Valuing Private and Public Greenspace Using Remotely Sensed Vegetation Indices

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ABSTRACT

In a typical metropolitan area, greenspace varies substantially in its quality and extent. Remotely sensed vegetation index data is used to characterize the heterogeneity in private and public greenspace (riparian corridors) in metropolitan Tucson, Arizona. This data set enables the researcher to test if: (1) "greenness" is a significant determinant of house price variation in this desert city; and (2) whether there is an interaction between public and private greenspace. Private greenspace amenities can be endogenously improved by homeowners as a complement or substitute for the greenspace that is publicly provided, whereas public greenspace might be exogenous or endogenous depending on households ability to pressure the local government to protect or restore public greenspace. The results of a Hausman test indicate that endogeneity is a problem in the dataset and therefore an instrumental variable two stage least squares estimation is used. The results of this analysis indicate that homebuyers in the study area have preferences for both greener lots and greener riparian corridors and that private and public greenspace appear to be substitutes. Results are robust across multiple identification strategies designed to address potential endogeneity. The study results could have fundamental implications for the efficient use of limited water supplies in this semi-arid metropolitan area.

INTRODUCTION

A growing body of literature seeks to understand preferences for open space resources. Nearby natural resources such as: open space, lakefront amenities, visibility, views, urban wetlands, coastal water quality, and ecological diversity and connectivity are often capitalized into property values (Irwin & Bockstael, 2001, Geoghegan, 2002, Shultz & King, 2001and Smith, Poulos & Kim, 2002; Spalatro and Provencher, 2001; Benson et al., 1998 and Paterson and Boyle, 2002; Mahan et al., 2000 and Acharya & Bennett, 2001; Leggett and Bockstael, 2002; and Geoghegan, et al., 1997). A motivation for this research is the desire to provide useful information to natural resource planners in a policy environment of rapid growth and concerns about quality of life. It is relatively straightforward to control for the presence or absence of openspace, its size, and proximity to communities. However two key features of openspace that are often absent from openspace research are measures of the quality of open space, and the empirical relationship between publicly and privately controlled amenities.

Few studies account for the variation in habitat quality. Perhaps, because of the large expense of collecting the ecological survey data makes it infeasible to perform this type of study on large scales or in many locations. For our purposes, it is important to identify an effective but inexpensive proxy for openspace 'greenness'.

In this paper remotely sensed vegetation index (VI) data is used as a proxy measure for the extent and vigor of private (lot-based) and public (community-based) vegetation amenities in Tucson, Arizona. This data allows us to test if increased greenness is a determinant of higher property values and to test for an interaction between public and private greenspace quality.[1] Our intent is not to precisely quantify the values of potential amenities but instead to perform a test of their existence and interplay. The differentiation between private and public open green space is important from a policy standpoint because although the homebuyer has direct control (at least after some time lag) over vegetation amenities on their lot, through landscaping and watering decisions, the same homebuyer has at most indirect control over community-based vegetation amenities through voter initiatives on preserving open space.[2]

A small number of studies have combined remote sensing data and economic analysis. Remote sensing products are typically used in one of two ways in such research: to inventory and map land uses and land use change (Millington, et al., 1994) or conversely to monitor regulatory compliance (Schweik and Thomas, 2002); or by using VIs as a proxy for agricultural productivity (Nivens et al, 2002) or landscape amenity (Sengupta and Osgood, 2003) in property price studies. In this latter study the authors used the normalized difference VI (NDVI) in a hedonic analysis of ranchette land value in

[1] We apply VI as a rough proxy for openspace heterogeneity. We use it as a proxy only, without directly specifying the many varied ecological processes it may represent. Research in other partially vegetated landscapes, similar to Tucson, Arizona, has shown that vegetation indices are positively correlated with percent vegetation cover (Carlson and Ripley, 1997 and Nagler et al., 2001) and furthermore that percent ground cover is positively correlated with a biological measure of habitat health, the leaf area index (Nagler et al., 2001). This research gives us confidence that vegetation indices can be used to measure meaningful vegetation characteristics; percent ground cover and vegetation vigor, two measures that are also easily assessed by homebuyers. Furthermore remotely sensed data can be used to classify vegetation over a large area: an exercise that would be overly costly using fieldwork surveys. An exploratory discussion on the use of VI and hedonic models for amenities in Tucson, Arizona is presented in (Bark-Hodgins, Osgood and Colby, 2006).

[2] Tucson voters approved such an initiative, the Sonoran Desert Conservation Plan. This plan incorporates a riparian habitat protection and restoration component and this type of habitat is the designated community-based open space in this research.

Arizona, USA to control for otherwise unobserved confounding variation such as temperatures, the presence of water, and contiguity with public land. Another aspect of value represented by NDVI could be aesthetic value, this may be particularly important in arid and semi-arid lands where greenness is scarce and therefore commands an added premium.

In the Sonoran Desert where Tucson, Arizona is located natural lush vegetation comprising shrubs and trees is concentrated in and on the banks of the intermittently flowing washes (desert rivers). These green riparian corridors provide startling visual contrast to an otherwise semi-arid, bare ground and cactus dominated landscape. However, the riparian ecosystem has been negatively affected by groundwater pumping and development with the result that relatively few stretches of intact riparian habitat remain in the Tucson basin. Other sources of greenness are lot-based vegetation amenities. Most homes in Tucson have xeriscaped yards, of rock, gravel, cactus and other low-water use varieties, and a small number of mostly desert tree species or citrus trees. Trees are important amenities in Tucson as elsewhere (Anderson and Cordell, 1985; Morales 1980; and Morales, Micha and Weber, 1983) because they provide shade for understory vegetation and houses and provide leafy visual contrast to cactus, creosote and agaves. Private greenness competes with the riparian system because the water resources used to green private lots is obtained by depleting regional groundwater aquifers and diverting surface waters flows that used to support riparian habitats. As policies such as the Sonoran Desert Conservation Plan, are debated to protect remaining riparian habitat and potentially restore stretches of the riparian corridor, it is important to understand the relationship between greenness preferences for riparian habitat and private lots.

In this paper prices of single family residences (SFR) in north central and northeast Tucson, Arizona are estimated using a hedonic price model with typical structural and neighborhood variables and also two sets of remotely sensed vegetation index data. The greenness index at each wash “arc”, or river stretch, and at each parcel, are used as a proxy for the variation in natural habitat extent and quality and also the variation in landscaping at the lot level. The addition of vegetation index data allows us to control more closely for the amenity value of vegetation in this desert city, than could be achieved, using other variables such as the distance to the nearest riparian corridor. The remotely sensed vegetation data also allows us to observe how homebuyers value different levels of greenness, different sources of greenness, and the interactions between them.

DATA

Four different data sets were collected or generated for the research: house sales and associated assessed characteristics, geographic information system (GIS) data, including a riparian corridor dataset, Census block-level statistics, and remotely sensed vegetation indices. These datasets provided the information for the variables comprising the vector of structural (**S**), neighborhood (**N**) and environmental (**E**) characteristics.[3] The source of

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[3] SAS 9.1 for Windows and Stata 7.1 were used in the data analysis. The geographically-referenced data was processed in ArcView 3.3 and ArcGIS 9.2.

the residential sales data and assessed structural characteristics was Pima County. 9,434 single family residence sales data for the period 1998-2003 (**P**) were joined each year (in order to account for additions) to the Assessor's data on structural characteristics (**S**) by the unique parcel identification number. The **N** vector comprises Census block level data and three levels of spatial data, from the largest to smallest unit of geography: north and south of the Rillito River (the main (dry) river which divides the metropolitan area); school districts; and zip codes. A separate model was run for each of these specifications: River Specification, Schools Specification and Zip Specification, respectively. The vector **E** incorporates remotely sensed vegetation index data and information on the proximity of each house to different green amenities.

The VI data was calculated from a single Landsat Enhanced Thematic Mapper Plus (ETM+) image[4] with the acquisition date July 30, 1999.[5] The study area covers 200 km^2 and contains a total 380 km of riparian corridors. Values from our selected vegetation index, the soil adjusted vegetation index (SAVI)[6] were joined to the georeferenced riparian corridor (Figure 1) and parcel data (Figure 2) in a GIS.

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[4] This preprocessed image was available through the Arizona Regional Image Archive. The image had been corrected for geometric and radiometric distortions or errors.

[5] The choice of acquisition date was determined by phenology. The mid-summer date coincides with the full leafing out period of riparian species and therefore is an optimal remote sensing date to measure peak vegetation extent and health.

[6] Two vegetation indices the normalized-difference vegetation index (NDVI) and the soil-adjusted vegetation index (SAVI, Huete, 1988) were generated. SAVI was chosen as the most appropriate vegetation index for this study because it has been explicitly modified from NDVI for remote sensing in areas where a vegetative groundcover is fragmented. It does this by adjusting the index for the brightness, or reflectivity, of the background soil (Huete and Liu, 1994). The SAVI variable is incorporated into the model as a digital number (DN). The possible range of SAVI in DNs is from 0 to 255, but the actual range of greenness in our study area was narrower: 100-198 for the parcels and 101-221 for the riparian corridors.

