

**THE POTENTIAL FOR COMMUNITY FORESTS TO BE SELF-FINANCING: AN  
HEDONIC ANALYSIS OF THE ENHANCEMENT VALUE OF GEORGIA'S TREES**

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## **Executive Summary**

Forested areas provide multiple benefits including recreational opportunities, aesthetic enjoyment, and ecological services such as water purification and wild life habitat. The presence of forested areas in the form of neighborhood parks, greenbelts, golf courses, and trails have been shown in a number of empirical studies to contribute to the overall value of surrounding real estate.

Researchers at The University of Georgia's Institute of Ecology and Department of Agricultural and Applied Economics recently investigated the relationship between forested areas and surrounding real estate values for four different case studies across Georgia. The study was funded by a Georgia Forestry Commission Urban and Community Forestry grant. The four scenarios were chosen for their unique provision of benefits, location, and the period of their existence.

Two of the case studies involved parks in an urban setting:

- The Sandy Creek Nature Center, a wildlife sanctuary with several miles of interpretive trails and the adjoining Sandy Creek Park that provides swimming, fishing, boating and camping opportunities just north of Athens in Athens-Clarke County.
- The Silver Comet Trail in Cobb County, a linear park with a paved trail that is shared by bikers, skaters, runners and walkers.

The other two case studies evaluated local ordinances:

- Fulton County's tree protection ordinance, which encourages developers to protect existing stands of trees to maintain a minimum tree cover.
- Habersham County's Comprehensive Land Development resolution, which, among other things, protects stream-side vegetation for a distance of seven miles upstream of a public drinking water supply intake.

The positive effect of a park or other environmental amenity on nearby real estate is often referred to as enhancement value. In this study, enhancement value due to the presence of forested areas was estimated using detailed information on housing characteristics (year constructed, heated square feet, foundation, exterior and lot size), neighborhood characteristics (such as proximity of park), and actual home sale transactions. Sale prices were adjusted to 2001 dollars.

### **Property Values and Forested Areas**

In general, the results of this study are in line with a priori expectations and with the results of previous studies of this kind. Major findings of the study are as follows:

- The presence of Sandy Creek Park in Athens-Clarke County enhanced surrounding real estate values up to 1,500 feet from the park. Enhancement value was dependent on distance and ranged from \$5,330 to \$8,570.
- No significant relationship was observed between property values and the Silver Comet Trail in Cobb County.
- Protection of mature trees resulted in a positive influence on home sale prices in Fulton County. Homes sold for approximately \$104,920 more in neighborhoods where mature trees were protected versus homes in neighborhoods where developers opted to replant with younger, smaller trees.

- The protection of streamside vegetation (riparian buffers) to preserve drinking water quality did not significantly affect the value of river front property.

At first glance, the results of the Silver Comet Trail seem to contradict previous research that showed a positive relationship between property values and nearby parks. The most likely reason for this result is the trail's "newness". The Silver Comet Trail has sparked considerable interest among developers and business owners since its official opening in October 2000. Both groups prominently advertise their proximity to the Trail as an enticement for potential customers. The UGA researchers believe that in time the Trail will attract buyers who are willing to pay more to be close to this amenity. When this happens, surrounding properties will increase in value and thus generate additional property tax revenue.

The result for Fulton County's tree protection ordinance also deserves some discussion. The neighborhoods selected for the study represented mid to high property values. However, only high-end homes were represented in the group that comprised neighborhoods built in the spirit of the ordinance. Values in this group ranged from \$387,650 to \$1,709,927 and averaged \$838,360. Therefore, the enhancement value due to the presence of mature trees may only be realized for high-end neighborhoods. In other words, developers of high-end neighborhoods know they can recoup their costs of protecting mature trees whereas developers of low to mid-range neighborhoods may price their homes out of the market if saving existing trees becomes too costly.

### **Revenue Generation**

The results of this study show that protection of forested areas can result in a stream of revenues for local governments. When environmental enhancements are provided, property values tend to increase, generating additional property tax revenue to the local government.

Local governments that face tight fiscal budgets with increasing responsibilities are understandably apprehensive about decisions that will affect their ability to generate revenue. Park creation typically involves purchasing land, removing it from the tax rolls, and budgeting for development and maintenance costs. However, if surrounding real estate increases in value due to the presence of the park, then the protection of open space for public use is not solely an economic drain to county coffers. This study estimated an additional \$43,490 in property tax revenue is generated each year due to the presence of Sandy Creek Park in Athens-Clarke County.

Likewise, the passage of local ordinances that protect aesthetics or water quality, for example, may be perceived as an economic hardship for property owners, developers, or businesses. However, the protection of mature trees in Fulton County resulted in increased home values on the order of \$100,000 for high-end neighborhoods. This increased value translated into approximately \$1,570 in additional property tax revenue per house per year for Fulton County. The protection of streamside vegetation resulted in neither an increase nor a decrease in property value. Therefore, the argument can be made that this type of regulation does not result in a taking while it saves the county money in potential water treatment costs.

