and allocated a percentage of each revenue line item to each land use category. Table 3 presents the total revenues attributable to each land use. The majority (67.9%) of the county’s revenue in 2004 was generated by residential land uses, followed by agricultural/open uses (18.6%), and commercial/industrial uses (13.5%). While it is normal for the residential category to generate the most revenue, it is unusual for agricultural uses to generate more revenue than commercial ones.

Table 3: Madison County 2004 Revenues Attributed to Land Use Type

	Residential	Commercial and Industrial	Agricultural and Open Space	Total
Revenues	54,219,761	10,780,070	14,852,541	79,852,372
Percent of Total	67.9%	13.5%	18.6%	100%

Source: Computed by author using data from Annual Report of Madison County 2004

Expenditures

The next step in the COCS analysis is to apportion county expenditures according to the land uses that benefit from them. The Madison County government provides many services throughout the county. Table 4 presents county expenditure in 2004 listed by type. County expenditures are tracked in the same seven funds as county revenues (the county’s General Fund and six special revenue funds: Road & Bridge, Social Services, Nursing Services, Library, Conservation Trust, and Tourism).

Table 4: Madison County 2004 Expenditures by Type

Category	Amount	Percent
General Government	\$26,161,111	32.35%
Public Safety	\$18,621,107	23.03%
Highway and Roads	\$11,329,184	14.01%
Sanitation/Water	\$12,742,765	15.76%
Recreation and Cultural	\$1,038,339	1.28%
Health	\$1,899,412	2.35%
Welfare	\$353,996	0.44%
Education	\$61,526	0.08%
Intergovernmental	\$12,959	0.02%
Capital Outlay	\$5,807,780	7.18%
Debt Service	\$2,838,727	3.51%
Total Expenditures as of September 30, 2004	\$80,866,911	100%

Source: Annual Report of Madison County 10/1/2003 through 9/31/2004

To attribute these expenditures to land use categories for the COCS analysis, we reviewed the county's 2004 Financial Report by line item and allocated a percentage of each expenditure line item to each land use category. Table 5 presents the total expenditures attributable to each land use. The majority of the county's expenditures (88.3%) in 2004 were allocated to residential land uses. Commercial and agricultural land uses combined accounted for just over 11-percent of all county expenditures in 2004.

Table 5: Madison County 2004 Expenditure Allocated to Land Use Type

	Residential	Commercial and Industrial	Agricultural and Open Space	Total
Expenditure	71,405,482	5,337,216	4,124,212	80,866,911
Percent of Total	88.3%	6.6%	5.1%	100%

Source: Computed by author using data from Annual Report of Madison County 2004

The final step in the COCS process is the computation of ratios. These ratios compare how much revenue the county receives from a given land use category with how much it expends providing services to that land use. The results for the computed ratios are presented and discussed below.

III. RESULTS AND DISCUSSION

Our analysis for Madison County shows significant differences among the ratios of revenue to expenditure associated with each of the three land use type (Table 6). The revenue/cost ratios show that for every dollar collected from residential land uses in 2004, \$1.24 was spent providing services to the residents themselves. For every commercial/industrial dollar collected, 50-cents were spent on services; and for every agricultural/open space dollar, 28-cents were spent on services. These ratios translate into a \$10.6 million surplus generated by agricultural and open lands for the county in 2004 and another \$5.3 million surplus generated by commercial uses – all of which were spent to offset the deficit generated by residential land uses during the year.

Table 6: Revenue/Cost Ratio by Land Use Type in Madison County Alabama, 2004

	Residential	Commercial and Industrial	Agricultural and Open Space	Total
Revenue	54,219,761	10,780,070	14,852,541	79,852,372
Expenditure	71,405,482	5,337,216	4,124,212	80,866,911
Revenue/Cost Ratio	\$1: \$1.24	\$1: 0.50	\$1: 0.28	\$1: \$1.01

Source: Computed by author using data from Annual Report of Madison County 2004

The Madison County findings make clear that while new residential development in the county increased the gross amount of income collected by the county (mainly through a marked increase in assessed valuation), the net fiscal impact on the county in 2004 was negative. Though

some commercial subsidy of residential uses within the county is to be expected, what is significant in Madison County is the degree to which agriculture is subsidizing residential land uses. In Madison County, agricultural uses not only generate a greater per dollar surplus than commercial/industrial uses, they also generate more total revenue than commercial/industrial uses.