Endogeneity diagnostics

It is likely that the greenness of a particular parcel is controlled through endogenous choices by the homeowner's irrigation decisions. It is conceivable that a homeowner might also influence nearby riparian corridor greenness either by directly supplying irrigation water (something we observed) or by applying political pressure to influence the treatment of the wash by government activities. To address potential endogeneity in greenness values several strategies were applied. First, the remote sensing data was spatially averaged or smoothed.[7] Although the homeowner has control over their parcel's SAVI value through landscaping and irrigation decisions, the owner cannot control what their neighbors do, however, the smoothing algorithm procedure incorporates some of the greenness of neighboring lots which might reduce endogeneity concerns. This procedure had an additional benefit in that it reduced potential differences in official property boundaries and the extent of a lot owner's irrigation activities. Nonetheless, diagnostics suggested that this strategy was insufficient to address potential endogeneity in two of three model specifications.[8]

Our second strategy was the application of two stage least squares instrumental variables techniques. Two sets of instruments for WASHSAVI and LOTSAVI were tested. In one (Reduced) we relied solely on the exogenous physical determinants of natural vegetation

[7] The spatial filtering procedure used an algorithm which assigned a weighted average to each pixel in a 5x5 pixel neighborhood. The algorithm weighs the center pixel the most and therefore is not a straight averaging mechanism.

[8] The results of a Hausman test found evidence at the tenth of a percent level that endogeneity was present in both SAVI-based variables (LOTSAVI and WASHSAVI) for the Schools and River specifications, but endogeneity was not a significant problem for the Zip Specification. Therefore only the robust OLS results are provided for the Zip Specification.

distribution such as aspect, slope, soil types, riparian corridor size and geography or the X and Y coordinates of each parcel centroid or riparian corridor arc (NORTH, EAST, WEST, SHALLOW, STEEP, STEEPEST, SOIL18, SOIL34, SOIL49, SOIL51, SOIL52, CFS_NO, X-COORD and Y-COORD).[9] The Full Set of instruments adds another instrument at the expense of including a variable that is potentially endogenous. This instrument characterizes the physical condition of the riparian corridor (BANK_PROTN). This binary variable is set equal to one if the riparian corridor has been bank protected (concrete-lined) and zero otherwise. The Reduced and Full Set results vary little, and therefore, only the Reduced Set results are presented.[10] The results for the Schools Specification are provided in Tables 4a-4d and for the River Specification in Tables 5a-5d. Only the robust OLS results are shown for the Zip Specification because endogeneity was not a problem for LOTSAVI using the Full and Reduced Sets of instruments and not for the WASHSAVI variable using the Full Set of instruments. The robust OLS results therefore incorporate BANKPROT in the model.

[9] The directions are compared to SOUTH and the slopes to NOSLOPE. The soil types are Pinaleno-Nickel-Palos Verdes, Anklam-Pantano-Chimenea, Tanque-RiverRd-Arizo-Riggs, Hayhook-Sonoita and Mohave-Sahuarita-Cave, respectively. CFS_NO describes the size of the corridor: CFS1 is the smallest designation and CFS6 denotes the largest washes in the study area.

[10] For the schools specification the IV 2SLS coefficients for LOTSAVI, WASHSAVI and WASHLOT are 0.158, 0.164, -0.001, for the first IV specification and 0.162, 0.162, and -0.001 for the second IV specification that includes BANK_PROTN. The same results for the river specifications are: 0.072, 0.84, and -0.0005 and 0.068, 0.072 and -0.0005, respectively. All coefficients are significant at the tenth of one percent level.

ESTIMATION

Following Rosen (1974) the following semi-log hedonic model was estimated[11] using ordinary least squares estimation with robust estimators.

$$\ln(\mathbf{P}_i)=[\mathbf{S}_i, \mathbf{N}_i, \mathbf{E}_i, \mathbf{T}_i]'\boldsymbol{\beta} + \boldsymbol{\varepsilon}_i \qquad [1]$$

Where, ln(**P**) is a vector of the log of house sales prices. The structural vector **S** consists of typical hedonic variables, lot size 100 m^2 (LOT), living area m^2 (LIVING), number of bath fixtures[12] (BATH), age in years (AGE), and also less familiar features that are important in the desert heat: number of garage spaces (GARAGE) and pool area m^2 (POOL). Neighborhood variables are also important in explaining house price variation in the study area. Three different specifications of space were identified and incorporated in the neighborhood vector, **N**. The first specification identified areas south of the Rillito River (S_RIVER) which is compared to those neighborhoods north of the river. The second uses school districts, a sometimes important determinant of house price variation in housing markets (Black, 1999; Downes and Zabel, 2002): two binary variables identified the Catalina Foothill School District (CFSD); the elite school district in the area, and the Tanque Verde School District (TVSD) both are compared to the lower-achieving Tucson Unified School District (TUSD). The final specification utilized zip codes: binary variables were created for zip codes 85710, 85711, 85712, 85715, 85748,

[11] Box-Cox procedures recovered transformation parameters of -0.188 and -0.323, for school district specification. We present and discuss the log linear estimates because they, are relatively easy to interpret, and comparable with much of the hedonic literature.
[12] Three bath fixtures is equivalent to a full or half bath and two bath fixtures to a half bath.

85749 and 85750, which are all compared to zip code 85718. A binary variable used in all specifications was set equal to one if the property is within the Federal Emergency Management Agency flood zone and equal to zero otherwise (FLOOD); properties with such a designation are at risk of floods and owners are required to purchase mandatory flood insurance if they have a mortgage backed by a federal agency.

Three Census variables were chosen to characterize the neighborhood. To capture the influence of retirees and snowbirds on the Tucson housing market, PCT>65 measures the percentage of households in each block group over 65 years, the other variables are the median household income by block group in 1999 (MEDINC99), and population density in the block group (POPDENS).

Golf courses have been identified as significant variables in explaining house price variation (Do and Grudnitski, 1995) and therefore are incorporated into this model. ADJTGOLF is a binary variable that equals one if the property is located either on a golf course or immediately adjacent to a golf course and zero otherwise. GOLFBUFF is a binary variable that equals one if the home is nearby, in this case, within 1056 ft of a golf course, but not ADJTGOLF, and zero otherwise. Similar variables for public parks (ADJTPARK and PARKBUFF) were also generated in the GIS. A final variable ELEV measures the elevation of each property in meters above sea level. It is a proxy variable for view and marginally lower summer time temperatures.

The environmental variables were chosen to characterize the heterogeneity in open space resources and accessibility to these resources. The **E** vector consists of the SAVI measure at each lot (LOTSAVI) and at the nearest riparian corridor to each property (WASHSAVI) and the interacted variable (LOTWASH). A binary variable tests homebuyers' preferences for a property that is adjacent to, and therefore has a view of, and access to, a riparian corridor (ADJTWASH). This variable may also incorporate privacy benefits resulting from County regulations that forbid building in a floodway. WASHBUFF is a binary variable set equal to one if a home is within a 1056 ft buffer, but not adjacent to, a wash, and zero otherwise. In order to account for SFR property appreciation for the **T** vector dummies for the year of sale (D99-D03) were generated and are compared to sales in 1998.

The mean house sales price in the study area in the period was $224,929. Tables 1 and 2 below report variable descriptions and also summary statistics for the variables used in the model.

RESULTS: OLS

Robust OLS results are presented as the benchmark model (note that the Zip Specification incorporates BANK_PROTN in the model)[13] and are followed by the robust IV 2SLS results. The OLS results presented in Tables 3a-3c, for the three different

[13] The robust OLS results with BANK_PROTN for the: River Specification are, adjusted R^2= 0.8947, WASHSAVI=0.0045 p>|t|=0.071, LOTSAVI=0.0051 p>|t|=0.043, WASHLOT=-0.00002, p>|t|=0.297; Schools Specification are, 0.8945, 0.0061 p>|t|=0.013, 0.0071 p>|t|=0.005, and -0.00003, p>|t|=0.085, respectively.

specifications, show that the control variables do not behave in surprising ways. Homebuyers in this market appear to prefer newer, larger houses on larger lots, with more garage spaces and a larger swimming pool. ELEV is also positive and significant, which may proxy premiums for a view. The parameters for school district binary variables are consistent with claims by realtors in this area who spotlight these school districts, in particular the high-achieving CFSD, in their sales literature. The discount for FLOOD is also expected. In the other two specifications the coefficients for S_RIVER and the zip codes are negative as expected.

The adjacency variables (ADJTWASH, ADJTGOLF and ADJTPARK) vary across the specifications. The ADJTGOLF variable is insignificant in the School and River Specifications, but is significant and positive, at the five percent level, in the Zip Specification. The ADJTWASH variable is positive and significant, at the one percent level, across all three specifications. The ADJTPARK variable is negative and significant, at the one percent level, in all specifications. This result may seem surprising, but, the public parks in the study area are mostly large, busy parks, not neighborhood parks. The buffer variables are insignificant for GOLFBUFF as expected. There is little amenity value to living near but not on a golf course for most homebuyers. In contrast PARKBUFF is negative and significant across all specifications. Again this is probably a reflection of the nature and location of the public parks. Homebuyers in this area however willing to pay premiums for proximity to washes (WASHBUFF), which may be capturing the fact that washes are community, open space recreation resources that can be accessed by nearby homeowners whereas golf courses restrict access to golfers and large municipal parks may be associated with disamenities such as traffic, noise and safety concerns.