## **OBJECTIVE AND CONTEXT OF RESEARCH**

Forested areas provide multiple benefits including recreational opportunities, aesthetic enjoyment, and ecological services such as water purification and wildlife habitat. The presence of forested land and open space may also contribute to the value of surrounding real estate. Anecdotal evidence of this positive effect on property value may be seen in real estate advertisements that prominently feature proximity to national forests, golf courses or parks.

Several empirical studies have sought to measure the enhancement value of greenbelts and parks (National Park Service, 1992). These studies have typically found a positive correlation between house prices and protected open space. In some cases, the increase in value of adjacent property offsets the loss in local revenue associated with preservation (i.e., because protected areas are either tax exempt or taxed at a lower rate) (National Park Service, 1992). This type of information serves to enlighten local governments who rely on property tax revenue to fund their general operating budget and can challenge the routine conversion of unimproved land to residential use to fund governmental services.

This study evaluates the relationship between forested areas and property values across four protection scenarios. The four scenarios were chosen for their unique provision of benefits to the public and the period of their existence. Although the enhancement value of forest cover, neighborhood parks, greenbelts and trails has been the subject of many studies, few have directly compared different types of open space and whether its age is a factor. This study attempts to determine if the four types of forested areas contribute to county coffers and evaluate if the age and type of amenity affects the degree to which property values are enhanced.

## **SCENARIO DESCRIPTIONS**

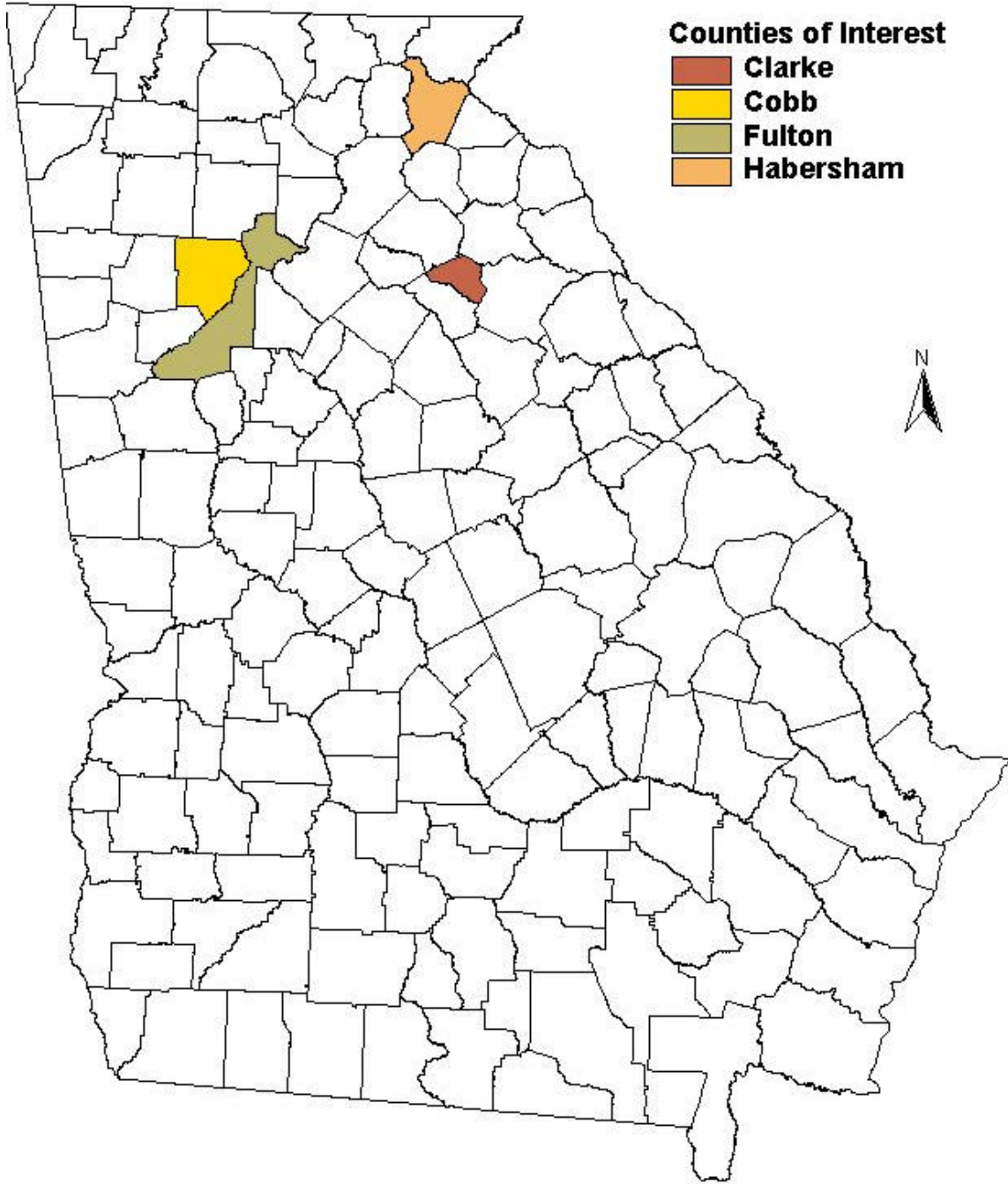
This project estimates the enhancement value of protected forested areas and open space for four different protection scenarios in four Georgia counties (Figure 1). Each scenario contributes a different public benefit: passive and active recreation, ecological services, and aesthetic enjoyment. The details of each of scenario are described below.