Given that our analysis relied heavily on fallback percentages in areas such as public safety, these findings should be viewed as conservative estimates of residential expenditures. Overall, these findings are consistent with other COCS results from around the U.S. (AFT, 2004). In a national survey of over 80 COCS studies, AFT found the median residential ratio to be \$1: \$1.15, the median commercial ratio to be \$1: 37-cents, and the median agricultural ratio to be \$1: 29-cents.

IV. CONCLUSION

In summary, Madison County's COCS analysis revealed that commercial and industrial activities alone are not enough to offset the deficit generated by residential land use. Even when they are combined, residential and commercial land uses require \$1.15 in services for every dollar they contribute. In other words, even if the construction of new houses is coupled with demand for additional commercial services, the net effect on the county's budget is still negative. These findings reflect the fiscal significance of agriculture in Madison County. The logical implication is that the loss of agricultural lands to development erodes the county's ability to maintain revenue/cost equilibrium across all-three land use types – thus reducing its ability to provide current levels of service to residents.

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APPENDIX: Summary of Previous Cost of Community Services (COCS) Studies

State/Town- Year of Study	Residential	Commercial Industrial	Farm/ Forest/Open	Source
Connecticut				
Durham-1995	\$1: 1.07	\$1: 0.27	\$1: 0.23	S. New England Forest Consortium
Farmington-1995	1: 1.33	1: 0.32	1: 0.31	S. New England Forest Consortium
Litchfield-1995	1: 1.11	1: 0.34	1: 0.34	S. New England Forest Consortium
Pomfret-1995	1: 1.06	1: 0.27	1: 0.86	S. New England Forest Consortium
Maine				
Bethel-1994	1: 1.29	1: 0.25	1: 0.06	Thomas Good, Antioch N. E. Grad School
Maryland				
Carroll County-1994	1: 1.15	1: 0.48	1: 0.45	Carroll Co. Dept. Of Mgt. & Budget
Frederick County-1997	1: 1.05	1: 0.39	1: 0.48	American Farmland Trust
Massachusetts				
Becket-1995	1: 1.02	1: 0.83	1: 0.72	S. N.E. Forest Consortium
Franklin-1995	1: 1.02	1: 0.58	1: 0.40	S. N.E. Forest Consortium
Leverett-1995	1: 1.15	1: 0.29	1: 0.25	S. N.E. Forest Consortium
Westford-1995	1: 1.15	1: 0.53	1: 0.39	S. N.E. Forest Consortium
Minnesota				
Farmington-1994	1: 1.02	1: 0.18	1: 0.48	American Farmland Trust
Lake Elmo-1994	1: 1.07	1: 0.20	1: 0.27	American Farmland Trust
Independence-1994	1: 1.04	1: 0.19	1: 0.47	American Farmland Trust
New York				
Kinderhook-1996	1: 1.05	1: 0.21	1: 0.17	Concerned Citizens of Kinderhook
Montour-1992	1: 1.50	1: 0.28	1: 0.29	Schuyler Co. League of Women Voters
Reading-1992	1: 1.08	1: 0.26	1: 0.32	Schuyler Co. League of Women Voters
Ohio				
Madison Village-1993	1: 1.67	1: 0.20	1: 0.38	American Farmland Trust
Madison Township-1993	1: 1.40	1: 0.25	1: 0.30	American Farmland Trust
Pennsylvania				
Bethel Township-1992	1: 1.08	1: 0.17	1: 0.06	Tim Kelsey
Carroll Township-1992	1: 1.03	1: 0.03	1: 0.02	Tim Kelsey
Staban Township-1992	1: 1.10	1: 0.11	1: 0.06	Tim Kelsey
Rhode Island				
Hopkinton-1995	1: 1.08	1: 0.31	1: 0.31	S. N.E. Forest Consortium
Little Compton-1995	1: 1.05	1: 0.56	1: 0.37	S. N.E. Forest Consortium
West Greenwich-1995	1: 1.46	1: 0.40	1: 0.46	S. N.E. Forest Consortium
Virginia				
Clarke County-1994	1: 1.26	1: 0.21	1: 0.15	Piedmont Environmental Council
Wisconsin				
Dunn-1994	1: 1.06	1: 0.29	1: 0.18	Town of Dunn

Source: American Farmland Trust