The two SAVI variables in all specifications indicate that homebuyers have preferences for more greenness, i.e. more vegetation, at the lot level and in their nearest riparian corridor. The coefficients for the WASHSAVI and LOTSAVI are very similar, in each specification, but vary in size between specifications. The lowest coefficient values are in the Zip Specification. This may reflect the fact that this geographical unit, the smallest used, captures some neighborhood level vegetation characteristics. The significant and negative WASHLOT coefficient in each specification indicates that a homebuyer living near a greener wash values a lot greenness less and vice versa, that is there is evidence that these vegetated areas are substitutes. The significance of the greenness coefficients also indicate that it is worthwhile to control for the heterogeneity in vegetated-amenities, at least in this desert city.

RESULTS: IV 2SLS

The results from the physical instrument specification are provided in Tables 4a-4d and Tables 5a-5d. The instruments chosen for LOTSAVI (Adjusted R^2=0.56 and 0.55, for the Schools and River Specifications, respectively) and WASHSAVI (Adjusted R^2=0.44 and 0.44, respectively) performed well. The parameters for the instrumental variables did not demonstrate obvious nonsensical relationships. For the Schools Specification the instrumented LOTSAVI variable instruments significant and positive at the 10 percent level are: northern exposures (NORTH), flat land (SHALLOW), certain soil types, CFS_NO, X-COORD and Y-COORD. The CFS_NO results shows that parcels are greener near larger washes: in fact very large washes in the area sometimes support wide, mesquite-tree woods. The X-COORD and Y-COORD results suggests that parcels further north and east in the study area are greener, this may reflect that these northern and eastern most parcels abut US National Forest land and perhaps were developed with greater care or receive marginally higher annual precipitation.

The results for Schools Specification WASHSAVI first stage regression suggest that larger washes are greener (CFS_NO) and again as with the LOTSAVI results some of the soil variables are significant. Areas that flat or very steep (SHALLOW and STEEPEST) are less vegetated whilst areas with EAST and WEST aspects are more vegetated. The Y-COORD result suggests that riparian corridors in the north are greener. There are similar results for the River Specification.

The IV (2SLS) regression with robust standard errors results are shown in Tables 4d and 5d. The sign and significance of our principal findings (WASHSAVI, LOTSAVI and WASHLOT) are robust across all of the OLS and 2SLS specifications, with larger magnitudes in the IV specifications.

CONCLUDING REMARKS

The results from this paper suggest that it is worthwhile to control for the heterogeneity of open space and landscape greenness. This is perhaps particularly relevant in a desert city where the supply of vegetation amenities is limited and therefore commands additional premiums that are significant determinants of SFR price variation. Homebuyers in the study area value greenness that they can control with some time lag, LOTSAVI, and also greenness that they cannot directly control, WASHSAVI. These results raise an interesting policy question because of a lack of explicit water rights for the riparian commons. It is likely that riparian corridors are underwatered while parcels are more likely to be optimally green[14] as this is greenness that the homebuyer can influence through landscaping and watering.[15]

[14] It could be that they are less green than optimal because of externalities. Neighbor A might benefit from Neighbor B's watering and landscaping but is unable to influence Neighbor B's behavior.

[15] Although washes are for the most part private property, because property lines typically extend to the wash centerline, the vegetation supported in the riparian corridors is a common good because of the water rights system in Arizona. Beginning in the 1870s surface water rights in the state were allocated by the prior appropriation doctrine (first in line first in right). Later a requirement of beneficial use was added: significantly instream flows were not viewed as beneficial. Meanwhile groundwater pumping rights are appurtenant to land and there are few controls to restrict groundwater pumping which contributes to degraded riparian habitat. Finally surface and ground waters are not managed conjunctively in Arizona meaning that the hydrologic connection between groundwater and surface waters is not recognized in law or water management. One outcome of Arizona's water rights and water management rules is that once flowing rivers now run dry, except after rain, in Tucson because the water tables of the aquifers, that used to support surface flows, are now up to several hundred feet below the surface level. This process of dewatering negatively impacts riparian habitat: recent research shows that as groundwater levels decline, riparian tree communities shift from more ecologically valued shallow groundwater-dependent riparian species to lower value dryland and invasive species communities or to bare ground (Lite and Stromberg, 2005). Such shifts in turn may negatively impact nearby private property values if degraded habitats are less green.

Because of the interaction between LOTSAVI and WASHSAVI, it may be more efficient[16] to return some water to/leave some water in the washes as homebuyers have preferences for wash greenness (WASHSAVI) which in turn can substitute (WASHLOT) for some landscape greenness (LOTSAVI). Thus, public good proposals such as the Pima County's Sonoran Desert Conservation Plan that advocates returning flows (probably treated wastewater) to some portion of the riparian network to conserve and rehabilitate riparian habitat may be particularly effective.

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[16] Approximately four times more land is in private yards than in riparian corridors in the study area. [There are 380km of washes and we estimate that the riparian corridors extend an average 7m either side of the wash side resulting in around 5.3M m^2 of riparian habitat. Estimated yard area is 21.3M m^2 (LOT – (LIVING + POOL + estimated garage area* the number of garages and carports))].

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TABLES AND FIGURES

Table 1: Variable names and definitions

Dependent variable	
LNSALESP	Log of unadjusted sales price
Home structure	
LOT	Lot size, 100 m^2
LIVING	Living area, m^2
AGE	Age of house in years
BATH	Number of bath fixtures
GARAGE	Number of garage spaces
POOL	Pool size, m^2
Neighborhood variables	
CFSD	Binary variable equal to one if school district is Catalina Foothills and equal to zero otherwise. Compared to Tucson Unified SD.
TVSD	Binary variable equal to one if school district is Tanque Verde and equal to zero otherwise. Compared to Tucson Unified SD.
S_RIVER	Binary variable equal to one if house is south of the Rillito River and equal to zero otherwise. Compared to houses north of river.
ZIP10/11/12/15/48/49/50	Binary variable equal to one if house is in zip code 85710, 85711, 85712, 85715, 85748, 85749, 85750. All compared to 85718.
ELEV	Elevation of property in meters above sea level
FLOOD	Binary variable equal to one if house is in the Federal Emergency Management Agency flood zone and equal to zero otherwise
Census variables	
MEDINC99	Median household income in Census Block in 1999.
PCT>65	Percent of households in Census Block 2000 over 65 years.
POP_DENS	Population density of Census Block, 10,000 people per sq.mi.
Amenity variables	
LOTSAVI	SAVI DN value at parcel, DN
WASHSAVI	SAVI DN value at nearest riparian corridor, DN
LOTWASH	LOTSAVI*WASHSAVI
ADJTWASH	Binary variable equal to one if house is adjacent to a riparian corridor and equal to zero otherwise
WASHBUFF	Binary variable equal to one if a house is not adjacent to, but within 1056 ft of a riparian corridor, and equal to zero otherwise
ADJTGOLF	Binary variable equal to one if house is adjacent to a golf course and equal to zero otherwise
GOLFBUFF	Binary variable equal to one if a house is not adjacent to, but within 1056 ft of a golf course, and equal to zero otherwise
ADJTPARK	Binary variable equal to one if house is adjacent to a public park and equal to zero otherwise
PARKBUFF	Binary variable equal to one if a house is not adjacent to, but within 1056 ft of a public park, and equal to zero otherwise
BANK_PROTN	Binary variable equal to one if the nearest wash is bank protected and equal to zero otherwise
Appreciation	
APPREC	Measure of general house price inflation (Year 2003 minus year of sale)
D99-D03	Binary variable for year of sale, 1999-2003 compared to a sale in 1998

Table 2: Summary Statistics

Variable	Mean	Std.Dev.	Min	Max
LOTSAVI	126.056	9.826	100	198
WASHSAVI	128.284	10.538	101	221
WASHLOT	16,237	2,509	10,900	42,510
SALESP	224,929	166,008	34,000	4,500,000
LOT	25.393	51.197	1.570	3350.633
LIVING	194.812	67.712	42.084	1,012.70
BATH	7.658	2.617	3	26
ELEV	807.206	35.319	751.886	1069.750
AGE	23.335	13.770	0	76
GARAGE	1.268	1.162	0	5
POOL	17.609	22.117	0	185.2426
FLOOD	0.030	0.172	0	1
S_RIVER	0.363	0.481	0	1
CFSD	0.179	0.384	0	1
TVSD	0.103	0.304	0	1
ZIP10	0.112	0.315	0	1
ZIP11	0.078	0.268	0	1
ZIP12	0.084	0.277	0	1
ZIP15	0.130	0.336	0	1
ZIP18	0.057	0.232	0	1
ZIP48	0.089	0.285	0	1
ZIP49	0.192	0.394	0	1
ZIP50	0.259	0.438	0	1
GOLFBUFF	0.035	0.183	0	1
ADJTGOLF	0.031	0.172	0	1
WASHBUFF	0.477	0.500	0	1
ADJTWASH	0.178	0.382	0	1
PARKBUFF	0.080	0.271	0	1
ADJTPARK	0.021	0.142	0	1
MEDINC99	61,161	20,819	17,005	115,387
PCT>65	23.222	10.098	7.5	72.2
POP_DENS	1.197	0.925	0.008	6.414
D99	0.177	0.382	0	1
D00	0.168	0.374	0	1
D01	0.164	0.370	0	1
D02	0.164	0.370	0	1
D03	0.163	0.370	0	1

Table 2: Summary Statistics cont.