### **Sandy Creek Park in Athens-Clarke County**

The Sandy Creek Park case study is comprised of the Sandy Creek Nature Center, Cook's Trail and Sandy Creek Park. Establishment of the Nature Center provided the protection of critical habitat for terrestrial and aquatic species characteristic of the Georgia Piedmont. Park use is limited to low-impact activities including walking, bird watching, and nature viewing. It exemplifies a protection scenario that focuses on passive recreation; human use is encouraged but limited.

Sandy Creek Nature Center protects 225 acres and is part of the Oconee Rivers Greenway system. Purchase of the land for the Nature Center was conducted in stages beginning in the late 1960s. The first 170 acres plus the facility were opened to the public in 1973. The Nature Center offers visitors four miles of interpretive nature trails covering a variety of habitats typical of the Georgia Piedmont: river floodplain, marshland, upland pine and hardwood forests, fields, ponds and streams. The Nature Center also conducts educational workshops and research at its facilities.

At the northern boundary of the Nature Center is the start of Cook's Trail, which winds it's way northward to the southern boundary of Sandy Creek Park. The trail is 4.1 miles and was opened to the public in 1989 with limited access. Trail access is at Sandy Creek Park or Sandy Creek Nature Center; however, several neighborhoods adjacent to the trail have created informal pathways to Cook's Trail. The trail protects 464 acres of river floodplain and marshland of the North Oconee River. The opportunity to protect this habitat was facilitated by the altered design of an upstream flood-control project that allowed for continual overflow. The project also resulted in the creation of Lake Chapman, the centerpiece of Sandy Creek Park.



**Figure 1. Location of counties with protection scenarios.**

Sandy Creek Park offers swimming, boating, and fishing on Lake Chapman, hiking trails and overnight campgrounds, and day-use shelters as well softball and soccer fields. Recreation on Lake Chapman is considered secondary to its role in flood control on the North Oconee River. Sandy Creek Park has only one entrance where visitors pay a one-dollar fee. Although Sandy Creek Park includes active recreation, it was included in this case study because of its connectivity with Sandy Creek Nature Center by way of Cook's Trail.

The parks are located two miles north of downtown Athens, population 70,000 and home of The University of Georgia. The parks are separated from and accessed by a four-lane divided freeway that encircles Athens.

### **Silver Comet Trail in Cobb County**

The Silver Comet Trail is a paved, multi-use trail that follows the abandoned railroad line once traveled by the Silver Comet passenger train. Walkers, hikers, joggers, bicyclists, inline skaters, and people with disabilities use the trail. The Silver Comet Trail is a protection scenario that represents active recreation. The trail was designed for high-impact use such as bike riding and its main purpose is human recreation.

Cobb County's section of the Silver Comet Trail is a scenic 12.8-mile trail that begins in Smyrna and travels west through the southern portion of the County. Construction of the trail began in 1998 with an official opening ceremony held on October 7, 2000. Traversing six trestles and bridges, the trail offers users spectacular views and direct access to one of Cobb County's newest recreation areas, Heritage Park. Four trailheads have been completed offering parking, restrooms, water fountains and related amenities. The trailheads are an excellent place to access the trail for those traveling by car. The trail may also be accessed at numerous cross streets and neighborhood connector paths.

The trail will ultimately extend 57 miles through Cobb, Paulding and Polk counties and link with the Chief Ladiga Trail at the Alabama state line, which runs 33 miles west to

Anniston. Stretching across three counties, the Silver Comet Trail will be the longest paved recreational trail in Georgia, and one of the longest in the Southeast.

### **Fulton County's Tree Protection Ordinance**

The intent of a tree protection ordinance is to provide developers guidance for the preservation of existing trees during land disturbing activities. Authors of the ordinance summarize several benefits that tree protection provides including aesthetic and scenic amenity and increased property value. This case study, therefore, is a protection scenario that results in aesthetic enjoyment.

Fulton County adopted its initial tree protection ordinance in 1986. The ordinance was revised in 1992 and again in 1999. The second round of revisions resulted in major changes to the ordinance. Most importantly the revised ordinance gave developers more incentive to protect mature trees and established disincentives for replacing existing specimens with younger, smaller trees. A second major revision was the inclusion of all activities requiring a land disturbance, building or timber harvest permit. Prior to 1999, construction of a single, family residence was exempt.

In consultation with Fulton County's senior arborist, neighborhoods were chosen for this study based on whether the development was conducted in the "spirit" of the ordinance or not. By spirit the arborist meant the developer chose to save as many existing and mature trees as possible thereby preserving a percentage of the mature canopy cover. Developments considered not to be in the spirit of the ordinance are those where minimal effort was made to protect mature trees, the developer opting to replant with smaller, younger trees of limited variety.

