Contribution of Land Conservation and Freshwater Resources to Residential Property Values in the Matanuska-Susitna Borough

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February 2013

The authors would like to thank Marcus Geist and James DePasquale for GIS analytical and technical support. The Nature Conservancy of Alaska, the Bullitt Foundation, and the U.S. Fish and Wildlife Service provided financial support for the project.

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Growing interest in quantifying values of ecosystem services has generated numerous studies attempting to measure the contribution of neighborhood environmental amenities to urban and suburban property values. Proximity to freshwater resources -- lakes and streams -- has also figured prominently in many of these studies.

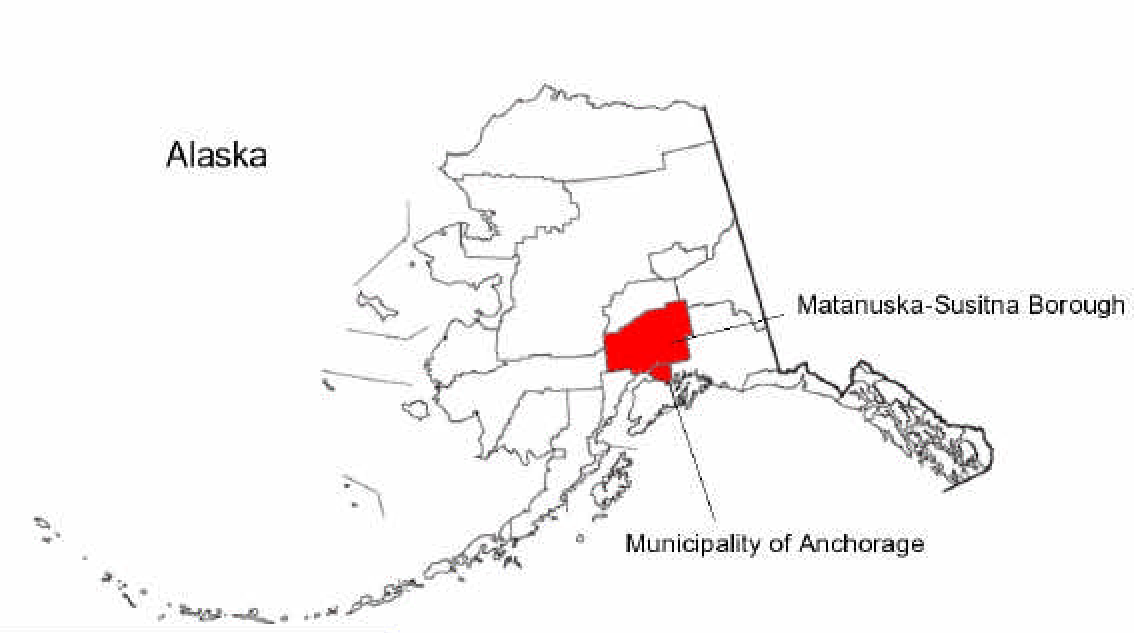
Alaska's Matanuska-Susitna (Mat-Su) Borough, analogous to a county under state law, is a large and rapidly urbanizing local government jurisdiction adjacent to Anchorage, the state's largest metropolitan area. As the population of the borough grows, and more land becomes subdivided and developed, an important question arises regarding the contribution of remaining undeveloped land and natural amenities to the economy of the borough. Visitors who are attracted to the scenery and recreation opportunities of the borough capture some of that value, and contribute to the borough economy through local purchases of goods and services. Private owners of borough real estate, who are willing to pay more for property located close to natural areas and recreation sites, also appropriate a portion of the value, however. This study focuses on this latter component of value of ecosystem services. It provides estimates of the enhanced value of private residential property and undeveloped land in the Mat-Su borough created by local protected open space and outdoor recreation opportunities.

After briefly describing the Mat-Su Borough region, we summarize the valuation methods and the data available for the study. Then we present statistical results, followed by a discussion of the implications of the findings for valuing ecosystem services in the Borough. We conclude with suggestions for future research to improve the estimates.

Mat-Su Borough study area

The Mat-Su Borough, along with the Municipality of Anchorage, forms the Anchorage Metropolitan Statistical Area (Figure 1). It encompasses 24,608 square miles ranging from Anchorage and Cook Inlet on the south to a northern border in remote wilderness in Denali National Park and Preserve. The borough hosts a diverse subarctic landscape of forest, wetlands and tundra, and features large, glacier-fed rivers, numerous lakes of varying sizes, and an active recreational salmon fishery focused mainly around smaller streams.