SOIL17	0.004	0.064	0	1
SOIL18	0.398	0.489	0	1
SOIL34	0.044	0.204	0	1
SOIL49	0.124	0.329	0	1
SOIL51	0.084	0.278	0	1
SOIL52	0.347	0.476	0	1
CFS_NO	3.108	1.446	1	6
X-COORD	838,236	13,625	816,582	884,601
Y-COORD	460,728	11,200	445,839	487,397
NORTH	0.129	0.335	0	1
EAST	0.126	0.332	0	1
WEST	0.140	0.347	0	1
SHALLOW	0.580	0.494	0	1
STEEP	0.021	0.142	0	1
STEEPEST	0.002	0.044	0	1
BANK_PROTN	0.079	0.270	0	1

Table 3a: Zip Specification, robust OLS and MIP

LNSALESP	Robust coeff.	S.E.	t	P>|t|	95%C.I.		MIP
LOT	0.0014	0.0004	3.39	0.001	0.0006	0.0022	305.90
LIVING	0.0036	0.0001	26.58	0	0.0034	0.0039	818.47
BATH	0.0128	0.0021	6.23	0	0.0088	0.0168	2,875.40
ELEV	0.0016	0.0001	13.93	0	0.0014	0.0018	361.28
AGE	-0.0055	0.0004	-14.55	0	-0.0062	-0.0048	(1,238.41)
GARAGE	0.0184	0.0028	6.57	0	0.0129	0.0238	4,127.71
POOL	0.0015	0.0001	14.71	0	0.0013	0.0017	329.39
FLOOD	-0.0267	0.0156	-1.71	0.087	-0.0573	0.0039	(6,009.89)
WASHSAVI	0.0043	0.0014	3.14	0.002	0.0016	0.0070	976.12
LOTSAVI	0.0038	0.0015	2.58	0.01	0.0009	0.0067	860.13
WASHLOT	-0.00002	0.00001	-1.81	0.071	-0.00004	0.00000	(4.25)
ZIP10	-0.1786	0.0141	-12.69	0	-0.2062	-0.1510	(40,181.55)
ZIP11	-0.0446	0.0165	-2.7	0.007	-0.0770	-0.0122	(10,031.99)
ZIP12	-0.1217	0.0172	-7.09	0	-0.1554	-0.0880	(27,375.94)
ZIP15	-0.1492	0.0135	-11.03	0	-0.1758	-0.1227	(33,570.27)
ZIP48	-0.2190	0.0117	-18.67	0	-0.2419	-0.1960	(49,248.71)
ZIP49	-0.0921	0.0110	-8.36	0	-0.1137	-0.0705	(20,711.08)
ZIP50	-0.0426	0.0131	-3.26	0.001	-0.0683	-0.0170	(9,585.74)
GOLFBUFF	0.0087	0.0140	0.62	0.533	-0.0187	0.0362	1,962.93
ADJTGOLF	0.0535	0.0237	2.26	0.024	0.0071	0.1000	12,044.16
WASHBUFF	0.0123	0.0040	3.05	0.002	0.0044	0.0202	0.28
ADJTWASH	0.0220	0.0072	3.08	0.002	0.0080	0.0361	4,958.44
PARKBUFF	-0.0116	0.0064	-1.81	0.071	-0.0242	0.0010	(2,611.58)
ADJTPARK	-0.0435	0.0113	-3.84	0	-0.0657	-0.0213	(9,785.25)
MEDINC99	0.0000	0.0000	10.04	0	0.0000	0.0000	0.45
PCT>65	0.0012	0.0002	5.03	0	0.0007	0.0016	259.99
POP_DENS	-0.0411	0.0034	-12.23	0	-0.0476	-0.0345	(0.92)
D99	0.0683	0.0057	11.9	0	0.0571	0.0796	15,371.23
D00	0.1247	0.0060	20.73	0	0.1129	0.1365	28,040.29
D01	0.1858	0.0061	30.64	0	0.1739	0.1977	41,785.58
D02	0.2521	0.0063	39.81	0	0.2397	0.2645	56,706.85
D03	0.3292	0.0067	49.31	0	0.3161	0.3423	74,040.18
BANK_PROT	0.0506	0.0080	6.35	0	0.0350	0.0662	11,373.65
CONSTANT	9.2078	0.2235	41.2	0	8.7696	9.6459	

Table 3b: Schools Specification, robust OLS and MIP

LNSALESP	Robust Coeff.	S.E.	t	P>|t|	[95%C.I.]		MIP
LOT	0.0013	0.0004	3.22	0.001	0.0005	0.0021	290.16
LIVING	0.0037	0.0001	28.12	0	0.0035	0.0040	837.95
BATH	0.0147	0.0021	7.16	0	0.0107	0.0187	3,303.14
ELEV	0.0008	0.0001	5.88	0	0.0005	0.0011	178.53
AGE	-0.0044	0.0003	-13.33	0	-0.0050	-0.0037	(979.99)
GARAGE	0.0230	0.0028	8.17	0	0.0174	0.0285	5,162.76
POOL	0.0014	0.0001	13.44	0	0.0012	0.0016	306.92
FLOOD	-0.0428	0.0153	-2.79	0.005	-0.0728	-0.0127	(9,622.44)
WASHSAVI	0.0107	0.0015	7.36	0	0.0079	0.0136	2,411.32
LOTSAVI	0.0110	0.0015	7.2	0	0.0080	0.0140	2,472.28
WASHLOT	-0.0001	0.0000	-5.66	0	-0.0001	0.0000	(14.17)
CFSD	0.1043	0.0089	11.74	0	0.0869	0.1217	23,463.56
TVSD	0.0163	0.0154	1.06	0.29	-0.0139	0.0466	3,672.57
GOLFBUFF	0.0097	0.0134	0.72	0.47	-0.0166	0.0360	2,176.75
ADJTGOLF	0.0289	0.0241	1.2	0.231	-0.0183	0.0760	6,490.31
WASHBUFF	0.0130	0.0042	3.11	0.002	0.0048	0.0212	2,929.94
ADJTWASH	0.0214	0.0073	2.92	0.003	0.0070	0.0357	4,808.57
PARKBUFF	-0.0199	0.0064	-3.12	0.002	-0.0324	-0.0074	(4,469.58)
ADJTPARK	-0.0468	0.0117	-3.99	0	-0.0698	-0.0238	(10,524.14)
MEDINC99	0.0000	0.0000	14.5	0	0.0000	0.0000	0.61
PCT>65	0.0015	0.0002	6.57	0	0.0010	0.0019	329.39
POP_DENS	-0.0490	0.0035	-14.1	0	-0.0558	-0.0422	(1.10)
D99	0.0663	0.0060	11.12	0	0.0546	0.0780	14,909.32
D00	0.1232	0.0062	19.91	0	0.1110	0.1353	27,704.27
D01	0.1825	0.0062	29.41	0	0.1703	0.1947	41,049.98
D02	0.2485	0.0064	38.57	0	0.2358	0.2611	55,884.53
D03	0.3201	0.0068	46.89	0	0.3067	0.3335	71,993.74
CONSTANT	8.6422	0.2410	35.86	0	8.1698	9.1146	
N=9,343							
F=1,792.29							
R^2=0.88							