### **Habersham County's Water Supply Watershed Ordinance**

In 1991, Habersham County passed a Comprehensive Land Development Resolution that included, among other things, protection of riparian buffers against impending development in the county's water supply watersheds. This resolution represents a protection scenario that maintains ecological services. Intact riparian buffers provide

such services as water purification and retention (flood control), temperature control and a source of food and habitat for aquatic and terrestrial species.

This case study focuses on properties along the eastern shore of the Chattahoochee River and the effect of this resolution on property values. In the Chattahoochee River watershed, the resolution affects all properties and development within a seven-mile radius upstream of the Demorest-Baldwin public drinking water supply intake, located at the confluence of the Soque and Chattahoochee Rivers. Enforcement of the resolution began July 1, 1992. Properties platted before the effective date of enforcement, also known as existing lots of record, are exempt from the more stringent standards of this resolution but are still required to conform to the standards as described below.

The state has a 25-foot buffer requirement on all streams. However, a single home built by or for the occupant is exempt from the state's buffer requirement. The resolution adopted by Habersham County goes beyond the state's minimum standard for stream buffer widths. It states that properties along the Chattahoochee River will maintain a natural stream buffer for a distance of 100 feet from the stream bank and that no impervious surface, septic tank or septic tank drainfield shall be constructed within 150 feet of the stream bank. Existing lots of record are required to maintain a 25-foot wide stream buffer in its natural state, and maintain a 50-foot wide setback area for impervious surfaces, septic tanks, and septic tank drain fields.

In addition, the state provides for the protection of primary and secondary trout streams under the Erosion and Sedimentation Act of 1975, as amended in 2000. This Act prohibits the disturbance of natural vegetation within 50 feet of a primary trout stream. A variance may be granted on secondary trout streams allowing for disturbances up to within 25 feet of the stream. Single homes are not exempt from this regulation.

## **MODEL**

The positive effect that environmental amenities such as forested areas and open space contribute to the value of real estate is often referred to as enhancement value. Enhancement value is estimated using the hedonic pricing approach, a method based on

the straightforward premise that the value of a good depends on the stream of benefits derived from that good. Using regression techniques, the hedonic pricing method identifies what portion of the differences in property value can be attributed to environmental amenities such as forested areas. This value can then be used to infer individuals' willingness to pay for environmental amenities and thus the overall value society places on a particular amenity.

We can express the sale price of a home by equation 1, where  $P_i$  is the price of the  $i^{\text{th}}$  home,  $\mathbf{S}_i$  is a vector of structural characteristics,  $\mathbf{N}_i$  is a vector of neighborhood characteristics and  $\mathbf{Q}_i$  is a vector of environmental characteristics.

$$P_i = P(\mathbf{S}_i, \mathbf{N}_i, \mathbf{Q}_i) \quad (1)$$

The partial derivative of the hedonic price function with respect to an environmental characteristic,  $q_i$ , gives the implicit marginal price of that characteristic. In other words, the partial derivative is the cost of marginally increasing that environmental characteristic, holding all else constant.

Since the hedonic price function consists of both supply and demand considerations, the appropriate functional form cannot be specified on theoretical grounds (Rosen, 1974). Cropper, et. al. (1988) found that a simple linear form consistently outperformed other forms when misspecification is present. In this study, the simple linear form is also preferable to other forms for the ease of communicating the results to our target audience: forest managers, local elected officials, planners, and the public.

## **DATA**

The local tax assessor's office in Athens-Clarke County, Cobb County, Fulton County and Habersham County provided data used in this study. Information included month and year of home sales, housing characteristics, lot size, and a neighborhood identifier. The housing characteristics included heated area of house, year of construction, foundation, exterior, and style of residential home – single-family detached, duplex, or triplex. The Cobb County data set did not include information on lot size or style of residential home.

For each protection scenario, the data set was restricted to the sale of residential improved lots. The data set was further restricted to home sales that were identified by the tax assessor's office as "arms-length" or true market transactions. Sale prices were adjusted to fourth quarter 2001 dollars using a price index derived for the Atlanta and Athens metropolitan statistical areas (MSA) by the Office of Federal Housing Enterprise Oversight (<http://www.ofheo.gov/house>).

Definitions of variables used in each scenario are given in Table 1. Descriptive statistics for the final data set of each case study are given in Tables 2 through 5.

### **Sandy Creek Park**

Information on the distance from each house to Sandy Creek was obtained from a Geographical Information System (GIS) database linked to the Athens-Clarke County's tax assessor's database. All residential parcels within a mile of Sandy Creek are included in the study. Parcels within the "Loop" – a highway encircling Athens – were excluded from the data set because they are physically separated from Sandy Creek Park by this major highway and are also considered part of downtown Athens. The final number of observations used in the estimation is 459.

The sale price of homes within a mile of Sandy Creek Park average \$90,280 and range from \$25,260 to \$295,650. The mean living area is 1,584 square feet. Lot sizes range from 6,080 square feet (0.14 acres) to 1,076,116 square feet (24.7 acres). Single-family detached and multi-family houses account for 65 percent and 35 percent of the sales, respectively.