Figure 1. Matanuska-Susitna Borough and Anchorage Metropolitan Statistical Area



The borough population stood at 88,925 in the 2010 U.S. Census, growing at over 3 percent per year. Population density overall remains low (3.6 persons per square mile), but settlement is concentrated in the southern portion near major highways connecting the borough to Anchorage. The borough contains three incorporated cities -- Wasilla (8,100), Palmer (6,100), and Houston (2,000) -- with the remaining population scattered in small settlements and along the highways. Like other suburban and exurban areas, a large proportion of the 43,000 housing units are owner-occupied (79 percent). The borough income is near the state average. Median household income for 30,609 households over the period 2007-2011 was $70,343, and median value of owner-occupied housing units was $216,500, according to U.S. Census figures (http://quickfacts.census.gov/qfd/states/02/02170.html).

The region was occupied by Dena'ina (Tanaina) Athabascan residents when Russian traders arrived in the early 19th Century. By 1835, a Russian Orthodox mission had been built in Knik, near the head of Cook Inlet, which became the site of a frontier trading post. Construction of Alaska Railroad through the Borough to Fairbanks in 1914 provided access for homesteaders, but settlement was sparse until the Matanuska Colony was established as a New Deal agricultural resettlement program in 1936. Rapid growth began after construction of the Parks Highway in 1972, and following expansion of the Anchorage economy and population associated with the North Slope oil boom.

In addition to Denali National Park, protected lands include 15 state parks ranging in size from small campgrounds of a few acres to 325,000 acre Denali State Park, and three large state wildlife refuges covering coastal wetlands. Numerous lakes and streams nurture resident and anadromous fish, including all five species of Pacific salmon. Accessible sport fishing opportunities attract residents and visitors alike. In 2011, the Alaska Department of Fish and Game estimated that 60,000 anglers spent 171,000 angler days fishing in the Knik Arm and Susitna River drainages of the Mat-Su Borough (http://www.adfg.alaska.gov/sf/sportfishingsurvey/).

The high diversity and heterogeneity of the Matanuska-Susitna Borough land and associated real estate markets makes valuation challenging. We next outline the methods we used to estimate values, followed by a description of the data available for applying the methods to the Mat-Su borough case.

Methods

As the saying goes in real estate, “Location is everything.” The *hedonic price* method (Rosen 1974) is a long-established theory in economics that explains how neighborhood characteristics and other features of a property determine its price in competitive real estate markets. "Hedonic prices are defined as implicit prices of attributes and are revealed to economic agents from observed prices of differentiated products and the specific amounts of characteristics associated with them." (Rosen, S. 1974: 34)

Freeman (2003) outlines the basic tenets of the hedonic price theory. Households are assumed to have a utility function that depends on built housing characteristic, location-specific amenities, other neighborhood characteristics, and non-housing consumption goods. Buyers have a budget constraint limiting their overall purchases of housing and other goods. Given the existing set of properties, each homebuyer chooses the welfare-maximizing property based on his or her preferences. In equilibrium, individuals have optimized residential choice based on prices, which are assumed to clear the market. In the resulting market equilibrium, a hedonic price function characterizes the relationship of the market price of each property to its attributes.

Applying the theory, we define the market equilibrium price P of a parcel of land h as a function of its improvements, S_h, location-related characteristics N_h, and environmental amenities A_h,

$$P_h = f(S_h, N_h, A_h). \qquad (1)$$

Differentiation of this hedonic price function with respect to each attribute yields the marginal implicit price of that attribute, which in market equilibrium equals the homebuyer's marginal willingness to pay for that attribute.

Empirical applications of the hedonic price method to valuation of environmental amenities involve statistical analysis to estimate the extent to which variations in property sales prices are associated with proximity to natural features, other location-specific features, and characteristics of structures. The same principles of hedonic pricing apply to vacant land as to existing homes, minus the contribution to value of the characteristics of structures.

Irwin and Bockstael (2001) identified two potential problems with specification and estimation of values of environmental amenities in hedonic price methods. One issue is that the amount of developable open space near a particular property may depend on the value of the parcel. In rapidly developing areas, such as portions of the Mat-Su Borough, land and homes in areas with the most open space are more likely to be located in areas least attractive to buyers, confounding cause and effect. This issue is of lesser concern if we attempt to measure only values from permanently protected areas. However, a more subtle problem occurs if unobserved variables that affect property value correlate with the presence of environmental amenities, including protected open space. Bates and Santerre (2001), for example, found that private land values affect the amount of public open space in Connecticut communities. Omitting the unobserved spatial variables from the equation could therefore bias estimates of the value of amenities derived from ordinary least squares regression.