Table 3c: River Specification, robust OLS and MIP

LNSALESP	Robust coeff.	S.E.	t	P>|t|	[95%C.I.]		MIP
LOT	0.0013	0.0004	3.48	0.001	0.0006	0.0020	283.41
LIVING	0.0036	0.0001	27.64	0	0.0034	0.0039	820.92
BATH	0.0163	0.0021	7.85	0	0.0122	0.0203	3,662.69
ELEV	0.0016	0.0001	15.95	0	0.0014	0.0018	368.86
AGE	-0.0033	0.0003	-10.19	0	-0.0040	-0.0027	(748.00)
GARAGE	0.0245	0.0028	8.6	0	0.0189	0.0301	5,505.87
POOL	0.0012	0.0001	11.63	0	0.0010	0.0014	261.19
FLOOD	-0.0497	0.0164	-3.03	0.002	-0.0819	-0.0175	(11,179.56)
WASHSAVI	0.0086	0.0015	5.7	0	0.0056	0.0116	1,933.37
LOTSAVI	0.0085	0.0016	5.28	0	0.0053	0.0116	1,903.95
WASHLOT	-0.00005	0.00001	-4.04	0	-0.0001	0.0000	(10.46)
S_RIVER	-0.0716	0.0053	-13.39	0	-0.0820	-0.0611	(16,095.39)
GOLFBUFF	0.0066	0.0137	0.48	0.631	-0.0203	0.0334	1,479.89
ADJTGOLF	0.0286	0.0220	1.3	0.193	-0.0145	0.0716	6,426.55
WASHBUFF	0.0223	0.0041	5.38	0	0.0142	0.0304	5,013.93
ADJTWASH	0.0337	0.0068	4.95	0	0.0203	0.0470	7,569.86
PARKBUFF	-0.0172	0.0064	-2.7	0.007	-0.0297	-0.0047	(3,865.96)
ADJTPARK	-0.0560	0.0120	-4.69	0	-0.0795	-0.0326	(12,605.85)
MEDINC99	0.0000	0.0000	10.99	0	0.0000	0.0000	0.47
PCT>65	0.0013	0.0002	6.07	0	0.0009	0.0017	297.49
POP_DENS	-0.0433	0.0037	-11.61	0	-0.0507	-0.0360	(0.97)
D99	0.0639	0.0059	10.8	0	0.0523	0.0754	14,363.22
D00	0.1208	0.0062	19.52	0	0.1087	0.1329	27,167.52
D01	0.1799	0.0062	28.91	0	0.1677	0.1921	40,464.33
D02	0.2445	0.0064	38	0	0.2318	0.2571	54,985.47
D03	0.3162	0.0068	46.58	0	0.3029	0.3295	71,119.48
CONSTANT	8.3413	0.2311	36.09	0	7.8883	8.7943	
N=9,434							
F=1,832.4							
R^2=0.8791							

Table 4a: Schools Specification, first stage regression

LOTSAVI	Coef.	Std Err.	t	P>|t|	[95% Conf. Interval]	
LOT	0.0074	0.0015	4.92	0	0.0045	0.0104
LIVING	0.0014	0.0018	0.75	0.454	-0.0022	0.0050
BATH	0.0231	0.0486	0.48	0.635	-0.0722	0.1184
ELEV	-0.0059	0.0040	-1.46	0.144	-0.0138	0.0020
AGE	0.1596	0.0094	17.01	0	0.1412	0.1780
GARAGE	0.3265	0.0903	3.62	0	0.1495	0.5036
POOL	-0.0084	0.0034	-2.52	0.012	-0.0150	-0.0019
FLOOD	7.1057	0.4380	16.22	0	6.2471	7.9644
CFSD	-0.1720	0.3750	-0.46	0.646	-0.9072	0.5631
TVSD	5.3679	0.3575	15.02	0	4.6671	6.0686
GOLFBUFF	4.7716	0.3968	12.02	0	3.9937	5.5494
ADJTGOLF	21.0646	0.4512	46.69	0	20.1802	21.9490
WASHBUFF	0.6047	0.1673	3.61	0	0.2767	0.9326
ADJTWASH	1.7009	0.2262	7.52	0	1.2575	2.1443
PARKBUFF	0.4594	0.2617	1.76	0.079	-0.0536	0.9723
ADJTPARK	-1.2718	0.4821	-2.64	0.008	-2.2168	-0.3268
MEDINC99	0.0000	0.0000	6.20	0	0.0000	0.0000
PCT>65	0.0169	0.0081	2.09	0.037	0.0010	0.0327
POP_DENS	-1.26	0.10	-13.15	0	-1.44	-1.07
D99	-0.4924	0.2312	-2.13	0.033	-0.9457	-0.0392
D00	-0.9194	0.2350	-3.91	0	-1.3801	-0.4586
D01	-0.8975	0.2369	-3.79	0	-1.3619	-0.4331
D02	-1.1198	0.2385	-4.70	0	-1.5873	-0.6523
D03	-1.1283	0.2405	-4.69	0	-1.5998	-0.6569
NORTH	0.6320	0.2808	2.25	0.024	0.0815	1.1825
EAST	0.0073	0.2559	0.03	0.977	-0.4943	0.5088
WEST	0.1764	0.2458	0.72	0.473	-0.3053	0.6582
SHALLOW	-0.7905	0.2038	-3.88	0	-1.1901	-0.3909
STEEP	-0.2086	0.5322	-0.39	0.695	-1.2519	0.8346
STEEPEST	0.8011	1.6571	0.48	0.629	-2.4472	4.0494
SOIL18	0.9648	1.0826	0.89	0.373	-1.1573	3.0868
SOIL34	-3.5568	1.1394	-3.12	0.002	-5.7903	-1.3233
SOIL49	3.7077	1.0977	3.38	0.001	1.5559	5.8594
SOIL51	3.2280	1.1239	2.87	0.004	1.0249	5.4311
SOIL52	0.6578	1.0711	0.61	0.539	-1.4417	2.7573
CFS_NO	0.3210	0.0576	5.58	0	0.2082	0.4339
X-COORD	-0.0001	0.0000	-5.29	0	-0.0001	0.0000
Y-COORD	0.0003	0.0000	19.76	0	0.0003	0.0003
CONSTANT	24.1606	13.1497	1.84	0.066	-1.6156	49.9368

N=9,434
F(38, 9,395)=313.89
Adjt R^2=0.5576

Table 4b: Schools Specification, first stage regression, cont.

WASHSAVI	Coeff.	S.E.	t	P>|t|	95% C.I.	
LOT	0.0095	0.0018	5.20	0	0.0059	0.0130
LIVING	0.0015	0.0022	0.66	0.509	-0.0029	0.0058
BATH	-0.0519	0.0586	-0.89	0.375	-0.1668	0.0629
ELEV	0.0116	0.0049	2.39	0.017	0.0021	0.0211
AGE	0.0557	0.0113	4.93	0	0.0335	0.0779
GARAGE	0.5710	0.1088	5.25	0	0.3578	0.7842
POOL	-0.0147	0.0040	-3.63	0	-0.0226	-0.0068
FLOOD	4.2978	0.5275	8.15	0	3.2637	5.3318
CFSD	-2.2054	0.4517	-4.88	0	-3.0908	-1.3201
TVSD	1.3646	0.4305	3.17	0.002	0.5207	2.2085
GOLFBUFF	7.2268	0.4779	15.12	0	6.2900	8.1636
ADJTGOLF	24.4153	0.5434	44.93	0	23.3502	25.4805
WASHBUFF	0.5511	0.2015	2.74	0.006	0.1562	0.9460
ADJTWASH	0.7307	0.2724	2.68	0.007	0.1967	1.2646
PARKBUFF	-0.2774	0.3151	-0.88	0.379	-0.8951	0.3403
ADJTPARK	1.9894	0.5806	3.43	0.001	0.8514	3.1275
MEDINC99	0.0001	0.0000	7.92	0	0.0000	0.0001
PCT>65	-0.0358	0.0097	-3.68	0	-0.0548	-0.0167
POP_DENS	-0.51	0.12	-4.44	0	-0.74	-0.29
D99	-0.4224	0.2785	-1.52	0.129	-0.9683	0.1234
D00	-0.3021	0.2831	-1.07	0.286	-0.8569	0.2528
D01	-0.6783	0.2853	-2.38	0.017	-1.2375	-0.1190
D02	-0.3945	0.2872	-1.37	0.17	-0.9575	0.1685
D03	-0.4628	0.2896	-1.60	0.11	-1.0305	0.1050
NORTH	0.2198	0.3382	0.65	0.516	-0.4432	0.8827
EAST	-0.9157	0.3081	-2.97	0.003	-1.5197	-0.3117
WEST	0.5835	0.2960	1.97	0.049	0.0033	1.1637
SHALLOW	-1.1167	0.2455	-4.55	0	-1.5979	-0.6355
STEEP	1.1649	0.6409	1.82	0.069	-0.0915	2.4213
STEEPEST	-5.7807	1.9957	-2.90	0.004	-9.6926	-1.8687
SOIL18	3.8572	1.3037	2.96	0.003	1.3016	6.4128
SOIL34	0.4489	1.3722	0.33	0.744	-2.2409	3.1387
SOIL49	2.9718	1.3220	2.25	0.025	0.3804	5.5632
SOIL51	4.2985	1.3535	3.18	0.001	1.6453	6.9517
SOIL52	6.5704	1.2899	5.09	0	4.0420	9.0989
CFS_NO	0.8424	0.0693	12.15	0	0.7065	0.9783
X-COORD	-0.00002	0.00001	-1.59	0.112	-0.00004	0.000005
Y-COORD	0.0004	0.00002	21.68	0	0.0004	0.0004
CONSTANT	-65.0521	15.8362	-4.11	0	-96.0945	-34.0097
N=9,434	F(38, 9,395)=197.74				Adjt R^2=0.4421	

Table 4c: Schools Specification, first stage regression, cont.