To estimate the effect of proximity of open space on house prices, each observation is classified according to one of six discrete distance categories: homes adjacent to Sandy Creek Park, within 500 feet but not adjacent to the park, and 501 to 1,000 feet, 1,001 to 1,500 feet, 1,501 to 3,000 feet, and 3,001 to 5,280 feet (1 mile) from the park. Because the sample area is small in scale – a one-mile radius from Sandy Creek Park – the neighborhood characteristics are considered equivalent for all homebuyers and thus no variables are defined.

TABLE 1 DEFINITION OF VARIABLES

Variable	Attributes	Type
AREA	area of parcel measured in square feet	C
HEATEDAREA	heated area of house measured in square feet	C
YR_BUILT	year house was built	C
SINGLE_FAM	single family home	D
SLAB	foundation construction	D
BRICK	brick exterior	D
STUCCO	stucco exterior	D

Sandy Creek Park – Athens-Clarke County

Variable	Attributes	Type
ADJACENT	property is adjacent to park	D
D_500	property is within 500 feet but not adjacent to park	D
D_1000	property is between 501 and 1,000 feet of park	D
D_1500	property is between 1,001 and 1,500 feet of park	D
D_3000	property is between 1,501 and 3,000 feet of park	D

Silver Comet Trail – Cobb County

Variable	Attributes	Type
ONE	property is within land lot adjacent to trail	D
TWO	property is within second land lot from trail	D
THREE	property is within third land lot from trail	D
EAST_WEST	distance of property beginning at eastern border of county and measured by land lots	C

Tree Protection Ordinance – Fulton County

Variable	Attributes	Type
SPIRIT	neighborhood developed in the spirit of the ordinance	D
TILLER WALK	neighborhood	D
BALL MILL	neighborhood	D
RICHMOND GLEN	neighborhood	D
AUTRY MILL	neighborhood	D
CROOKED CREEK	neighborhood	D
LAUREN HALL	neighborhood	D
HEDDINGTON	neighborhood	D
SQAURE		

Water Supply Watershed Ordinance – Habersham County

Variable	Attributes	Type
WS_150	property subjected to a 150-foot building set-back and a 100-foot undisturbed riparian buffer	D
WSX_50	property subjected to a 50-foot building set-back and a 25-foot undisturbed riparian buffer	D
TROUT	property subjected to a 50-foot buffer	D

TABLE 2 DESCRIPTIVE STATISTICS – SANDY CREEK PARK, ATHENS-CLARKE COUNTY

Continuous Housing Variables

	SALEPRICE_2001	AREA	HEATEDAREA	YR_BUILT
Mean	90,282	36,492	1,584	1986
Median	86,983	23,482	1,547	1983
Std Dev	29,705	70,759	398	10
Minimum	25,259	6,079	704	1945
Maximum	295,646	1,076,116	4,247	2001
N=459				

Housing Dummy Variables

	SINGLE_FAM	SLAB	BRICK	STUCCO
Probability	0.65	0.23	0.25	0.007
Count	298	106	116	3

Open Space Dummy Variables

	ADJACENT	D_500	D_1000	D_1500	D_3000
Probability	0.08	0.15	0.12	0.06	0.27
Count	37	67	54	27	122

## **Silver Comet Trail**

Tax parcels in Cobb County were not available on GIS at the time of this study. Therefore, parcels are spatially located based on their land lot designation. All sales that occurred within four land lots on either side of the trail are included in the data set. Each land lot in Cobb County is approximately a quarter mile on a side; therefore, the data set consists of transactions within approximately one mile of the trail. Observations are also limited to sales that occurred after the official opening ceremony of the trail in October 2000. The final number of observations used in the study is 1,581.

Home sales between the opening of the trail and the most current tax assessors records – October 2000 to December 2001 – ranged between \$46,020 and \$785,380 and averaged \$191,710. The average home size is 2,053 square feet. Lot sizes were not consistently available and thus not included in the study.

To test for the influence of the Silver Comet Trail on property prices, each sales transaction is identified by its spatial location to the trail. In this case, the land lot designation. Three categories are defined: land lots adjacent to the trail (ONE), land lots one removed from the trail (TWO), and greater than two land lots from the trail. The Silver Comet Trail runs east to west for nearly 13 miles across the lower portion of Cobb County. Therefore, differences in house prices may be a result of changes in neighborhood characteristics. To account for neighborhood effects the land lots were numbered from east to west along the length of the trail and included as a variable in the estimation (EAST\_WEST).

## **Tree Protection Ordinance**

The county arborist identified nine neighborhoods over a range of mid to high property values for analysis. Eight of the nine neighborhoods were built after the adoption of the tree protection ordinance in 1986. Homes in the ninth neighborhood were constructed in phases. Only homes built after 1986 are included in the data set. A total of 801 observations are used in the estimation.