Use of instrumental variables offers one approach to remove the bias potentially caused by unobserved spatial variables influencing the local availability of open space (Irwin and Bockstael, 2001; Irwin, 2002; Geoghegan et al., 2003). If the data set is relatively large, a simpler method is to use local fixed effects to control for potential omitted spatial variables (Anderson and West 2006). We followed this latter approach, as described below.

Data

The Mat-Su Borough Assessor's office provided data for all properties within the borough. Of the 75,431 total parcels, we selected the 5,931 parcels (8 percent) that transferred ownership in 2009 or 2010 (2,801 in 2009 and 3,130 in 2010). The borough relies on voluntary reporting of sales price information from the seller, and 3,250 (55 percent) of the parcels sold in these years contained the sales price information. The average appraised value of the properties with sales price information was slightly higher than that of the properties sold without the data ($145,000, vs. $133,000), but the two groups appeared otherwise similar with respect to location and size.

From the list of parcels sold, we excluded parcels with commercial or industrial land uses, and those with more than one residential structure (not counting accessory units such as garages or outbuildings) on the parcel. We excluded 14 properties whose selling price was less than one-fourth of the appraised land value, due to doubts that the selling price reflected competitive arms-length transactions. We also excluded parcels under construction in the sale year, since it was not possible to determine how much of the property improvement had been priced into the transaction. Finally, we excluded remote parcels located more than 20 miles from the nearest road. The remaining data set consisted of 2,656 parcels of vacant land and residential properties, including 252 parcels that were not road-accessible but within 20 miles of a road for which access from the road system by boat, snow-machine or all-terrain vehicle was considered feasible.

Using Google Maps, we calculated drive times to Anchorage, the main urban center, as well as to the nearest shopping center (Wasilla or Palmer), and to the designated high school. We considered drive time to be a better indicator of remoteness than pure distance, as it takes into account slower speeds for secondary roads. We also calculated distances to the nearest road and air miles to Anchorage for non-road-accessible properties. We obtained information on land and water features derived from public sources (Marcus Geist, The Nature Conservancy, personal communication, April 9, 2012), including calculated shortest linear distances to lakes, streams, open space, and calculated percentages of buffers in different land cover and land use categories for 1/4 mile, 1 mile, and 5-mile radii.

Table 1 summarizes the property attributes available for the study in the three categories specified in the hedonic price equation (1). Characteristics of the the parcel itself consist of those recorded by the Mat-Su Borough Assessor's office on the property appraisal database, supplemented by limited data on property improvements from land use permits filed with the borough planning department. With limited staff and a rapidly changing housing stock, information available for the assessor's office to establish an appraised value for the property is limited to characteristics visible from the exterior of the structure. Because of limited information on structural characteristics, we also include the borough's appraised value of property improvements.

Information on neighborhood attributes available from the Mat-Su Borough Planning Department includes subdivision characteristics and several different but heavily overlapping and partially nested choices for local fixed effects to address potential bias potentially arising from unobserved spatial effects. Choices for neighborhood fixed effects represent contiguous relatively social, economic, or political connections: property fire service area, school catchment area, neighborhood community council, and election precinct. We chose election precinct as the most spatially detailed (34 precincts) option available

Historical development patterns in Mat-Su Borough have resulted in a spatially patchy configuration that avoids wetlands and poorly drained sites with peat soils, and favors uplands with well-drained soils. Consequently, development patterns generally correlate with land cover types. More generally, many spatial environmental variables are highly correlated with neighborhood characteristics and with each other, making it difficult if not impossible to distinguish one from the other in statistical tests.

Given what amounted to competing alternatives for specifying ecosystem services, we decided to focus on proximity to important natural features -- lakes and streams -- and proximity to parks and other protected open space. Among potential ways to measure proximity to protected open space listed in the first two rows of Table 1, we tested all possible measures alone and in combination, and kept only those measures in each category that consistently had some statistically significant correlation with the sales price. Table 2 displays means and standard deviations for the final set of variables for the statistical analysis, along with the data source.

Even with the allowance for separate intercept terms for each of the 34 election precincts, we note the possibility of spatially correlated errors if we have omitted unobserved influences operating at finer spatial scales. We therefore tested for spatial autocorrelation assuming the spatial error model appropriate for such unobserved spatial explanatory variables. The Mat-Su Borough property appraisal database contains the latitude and longitude for the property centroid at a scale of 0.01 degree. At the latitude of the Mat-Su Borough (61.5 degrees North) 0.01 degree of longitude represents a spatial scale in the borough's predominantly east-west development pattern of about 600 meters. Slightly more than one-half (53 percent) of the parcels that sold in 2009 or 2010 contain at least one neighbor with the identical coordinates at this scale. Consequently, we applied a spatial error model assuming that parcels are neighbors if they have the same latitude and longitude to two decimal places, testing for spatial correlation of errors and correcting for spatial autocorrelation if necessary.