WASHLOT	Coeff.	S.E.	t	P>|t|	95% C.I.
LOT	2.1351	0.3735	5.72	0	1.4031
LIVING	0.2896	0.4547	0.64	0.524	-0.6016
BATH	-0.1322	12.0299	-0.01	0.991	-23.7134
ELEV	1.4100	0.9963	1.42	0.157	-0.5429
AGE	28.5678	2.3214	12.31	0	24.0174
GARAGE	113.8152	22.3376	5.10	0	70.0286
POOL	-2.9196	0.8300	-3.52	0	-4.5466
FLOOD	1580.8840	108.3357	14.59	0	1368.5220
CFSD	-263.6727	92.7598	-2.84	0.004	-445.5019
TVSD	778.0137	88.4147	8.80	0	604.7019
GOLFBUFF	1576.3290	98.1457	16.06	0	1383.9420
ADJTGOLF	6615.0810	111.5915	59.28	0	6396.3370
WASHBUFF	155.5703	41.3766	3.76	0	74.4633
ADJTWASH	355.4499	55.9426	6.35	0	245.7902
PARKBUFF	42.5101	64.7159	0.66	0.511	-84.3471
ADJTPARK	82.7841	119.2356	0.69	0.488	-150.9435
MEDINC99	0.0126	0.0014	8.85	0	0.0098
PCT>65	-1.6266	1.9963	-0.81	0.415	-5.5398
POP_DENS	-220.72	23.63	-9.34	0	-267.03
D99	-111.7343	57.1900	-1.95	0.051	-223.8391
D00	-165.0497	58.1338	-2.84	0.005	-279.0045
D01	-216.1716	58.5940	-3.69	0	-331.0286
D02	-206.3744	58.9833	-3.50	0	-321.9944
D03	-214.7482	59.4832	-3.61	0	-331.3482
NORTH	104.4055	69.4566	1.50	0.133	-31.7444
EAST	-129.3230	63.2821	-2.04	0.041	-253.3696
WEST	82.7675	60.7862	1.36	0.173	-36.3865
SHALLOW	-219.4667	50.4156	-4.35	0	-318.2921
STEEP	124.5639	131.6307	0.95	0.344	-133.4607
STEEPEST	-693.8674	409.8497	-1.69	0.09	-1497.2610
SOIL18	528.6523	267.7472	1.97	0.048	3.8098
SOIL34	-486.0072	281.8057	-1.72	0.085	-1038.4070
SOIL49	801.5737	271.4954	2.95	0.003	269.3839
SOIL51	885.0898	277.9743	3.18	0.001	340.2001
SOIL52	877.7731	264.9032	3.31	0.001	358.5055
CFS_NO	149.2824	14.2393	10.48	0	121.3703
X-COORD	-0.00772	0.00253	-3.05	0.002	-0.01268
Y-COORD	0.0913	0.00389	23.47	0	0.0837
CONSTANT	(23,165.90)	3,252.28	-7.12	0	(29,541.08)
N=9,434		F(38, 9,395)=351.03		Adjt R^2=0.5851	

Table 4d: Schools Specification, IV 2SLS

	Coeff.	Std Err.	t	P>|t|	[95% Conf. Interval]	
LOTSAVI	0.1585	0.0259	6.11	0	0.1077	0.2094
WASHSAVI	0.1639	0.0262	6.27	0	0.1127	0.2152
WASHLOT	-0.0012	0.0002	-5.88	0	-0.0016	-0.0008
LOT	0.0013	0.0004	3.53	0	0.0006	0.0020
LIVING	0.0036	0.0002	23.7	0	0.0033	0.0038
BATH	0.0187	0.0029	6.36	0	0.0130	0.0245
ELEV	0.0015	0.0003	5.38	0	0.0010	0.0021
AGE	-0.0041	0.0006	-7.31	0	-0.0052	-0.0030
GARAGE	0.0163	0.0043	3.81	0	0.0079	0.0246
POOL	0.0014	0.0002	9.31	0	0.0011	0.0018
FLOOD	0.1048	0.0525	2	0.046	0.0020	0.2077
CFSD	0.0933	0.0134	6.95	0	0.0670	0.1196
TVSD	-0.0273	0.0211	-1.29	0.196	-0.0686	0.0141
GOLFBUFF	0.0294	0.0289	1.02	0.309	-0.0272	0.0859
ADJTGOLF	0.8933	0.1794	4.98	0	0.5415	1.2450
WASHBUFF	0.0132	0.0070	1.9	0.057	-0.0004	0.0269
ADJTWASH	0.0649	0.0136	4.76	0	0.0382	0.0916
PARKBUFF	0.0164	0.0094	1.75	0.081	-0.0020	0.0349
ADJTPARK	-0.0644	0.0173	-3.73	0	-0.0983	-0.0305
MEDINC99	0.0000	0.0000	10.17	0	0.0000	0.0000
PCT>65	0.0022	0.0005	4.61	0	0.0013	0.0032
POP_DENS	-0.0316	0.0045	-7.04	0	-0.0404	-0.0228
D99	0.0760	0.0119	6.38	0	0.0527	0.0994
D00	0.1164	0.0118	9.88	0	0.0933	0.1395
D01	0.1729	0.0101	17.12	0	0.1531	0.1927
D02	0.2383	0.0106	22.47	0	0.2175	0.2590
D03	0.3138	0.0115	27.37	0	0.2914	0.3363
Instrumented:	LOTSAVI WASHSAVI LOTWASH					
Instruments:	LOT, LIVING, AGE, BATH, GARAGE, POOL, CFSD, TVSD, FLOOD GOLFBUFF, ADJTGOLF, WASHBUFF, ADJTWASH, PARKBUFF, ADJTPARK, ELEV, POP_DENS, D99, D00, D01, D02, D03, NORTH, EAST, WEST, SHALLOW, STEEP, STEEPEST, SOIL18, SOIL34, SOIL49, SOIL51, SOIL52, CFS_NO, X-CRD, Y-CRD					

N=9,434
F (27, 9,406)=1,046.95
R^2=0.68

Table 5a: River Specification, first stage regression

LOTSAVI	Coeff.	Std Err.	t	P>|t|	[95% Conf. Interval]	
LOT	0.0112	0.0015	7.43	0	0.0083	0.0142
LIVING	0.0026	0.0019	1.41	0.159	-0.0010	0.0063
BATH	0.0378	0.0492	0.77	0.442	-0.0586	0.1343
ELEV	-0.0049	0.0036	-1.37	0.17	-0.0120	0.0021
AGE	0.1923	0.0094	20.55	0	0.1740	0.2106
GARAGE	0.4341	0.0911	4.76	0	0.2555	0.6127
POOL	-0.0105	0.0034	-3.09	0.002	-0.0172	-0.0038
FLOOD	7.9933	0.4391	18.20	0	7.1325	8.8541
S_RIVER	-0.2341	0.3344	-0.70	0.484	-0.8897	0.4215
GOLFBUFF	4.8909	0.4014	12.19	0	4.1041	5.6776
ADJTGOLF	21.7625	0.4536	47.98	0	20.8733	22.6516
WASHBUFF	0.5007	0.1716	2.92	0.004	0.1643	0.8370
ADJTWASH	1.6553	0.2321	7.13	0	1.2003	2.1103
PARKBUFF	0.5465	0.2648	2.06	0.039	0.0275	1.0655
ADJTPARK	-1.3186	0.4881	-2.70	0.007	-2.2755	-0.3618
MEDINC99	0.0000	0.0000	4.69	0	0.0000	0.0000
PCT>65	0.0194	0.0082	2.37	0.018	0.0033	0.0355
POP_DENS	-1.5194	0.0945	-16.08	0	-1.7046	-1.3342
D99	-0.51	0.23	-2.19	0.028	-0.97	-0.05
D00	-0.9629	0.2380	-4.05	0	-1.4295	-0.4963
D01	-1.0020	0.2398	-4.18	0	-1.4721	-0.5319
D02	-1.2165	0.2414	-5.04	0	-1.6898	-0.7433
D03	-1.3017	0.2433	-5.35	0	-1.7787	-0.8248
NORTH	0.0792	0.2844	0.28	0.781	-0.4783	0.6367
EAST	-0.3089	0.2551	-1.21	0.226	-0.8090	0.1912
WEST	0.0839	0.2491	0.34	0.736	-0.4044	0.5722
SHALLOW	-0.2919	0.2221	-1.31	0.189	-0.7273	0.1435
STEEP	-0.1275	0.5372	-0.24	0.812	-1.1805	0.9256
STEEPEST	0.3462	1.6629	0.21	0.835	-2.9135	3.6058
SOIL18	1.3785	1.0969	1.26	0.209	-0.7717	3.5287
SOIL34	-2.3774	1.1534	-2.06	0.039	-4.6383	-0.1164
SOIL49	4.6441	1.1100	4.18	0	2.4683	6.8198
SOIL51	4.8478	1.1367	4.26	0	2.6196	7.0759
SOIL52	1.4138	1.0847	1.30	0.192	-0.7125	3.5401
CFS_NO	0.2730	0.0583	4.68	0	0.1587	0.3872
X-COORD	0.0000	0.0000	2.60	0.009	0.0000	0.0000
Y-COORD	0.0003	0.0000	16.51	0	0.0003	0.0004
CONSTANT	-47.2055	14.3069	-3.30	0.001	-75.2501	-19.1609
N=9,434		F(37, 9,396)=308.19			Adjt R^2=0.5465	

Table 5b: River Specification, first stage regression cont.