House prices in the neighborhoods identified as being comprised of mid-property values range from \$191,800 to \$ 250,550 and prices in the neighborhoods comprised of high

TABLE 3 DESCRIPTIVE STATISTICS – SILVER COMET TRAIL, COBB COUNTY

Continuous Housing Variables

	SALEPRICE_2001	AREA	HEATEDAREA	YR_BUILT
Mean	191,706	na	2,053	1991
Median	163,155	na	1,843	1996
Std Dev	85,216	na	789	13
Minimum	46,020	na	840	1910
Maximum	785,379	na	5,771	2002
N=1581				

Housing Dummy Variables

	SINGLE_FAM	SLAB	BRICK	STUCCO
Probability	na	0.37	0.13	0.005
Count	na	588	206	9

Open Space Dummy Variables

	ONE	TWO	EAST_WEST
Probability	0.09	0.27	na
Count	149	424	na
Mean	na	na	25
Median	na	na	25
Std Dev	na	na	16
Minimum	na	na	2
Maximum	na	na	52

property values range from \$305,790 to \$1,709,930. The average sale price for all nine the neighborhoods is \$545,890 and range from \$191,800 to \$1,709,930. The mean living area is 4,400 square feet. Lot sizes range from 6,370 to 104,540 square feet.

All nine neighborhoods are located within 20 miles of each other on the north side of Atlanta. At least six of the nine neighborhoods have tennis courts, a swimming pool and open space common areas. A public golf course is maintained within one of the nine neighborhoods. Each neighborhood is sufficiently unique that a dummy variable is included in the model to account for neighborhood effects.

A dummy variable (SPIRIT) is used to compare neighborhoods identified as being developed in the “spirit” of the tree protection ordinance to neighborhoods developed with minimal effort to protect existing trees. Four neighborhoods – Tiller Walk, Richmond Glen, Ball Mill and Glen Abbey – constitute the spirit neighborhoods. The remaining five neighborhoods – The Falls at Autry Mill, Crooked Creek, Lauren Hall, Heddington Square, and Glenside – are considered non-spirit neighborhoods. Three of these neighborhoods – Lauren Hall, Heddington Square, and Glenside – constitute the mid-property value range.

### **Water Supply Watershed Ordinance**

The Habersham County data set includes only riparian tax parcels, as those would be the only parcels potentially affected by the Comprehensive Land Development Resolution and efforts to protect watersheds that are a source of public drinking water. Restriction of the data set to improved residential parcels that were sold after the effective date of the ordinance – July 1, 1992 – resulted in insufficient data for the analysis. Therefore, the sales of vacant land are used instead of the sales of improved properties. Fifty-eight observations are used in the estimation.

Vacant land sales range from \$4,030 to \$327,770 along the shores of the Chattahoochee River. The average sale price is \$70,460. The minimum lot size is 15,350 square feet (0.35 acres) and the maximum lot size is 758, 570 square feet (17.4 acres). Stream frontage for each parcel in the data set (STREAM) was measured using

TABLE 4 DESCRIPTIVE STATISTICS – TREE PROTECTION ORDINANCE, FULTON COUNTY

Continuous Housing Variables

	SALEPRICE_2001	AREA	HEATEDAREA	YR_BUILT
Mean	545,894	20,884	4,402	1999
Median	514,875	18,295	4,270	1999
Std Dev	166,772	8,750	1,023	2
Minimum	191,802	6,373	1,888	1987
Maximum	1,709,927	104,544	13,465	2002
N=801				

Housing Dummy Variables

	SINGLE_FAM	SLAB	BRICK	STUCCO
Probability	na	0.03	0.77	0.14
Count	na	28	618	112

Open Space Dummy Variables

	SPIRIT	TILLER WALK	BALL MILL	RICHMOND GLEN	AUTRY MILL	CROOKED CREEK	LAUREN HALL	HEDDINGTON SQUARE
Probability	0.53	0.02	0.01	0.01	0.34	0.08	0.03	0.004
Count	426	15	7	6	269	62	23	3

TABLE 5 DESCRIPTIVE STATISTICS – WATER SUPPLY WATERSHED ORDINANCE, HABERSHAM COUNTY

Continuous Housing Variables

	SALEPRICE_2001	AREA	STREAM
Mean	70,458	168,776	269
Median	53,303	104,421	206
Std Dev	62,688	176,631	259
Minimum	4,033	15,349	17
Maximum	327,769	758,573	1,636
N=58			

Note: Vacant land sales

Open Space Dummy Variables

	WS_150	WSX_50	TROUT
Probability	0.14	0.40	0.33
Count	8	23	19

a GIS database linked to tax parcel information. Stream frontage ranges from 17 to 1,635 feet.

Two dummy variables are used to differentiate between lots that are subject to a 150-foot buffer (WS\_150) versus grand fathered lots that are subject to a 50-foot buffer (WSX\_50). A third dummy variable accounts for lots affected by trout stream legislation (TROUT). The differences in neighborhood characteristics are considered negligible for this scenario.

## **SUMMARY OF ESTIMATION RESULTS**

The variables associated with housing characteristics are consistent with theoretical expectations. In other words, the size of the lot (AREA), heated area of house (HEATEDAREA), type of foundation (other than SLAB), and exterior (BRICK and STUCCO) do increase the value of a house, all else remaining the same. The age of a house (YR\_BUILT) may or not contribute to a home's value depending on the local market.