Hedonic price theory does not indicate a specific functional form for the relationship of attributes to market prices. Published studies include linear, log-linear, and semi-log functional forms, as well as Box-Cox transformations of the dependent and independent variables of equation (1). We tested a number of different specifications, and found that a log-linear relationship generally provided the best fit to the data. The logarithmic firm makes sense given the two orders of magnitude variation of observed sales prices, which ranged from less than \$10,000 to several million dollars. The natural logarithm of sales price was not adjusted for inflation, since the study will be focused on only two years during which local real estate markets were quite stable. Differences in the market between the two years were captured with a binary variable for year of sale.

We therefore estimated a hedonic price equation of the following form:

$$\ln P_{hi} = a \ln S_{hi} + bY_{hi} + gN_{hi} + dA_{hi} + l_L \ln d_{Lhi} + l_S \ln d_{Shi} + u_i + re_{ji} + e_{hi}, \qquad (2)$$

where: P_{hi} is the sales price of home h in local area (election precinct) i; S_{hi} is a vector of continuous home structural characteristics; D_{hi} is a vector of dichotomous property characteristics and other dummy variables; N_{hi} is the set of characteristics of the neighborhood; A_{hi} is the set of environmental amenities; d_{ahi} is the distance to the nearest waterway of type a (L = lakes, S = salmon streams); a, b, g, and l are parameter vectors to be estimated; u_i is the election precinct fixed effect; e_{ji} represents the average of random errors for neighbor properties with the same latitude and longitude as property h ($j \neq h$); r is the spatial error correlation coefficient to be estimated; and e_{hi} is a random error term. In equation (2), the elasticity of sales price with respect to distance to waterway type a is given by l_a. A negative l_a means that sales price falls as distance increases, so proximity to the amenity has a positive effect on home value.

Results

Table 3 shows the results of estimating equation (2) for the data described in Table 2.
The columns on the left-hand side show the regression results for the fixed effects model without correcting for potential spatial correlation of the errors. The Moran's I test on the residuals, shown at

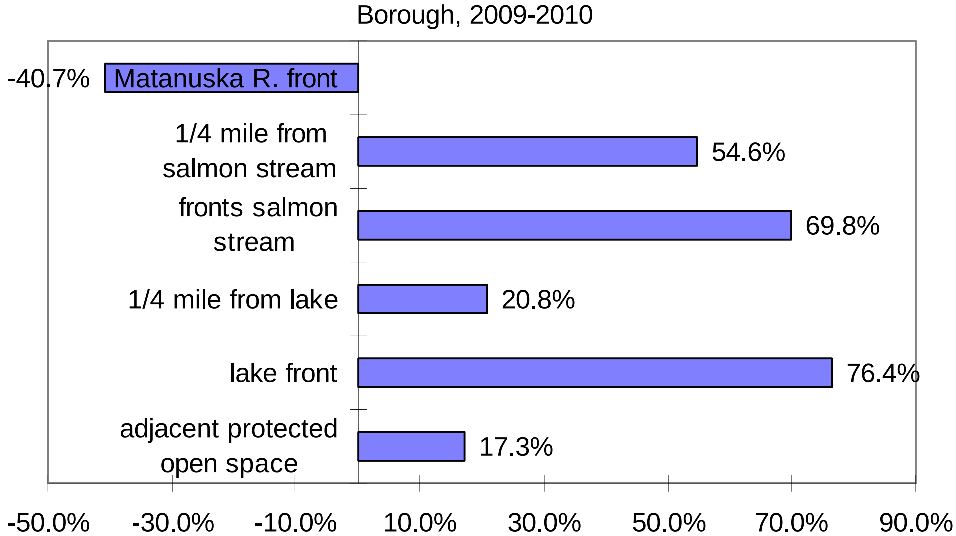
the bottom of the table, clearly rejects the null hypothesis of no spatial autocorrelation ($p<0.001$). The columns on the right side of Table 2 show the same equation estimated for the spatial error model or equation (2). The correlation of errors among neighboring properties is 0.22 and highly significant ($p<0.001$). The adjustment for spatially correlated errors seems to have relatively little effect on the other equation coefficients or the statistical significance of the results.

As expected structural characteristics such as parcel land area, structure size, and structure appraised value all had positive and significant effects on the sales price, with elasticities ranging from 0.10 to 0.17. Distance to Anchorage had an elasticity of -0.3, suggesting that the property value decreased by three percent for each 10 percent greater distance to the urban center. Parcels located off the road system had an even greater reduction in value. One should note that the coefficients for these access indicators and other neighborhood characteristics express the effects on sales prices within the election precincts; fixed effects (not shown in the table) pick up variation at larger spatial scales.