WASHSAVI	Coeff.	Std Err.	t	P>|t|	[95% Conf. Interval]	
LOT	0.0106	0.0018	5.92	0	0.0071	0.0141
LIVING	0.0035	0.0022	1.56	0.118	-0.0009	0.0078
BATH	-0.0674	0.0584	-1.15	0.249	-0.1820	0.0471
ELEV	-0.0117	0.0043	-2.74	0.006	-0.0201	-0.0033
AGE	0.0536	0.0111	4.82	0	0.0318	0.0754
GARAGE	0.6019	0.1082	5.56	0	0.3898	0.8140
POOL	-0.0130	0.0040	-3.22	0.001	-0.0209	-0.0051
FLOOD	4.6368	0.5216	8.89	0	3.6145	5.6592
S_RIVER	3.2757	0.3972	8.25	0	2.4970	4.0543
GOLFBUFF	7.4057	0.4767	15.54	0	6.4713	8.3401
ADJTGOLF	24.5267	0.5387	45.53	0	23.4707	25.5827
WASHBUFF	0.2119	0.2038	1.04	0.299	-0.1876	0.6114
ADJTWASH	0.2704	0.2757	0.98	0.327	-0.2700	0.8107
PARKBUFF	-0.2534	0.3145	-0.81	0.42	-0.8699	0.3630
ADJTPARK	2.0473	0.5798	3.53	0	0.9108	3.1838
MEDINC99	0.0001	0.0000	8.55	0	0.0000	0.0001
PCT>65	-0.0239	0.0097	-2.45	0.014	-0.0430	-0.0048
POP_DENS	-0.6930	0.1122	-6.18	0	-0.9130	-0.4731
D99	-0.39	0.28	-1.39	0.163	-0.93	0.16
D00	-0.2760	0.2827	-0.98	0.329	-0.8302	0.2781
D01	-0.6720	0.2848	-2.36	0.018	-1.2304	-0.1137
D02	-0.4005	0.2867	-1.40	0.162	-0.9626	0.1615
D03	-0.4785	0.2890	-1.66	0.098	-1.0450	0.0880
NORTH	-0.5659	0.3378	-1.68	0.094	-1.2280	0.0962
EAST	-1.2632	0.3030	-4.17	0	-1.8572	-0.6692
WEST	0.4095	0.2959	1.38	0.166	-0.1705	0.9895
SHALLOW	-1.9232	0.2638	-7.29	0	-2.4403	-1.4061
STEEP	1.0204	0.6380	1.60	0.11	-0.2303	2.2711
STEEPEST	-5.0437	1.9750	-2.55	0.011	-8.9152	-1.1722
SOIL18	3.5969	1.3028	2.76	0.006	1.0431	6.1507
SOIL34	0.2011	1.3699	0.15	0.883	-2.4842	2.8864
SOIL49	3.1459	1.3183	2.39	0.017	0.5617	5.7300
SOIL51	3.9841	1.3501	2.95	0.003	1.3376	6.6305
SOIL52	6.2776	1.2883	4.87	0	3.7522	8.8030
CFS_NO	0.7861	0.0692	11.36	0	0.6504	0.9217
X-COORD	0.0001	0.0000	4.69	0	0.0000	0.0001
Y-COORD	0.0005	0.0000	22.01	0	0.0005	0.0006
CONSTANT	-151.3769	16.9924	-8.91	0	-184.6858	-118.0681
N=9,434		F(37, 9,396)=204.38			Adjt R^2=0.4437	

Table 5c: River Specification, first stage regression cont.

WASHLOT	Coeff.	Std Err.	t	P>|t|	[95% Conf. Interval]	
LOT	2.7057	0.3697	7.32	0	1.9809	3.4304
LIVING	0.6996	0.4562	1.53	0.125	-0.1947	1.5939
BATH	-0.4758	12.0615	-0.04	0.969	-24.1190	23.1674
ELEV	-1.4990	0.8837	-1.70	0.09	-3.2312	0.2332
AGE	31.6527	2.2941	13.80	0	27.1559	36.1496
GARAGE	130.2912	22.3358	5.83	0	86.5082	174.0742
POOL	-2.8966	0.8336	-3.47	0.001	-4.5305	-1.2626
FLOOD	1729.4010	107.6434	16.07	0	1518.3960	1940.4050
S_RIVER	466.5611	81.9823	5.69	0	305.8580	627.2642
GOLFBUFF	1611.5900	98.3830	16.38	0	1418.7380	1804.4420
ADJTGOLF	6710.4530	111.1856	60.35	0	6492.5050	6928.4010
WASHBUFF	94.6222	42.0602	2.25	0.024	12.1752	177.0692
ADJTWASH	283.8359	56.8937	4.99	0	172.3120	395.3599
PARKBUFF	52.9066	64.9019	0.82	0.415	-74.3152	180.1283
ADJTPARK	85.9376	119.6581	0.72	0.473	-148.6182	320.4933
MEDINC99	0.0123	0.0014	8.60	0	0.0095	0.0151
PCT>65	0.3273	2.0115	0.16	0.871	-3.6157	4.2704
POP_DENS	-272.6251	23.1574	-11.77	0	-318.0187	-227.2316
D99	-108.64	57.40	-1.89	0.058	-221.16	3.88
D00	-165.3190	58.3456	-2.83	0.005	-279.6891	-50.9490
D01	-225.7306	58.7890	-3.84	0	-340.9698	-110.4915
D02	-216.3612	59.1757	-3.66	0	-332.3583	-100.3640
D03	-234.1558	59.6443	-3.93	0	-351.0716	-117.2401
NORTH	-65.0383	69.7123	-0.93	0.351	-201.6896	71.6130
EAST	-205.1707	62.5367	-3.28	0.001	-327.7562	-82.5853
WEST	47.3857	61.0673	0.78	0.438	-72.3195	167.0909
SHALLOW	-285.1968	54.4457	-5.24	0	-391.9221	-178.4715
STEEP	95.4617	131.6853	0.72	0.469	-162.6700	353.5934
STEEPEST	-680.4969	407.6196	-1.67	0.095	-1479.52	118.5257
SOIL18	525.0420	268.8835	1.95	0.051	-2.0278	1052.1120
SOIL34	-403.4724	282.7313	-1.43	0.154	-957.6869	150.7421
SOIL49	920.6343	272.0800	3.38	0.001	387.2987	1453.9700
SOIL51	1005.3510	278.6356	3.61	0	459.1649	1551.5370
SOIL52	912.9345	265.8947	3.43	0.001	391.7233	1434.1460
CFS_NO	136.1764	14.2841	9.53	0	108.1764	164.1763
X-COORD	0.0108	0.0023	4.69	0	0.0063	0.0154
Y-COORD	0.1078	0.0047	22.73	0	0.0985	0.1171
CONSTANT	-44152.60	3507.02	-12.59	0	-51027.13	-37278.08
N=9,434		F(37, 9,396)=308.19			Adjt R^2=0.5822	

Table 5d: River Specification, IV 2SLS

	Coeff.	Std Err.	t	P>|t|	[95% Conf. Interval]	
LOTSAVI	0.0724	0.0200	3.63	0	0.0333	0.1115
WASHSAVI	0.0843	0.0200	4.22	0	0.0452	0.1234
WASHLOT	-0.0006	0.0002	-3.65	0	-0.0009	-0.0003
LOT	0.0012	0.0003	3.58	0	0.0005	0.0019
LIVING	0.0036	0.0001	25.43	0	0.0033	0.0039
BATH	0.0182	0.0023	7.79	0	0.0136	0.0228
ELEV	0.0017	0.0002	10.18	0	0.0014	0.0020
AGE	-0.0040	0.0005	-8.69	0	-0.0049	-0.0031
GARAGE	0.0183	0.0033	5.62	0	0.0119	0.0247
POOL	0.0014	0.0001	11.32	0	0.0011	0.0016
FLOOD	0.0042	0.0305	0.14	0.889	-0.0555	0.0640
S_RIVER	-0.0265	0.0116	-2.29	0.022	-0.0492	-0.0038
GOLFBUFF	-0.0257	0.0184	-1.4	0.163	-0.0617	0.0104
ADJTGOLF	0.2829	0.1213	2.33	0.02	0.0452	0.5206
WASHBUFF	0.0184	0.0051	3.61	0	0.0084	0.0284
ADJTWASH	0.0502	0.0095	5.3	0	0.0316	0.0688
PARKBUFF	-0.0014	0.0083	-0.16	0.87	-0.0176	0.0149
ADJTPARK	-0.0793	0.0153	-5.19	0	-0.1092	-0.0494
MEDINC99	0.0000	0.0000	8.9	0	0.0000	0.0000
PCT>65	0.0020	0.0003	6.28	0	0.0014	0.0026
POP_DENS	-0.0332	0.0051	-6.46	0	-0.0433	-0.0232
D99	0.0714	0.0079	9.09	0	0.0560	0.0868
D00	0.1198	0.0078	15.36	0	0.1045	0.1351
D01	0.1813	0.0076	23.88	0	0.1664	0.1962
D02	0.2433	0.0078	31.34	0	0.2281	0.2586
D03	0.3175	0.0082	38.54	0	0.3013	0.3336
Instrumented:	LOTSAVI WASHSAVI LOTWASH					
Instruments:	LOT, LIVING, AGE, BATH, GARAGE, POOL, CFSD, TVSD, FLOOD GOLFBUFF, ADJTGOLF, WASHBUFF, ADJTWASH, PARKBUFF, ADJTPARK, ELEV, POP_DENS, D99, D00, D01, D02, D03, NORTH, EAST, WEST, SHALLOW, STEEP, STEEPEST, SOIL18, SOIL34, SOIL49, SOIL51, SOIL52, CFS_NO, X-CRD, Y-CRD					