The house sale price is also influenced by whether the dwelling is single-family or multi-family. The variable for single-family home (SINGLE\_FAM) is positive and significant in the Sandy Creek scenario. This variable is not included in the tree protection ordinance estimation because the data set consists entirely of single-family, detached homes. The data set for the Silver Comet Trail did not include information on the occupancy of residential homes.

The variables depicting neighborhood and open space characteristics are different for each scenario and are described below. Estimation results are summarized in tables 6 through 9.

### **Sandy Creek Park**

The results show a positive correlation between house prices and the presence of Sandy Creek Park. Three of the five the variables included in the model to investigate this relationship are statistically significant at the 0.1 level clearly indicating the park exerts a

positive effect on property prices up to 1,500 feet (Table 6). The coefficients on these variables can be interpreted as the park's influence on the sale price relative to properties at a distance greater than 3,000 feet, all else being equal. The presence of Sandy Creek Park raises values of adjacent properties (ADJACENT) by \$7,400 and for properties between 501 to 1,000 feet (D\_1000) and 1,001 and 1,500 feet (D\_1500) by \$5,330 and \$8,570, respectively.

Homes in Georgia are assessed at 40 percent of market value for ad valorem tax purposes. In 2001, the millage rate in Athens-Clarke County was 32.70 per \$1,000 of assessed value. A home adjacent to Sandy Creek Park will generate approximately \$97 in additional property tax revenue per year. A home between 501 and 1,000 feet of the park will generate approximately \$70 and a home between and 1,001 and 1,500 feet of the park will generate approximately \$112 in additional property tax revenue per year. There are 101 residential parcels adjacent to Sandy Creek Park, 154 residential parcels within 501 and 1,000 feet of the park, and 205 residential parcels within 1,001 and 1,500 feet of the park. Assuming each residential parcel has at least one home, an aggregate property tax revenue of approximately \$43,490 per year will be generated because of the existence of the park.

### **Silver Comet Trail**

Table 7 summarizes the results of the estimation. The sale prices of homes along the length of the Silver Comet Trail (EAST\_WEST) are statistically different. In other words, for every quarter mile west the home is located along the trail, the sale price decreases by \$1,165. This result is expected given decreasing proximity to downtown Atlanta and an increasing commute distance.

The presence of the Silver Comet Trail, however, does not significantly effect the sale price of homes within approximately one half mile of the trail, keeping all else constant. This is revealed in the statistically insignificant results for the three variables (ONE, TWO and THREE) that are included to investigate this relationship. At first glance this may appear to contradict previous studies; however, taking into account the age of the trail may explain this result. The trail has only been officially opened since October 2000,

TABLE 6 – SANDY CREEK PARK ESTIMATION RESULTS

Variable	Coefficient		
	Estimate	T-value	P-value
Intercept	-1,001,324.41	-5.7340	0.0000
AREA	0.05	4.4527	0.0000
HEATEDAREA	56.99	22.1347	0.0000
YR_BUILT	485.64	5.4959	0.0000
SINGLE_FAM	49,285.61	21.0237	0.0000
SLAB	-2,155.32	-1.0099	0.3131
BRICK	29,00.33	1.3523	0.1770
STUCCO	21,783.76	2.1510	0.0320
ADJACENT	7,402.42	2.3227	0.0206
D_500	3,514.98	1.3517	0.1772
D_1000	5,331.66	1.7897	0.0742
D_1500	8,572.64	2.3327	0.0201
D_3000	1,723.61	0.7325	0.4642

degrees of freedom = 446 R-square = 0.6923 DW = 1.5044

TABLE 7 – SILVER COMET TRAIL ESTIMATION RESULTS

Variable	Coefficient		
	Estimate	T-value	P-value
Intercept	-2,202,023.63	-11.3700	0.0000
HEATEDAREA	78.19	53.8357	0.0000
YR_BUILT	1,138.43	11.6179	0.0000
SLAB	-18,075.41	-9.5713	0.0000
BRICK	23,916.52	7.3322	0.0000
STUCCO	-5,586.48	-0.4627	0.6437
EAST_WEST	-1,165.32	-19.1382	0.0000
ONE	-3,468.29	-1.0273	0.3044
TWO	1,421.59	0.6136	0.5396
THREE	-741.22	-0.3221	0.7474

degrees of freedom = 1571 R-square = 0.8253 DW = 1.2337

providing only 14 months of sales transactions for this study. Sandy Creek Park in Athens-Clarke County, on the other hand, has been part of the community for nearly 30 years.

### **Tree Protection Ordinance**

Estimation results (Table 8) indicate the protection of mature trees exerts a significant upward influence on house sale prices (SPIRIT). The prominence of neighborhood effects is demonstrated by the statistical significance of four variables included to account for this effect. The coefficient on SPIRIT variable can be interpreted as the enhancement value due to the presence of mature trees in the neighborhood. Homes in neighborhoods that were built in the “spirit” of the Fulton County tree protection ordinance sell for \$104,920 more than homes in the non-spirit neighborhoods. This value represents 8 percent of the average sale price of homes in the four neighborhoods that represent development in the spirit of the ordinance.