Environmental amenities also showed statistically significant associations with property sales prices, after controlling for structural attributes and neighborhood characteristics.
The significant coefficient of 0.16 on protected open space frontage represents a 17 percent increment to the price (Figure 2). Parcels located near Denali National Park also had much higher sales prices. Actual distance to salmon streams showed a better fit to the data than the logarithm of distance. The coefficient suggests about a five percent loss of value per km distance from the nearest stream. The relatively low, but statistically significant coefficient appears to reflect an enhanced value for a general proximity to areas where salmon fishing may occur, perhaps reflecting the reduced travel cost of seasonal access to the fishery. The effect of proximity to lakes, on the other hand, is large for properties close to the lakeshore, but drops off more rapidly with distance, as the example calculations in Figure 2 illustrate.

We note that despite the enhanced value from living near salmon streams, property frontage on the Matanuska River has a strong negative effect on property values (a 41 percent loss, shown in Figure 2). This large, swift-moving glacial stream has been eroding its banks along portions of its course, swallowing several structures of riverfront properties in recent years.

Figure 2. Estimated Percentage Change in Sales Value from Proximity to Natural Amenities, Properties Sold in the Mat-Su Borough, 2009-2010



Discussion

The equation results shown in Table 3 and summarized in Figure 2 may be applied to make estimates of the overall effects of proximity to natural amenities and protected open space on property values in the Mat-Su Borough. Figure 3 shows estimates of the average contribution of amenities to property values of parcels sold in 2009 and 2010, based on the hedonic price equation results. These numbers were estimated using the mean values for structural and neighborhood characteristics, ignoring the relatively few properties located near Denali National Park mentioned above. The estimates shown in Figure 3 also exclude properties with frontage on the Matanuska River potentially subject to river erosion. On average, local salmon streams contributed about $25,000 to the market value of the typical property sold in 2009 and 2010, while lakes contributed about $12,000. Protected open space generated an additional $458 per parcel on average. We estimated that frontage on protected open space increased property values by 17 percent. However, relatively few parcels were adjacent to protected open space, while many more properties were located near lakes and salmon streams. The estimated contribution of all these amenities combined was about $33,000. The total is somewhat less than the sum of the components due to nonlinear effects of multiple attributes on price.

Figure 3 also shows the average sales prices and average appraised value, as of January 2011, for the parcels sold in 2009 and 2010. With an average sales price of $75,000, the $33,000 value for natural amenities represents 44 percent of the market value. While this may seem like an implausibly high percentage of the value, it goes without saying that the entire character of the Mat-Su Borough would be fundamentally different if lakes and salmon streams were absent. These recreational water resources make a big contribution to the local economy through visitor expenditures, so it should not be surprising that they also figure prominently in residential property values. The average appraised value of parcels that sold in 2009 and 2010 was about 88 percent of the reported sales price. If one applied the same percentage of appraised value to sales value (88 percent) to ecosystem services, the contribution of natural amenities to appraised value would average about $29,000 per parcel.

Figure 3. Contribution of Natural Amenities to Average Value per Parcel Sold in the Mat-Su Borough, 2009-2010