N=9,434
F (26, 9,407)=1,326.89
R^2=0.8316

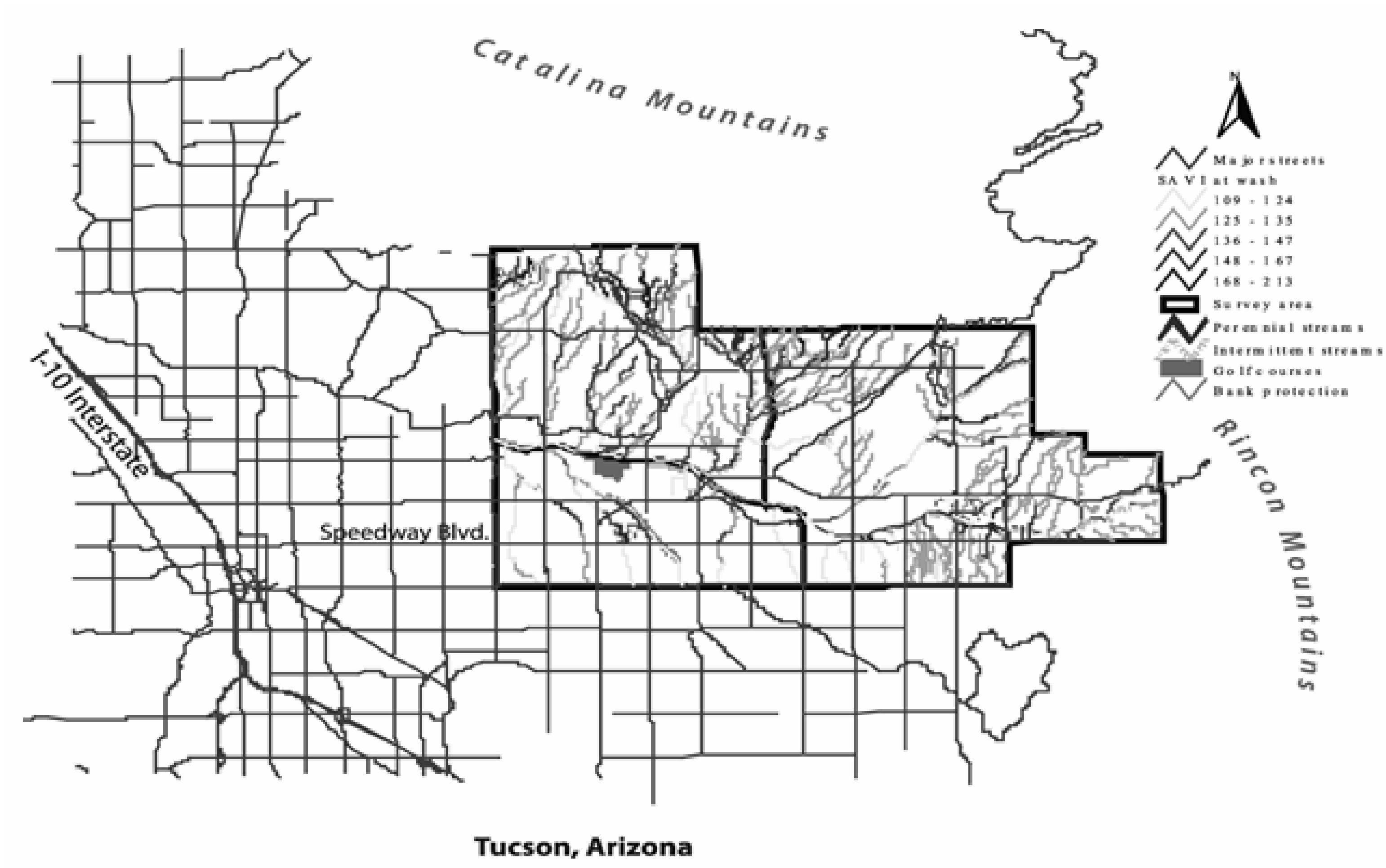

Figure 1: Study area with riparian corridor SAVI values

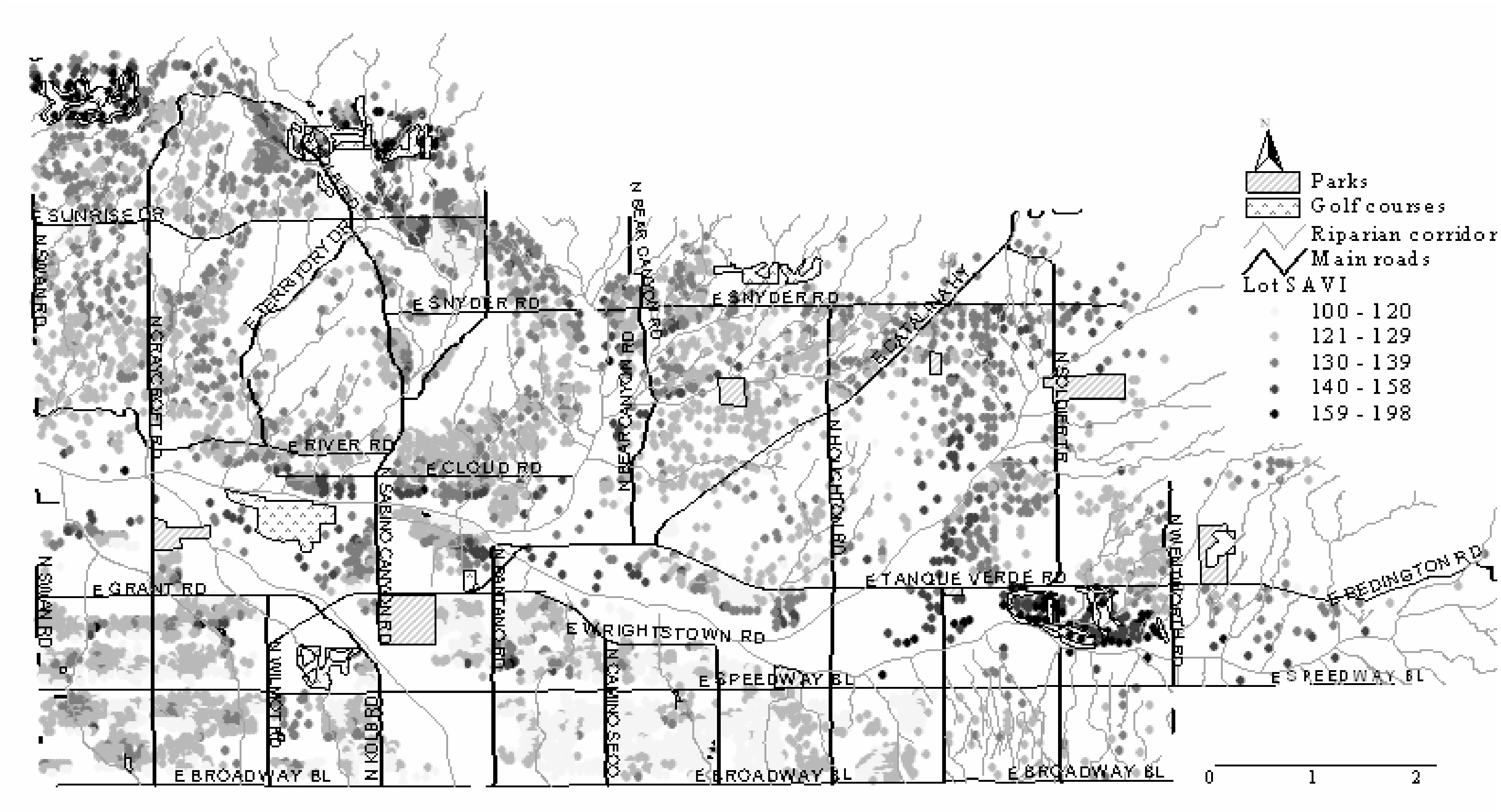

Figure 2: Study area with LOTSAVI values: darker colors represent a greener lot