The 2001 millage rate for unincorporated Fulton County was 37.31 per \$1,000 of assessed value. The study shows that a home located within a neighborhood that was developed in the spirit of the tree protection ordinance will generate on average approximately \$1,566 in additional property tax revenue per year. Combined there are 612 single family residences in the four neighborhoods used in this study. The presence of mature trees in these neighborhoods results in approximately \$958,390 in property tax revenue.

### **Water Supply Watershed Ordinance**

The model shows that the presence of regulation in the form of riparian buffer protection does not significantly affect the value of unimproved land (Table 9). Two variables are included in the model to account for the Water Supply Watershed Ordinance (WS\_150 and WSX\_50) and one variable for the protection of trout streams (TROUT). All three variables are not statistically significant. Although this scenario demonstrates that increased buffer width does not enhance the value of unimproved property, nor is there a reduction in value. Therefore, the argument can be made that this type of regulation does not result in a taking.

TABLE 8 - TREE PROTECTION ORDINANCE ESTIMATION RESULTS

Variable	Coefficient		
	Estimate	T-value	P-value
Intercept	3,643,663.12	1.1083	0.2681
AREA	2.1643	6.0949	0.0000
HEATEDAREA	67.55	20.8009	0.0000
YR_BUILT	-1,801.69	-1.0943	0.2742
SLAB	-30,789.87	-1.3658	0.1724
BRICK	18,192.19	1.1289	0.2593
STUCCO	19,740.74	1.0920	0.2751
SPIRIT	104,917.22	4.3130	0.0000
TILLER WALK	405,301.40	16.8655	0.0000
BALL MILL	592,018.61	19.9795	0.0000
RICHMOND GLEN	-52,464.28	-1.4864	0.1376
AUTRY MILL	202,161.61	8.0972	0.0000
CROOKED CREEK	109,717.73	4.4001	0.0000
LAUREN HALL	1,740.13	0.0651	0.9481
HEDDINGTON SQUARE	14,470.31	0.2976	0.7661

degrees of freedom = 786 R-sq = 0.8181 DW = 1.9190

TABLE 9 – WATER SUPPLY WATERSHED ESTIMATION RESULTS

Variable	Coefficient		
	Estimate	T-value	P-value
Intercept	8,271.67	1.1408	0.2592
AREA	0.25	7.9592	0.0000
STREAM	66.64	3.1307	0.0029
WS_150	1,718.11	0.1387	0.8902
WSX_50	-177.33	-0.0198	0.9843
TROUT	7,502.99	0.9054	0.3695

degrees of freedom = 52 R-sq = 0.8409 DW = 1.8185

## **DISCUSSION AND POLICY IMPLICATIONS**

In this study we have show that the enhancement value of forested areas is dependent on the age, type, and location of the amenity. The number of years that the amenity has been part of the community is clearly demonstrated by the results of the Sandy Creek Park and Silver Comet Trail scenarios. Protected areas that provide trails for walking or biking may take some time for the community to embrace. Immediate neighbors of the project initially express some fear as to who will be using the trail, hours of operation, police protection and maintenance. In time, the community sees the protected area as providing direct benefits – exercise opportunities, a space for family outings, education, transportation alternatives and business opportunities. As the community needs time to adjust so does the real estate market. In time, individuals interested in being close to the amenities that the protected area provides will pay more for a home for the privilege of proximity. We believe the results of the Silver Comet Trail are indicative of this lag time.

The type and location of protection is also significant in the presence or absence of enhancement value. The existence of a protected forested area for light recreation and wildlife habitat raises the price of adjoining suburban homes up to 1,500 feet. The protection of tree canopy in urban/suburban neighborhoods also exerts an upward shift in house prices. However, the effect of protecting tree canopy and vegetation along stream buffers was insignificant for unimproved land in rural north Georgia. Although it is incorrect to directly compare the results of improved land to those of unimproved land, there is merit in discussing them together. The three scenarios contrast urban/suburban versus rural location and voluntary versus legislated protection. Looking at what the scenarios have in common and their results, we may conclude that population density (urban/suburban versus rural) is more likely to dictate the generation of enhancement value than the type of protection. This is a reasonable outcome given that land scarcity and development pressure drive real estate values and thus, in part, the enhancement value of the environmental amenity in question. A question worth investigating would be the relationship between density levels and enhancement value.

The results of this study provide additional evidence that the protection of forested areas in the form of greenways, wildlife sanctuaries, and neighborhood tree canopies pays off. Additional revenues per house per year generated from the presence of open space range from \$70 to \$112 for passive recreation to \$1,566 for aesthetic enjoyment. Combined with the knowledge that residential developments, on average, do not generate as much in revenue as they require in services, whereas farmland, forested land and open space generate more than enough revenue for the services they require (Dorfman, et al., 2002) serves to directly challenge conventional wisdom regarding the economic consequences of development.

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