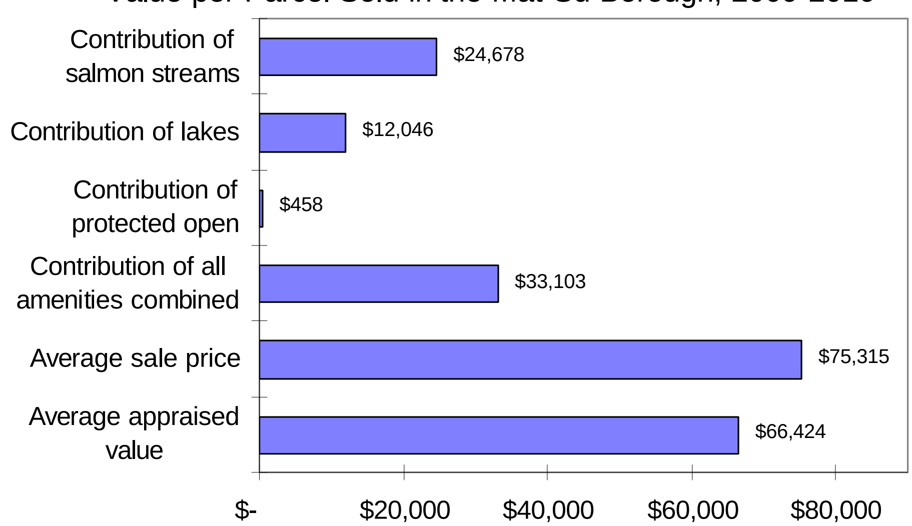
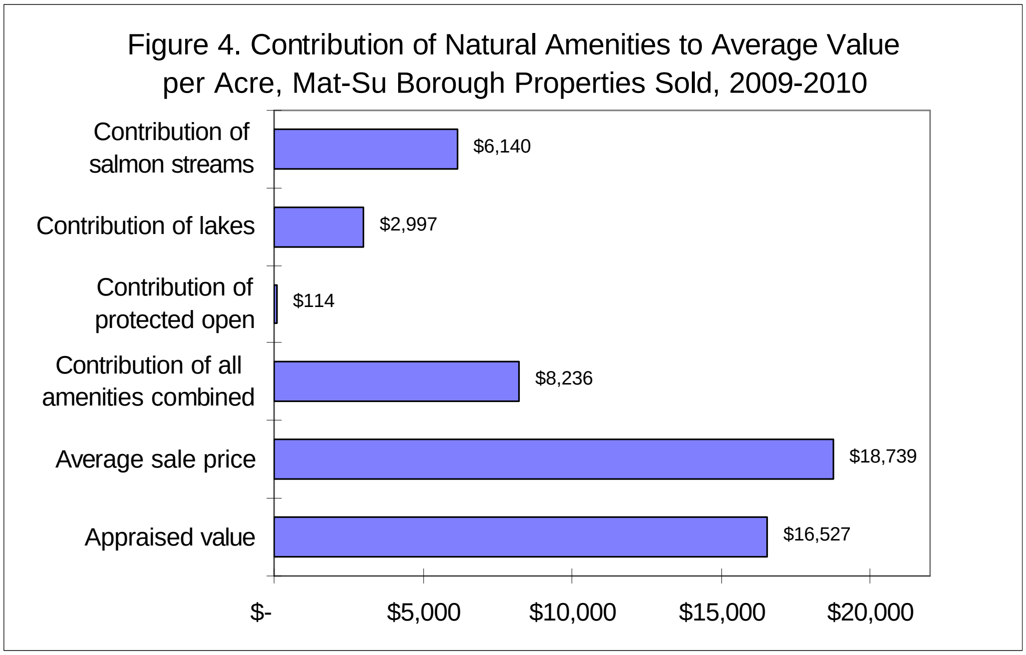


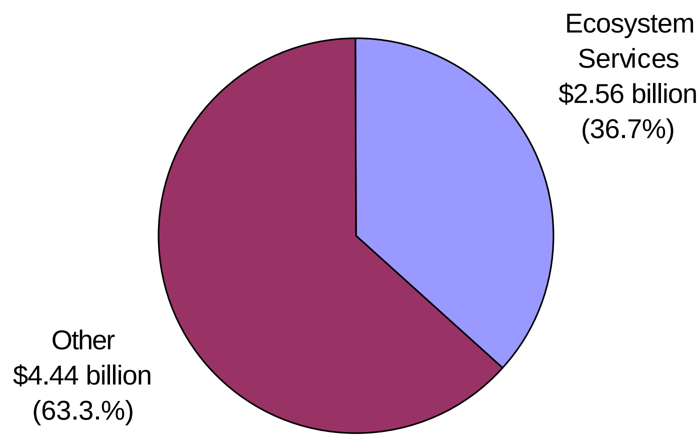
Figure 4 reframes the average values shown in Figure 3 in terms of dollars per acre. The contribution of lakes, streams, and open space comes to about $8,000 per acre to parcels sold in 2009 and 2010. It should be emphasized that these are average values for the portfolio of properties that were sold in

2009 and 2010. These parcels may not represent fairly represent private property in the Borough overall. They were estimated using sales of vacant and residential property, so they exclude commercial real estate and other site-specific values capitalized in businesses such as lodges and fishing guides.



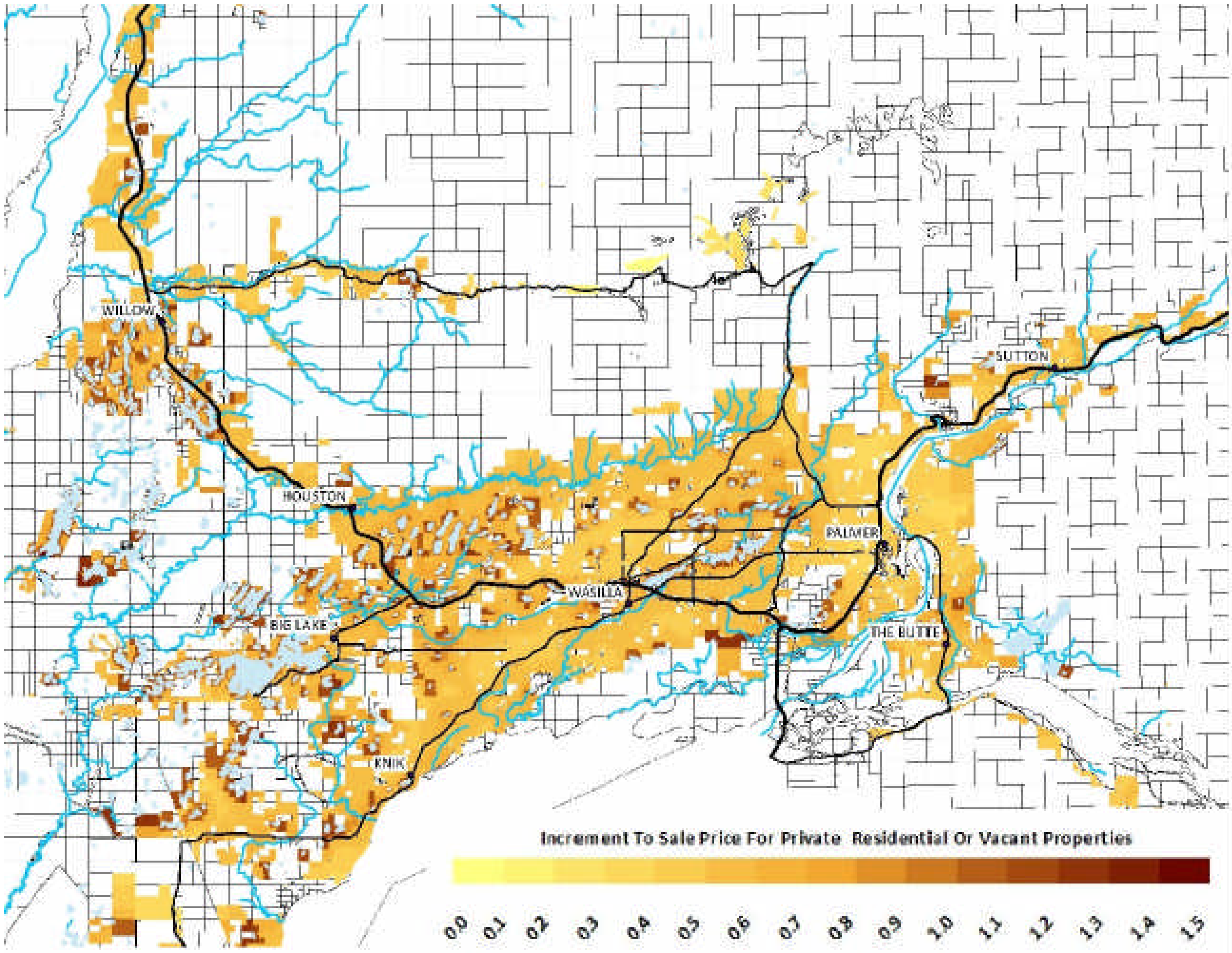
The Alaska State Assessor's Office determined that the Mat-Su Borough appraised values were on average equal to 98 percent of the full value in 2011 **(**Alaska Division of Community and Regional Affairs. 2012). This suggests that appraised values are only slightly less than actual property values on average, despite the fact that the parcels that sold in 2009 and 2010 had appraised values averaging only 88 percent of their sales prices. The January 2011 appraised value of all private residential properties and vacant land in the Mat-Su Borough was just over $7 billion, or about $100,000 per parcel. Applying the hedonic price equation results to the full set of private residential property and vacant land in the borough generates a somewhat lower percentage of value contributed by ecosystem services than the 44 percent of value for the parcels that changed hands in 2009 and 2010. This implies that parcels with relatively higher ecosystem service values were more actively traded in real estate markets than the average parcel, as well as being more valuable. Based on Borough appraised values, the hedonic price equation estimates that lakes, streams, and open space contributed 36.7 percent of the 2011 appraised value of residential property and vacant private land ($2.56 billion out of $7.00 billion) in the Mat-Su Borough (Figure 5).

Figure 5. Estimated Contribution of Ecosystem Services to Mat-Su Borough Private Vacant Land and Residential Appraised Value
(2011 Appraised Value = $7.00 billion)



As one might expect, the increment to value due to ecosystem services is unevenly distributed across the borough. Figure 6 displaces a map showing the spatial distribution of the value increment derived from ecosystem services. A value of 0.2 on the scale indicates 20 percent greater value than projected to occur in the absence of lakes, streams, and protected open space. Nearly all private residential and vacant properties show at least some shading, representing a positive contribution, but the increment is highly spatially variable. The heavily shaded areas in Figure 6 typically show lake front properties. Lighter shades appear for properties near salmon streams (shown in blue lines) and fronting open space. Properties more distant from lakes and streams have pale shading representing only a small percentage increment to value.

Figure 6. Map Showing Location of Private Residential and Vacant Properties in the Mat-Su Borough and Value increment from Ecosystem Services.



Conclusion

The study provided estimates of the increment to the value of private residential property and undeveloped land in the Mat-Su borough has been created by protected open space and water resources. The private property values that we can measure consist of the portion of the total value generated by these resources that private owners can capture due to the location of their property. By far the largest component of these amenity values appears associated with proximity to lakes and salmon streams. Open space in various categories may also play an important role. Indeed, we found strong association for a few measures, but the overall effect is much smaller than that estimated for water resources. This does not mean that such values do not exist for open space in the Mat-Su Borough, but only that the measurement techniques are too imprecise to estimate these values with the available data.

To obtain more precise estimates, future studies would need to analyze more years of sales data, and possibly focus on a smaller area of the Borough. Using more years of sales data would introduce its own challenges, given how the region's rapid development has changed the character of Mat-Su property and real estate markets over time.

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Table 1. Characteristics of Properties, by Type of Attribute

Structure (S_h)	Neighborhood (N_h)	Natural amenities (A_h)
Residential structure type	Road access	Distance to public open space, various categories
Structure area	Distance to Anchorage	Percentage of surrounding area in public open space of various categories within 1/4 mile, 1 mile, and 5 mile buffers
Structure age	Drive time to Anchorage, high school, shopping	Percentage of surrounding area in various land cover types within 1/4 mile, 1 mile, and 5 mile buffers
Structure quality category	Restrictive covenant	Distance to nearest lake
Structure appraised value	Subdivision size (parcels)	Distance to nearest salmon stream
Total parcel land area	Subdivision development status	
Condominium (some land in shared ownership)	Fire Service Area	
	School catchment area	
	Neighborhood council area	
	Election precinct	

Table 2. Sources and Summary Statistics for Final Set of Variables

Variable name	Source	Mean	Std. Dev.
Natural logarithm of property sales price	Mat-Su Borough	11.228	1.368
Sold in 2009 (binary)	Mat-Su Borough	0.524	0.500
Protected open space[a] frontage (binary)	TNC[d]	0.025	0.156
Percent park/wilderness[b] within 5 mile buffer	TNC[d]	0.0002	0.005
Percent park/wilderness[b] within 1 mile buffer	TNC[d]	0.00001	0.00030
Structure on parcel (binary)	Mat-Su Borough	0.625	0.4842
Natural logarithm of structure square feet	Mat-Su Borough	4.748	3.71440
Single-family home (binary)	Mat-Su Borough	0.625	0.484
Home with accessory unit (binary)	Mat-Su Borough	0.002	0.048
Mobile home (binary)	Mat-Su Borough	0.012	0.108
Duplex (binary)	Mat-Su Borough	0.011	0.102
Multifamily (binary)	Mat-Su Borough	0.005	0.070
Natural logarithm of structure appraised value	Mat-Su Borough	7.739	5.573
Building age	Mat-Su Borough	9.250	12.365
New building (binary)	Mat-Su Borough	0.045	0.206
Natural logarithm of parcel acres	Mat-Su Borough	0.346	1.369
Natural logarithm of drive time to Anchorage	Authors' estimate	3.955	0.994
Miles to nearest road	Authors' estimate	0.914	3.478
Remote parcel, air access only (binary)	Authors' estimate	0.053	0.225
Natural logarithm of flight miles to Anchorage	Authors' estimate	0.221	0.935
Lake front[e] property (binary)	TNC[d]	0.065	0.246
Natural logarithm of meters to nearest lake	TNC[d]	6.366	2.007
Frontage on salmon stream[c] (binary)	TNC[d]	0.030	0.170
Kilometers to nearest salmon stream[c]	TNC[d]	1.274	1.238
Matanuska River frontage (binary)	TNC[d]	0.002	0.039
Home described as "cabin" (binary)	Mat-Su Borough	0.083	0.276
Condominium (binary)	Mat-Su Borough	0.023	0.151
Alaska State Land Sale parcel (binary)	Mat-Su Borough	0.172	0.378
Special Planning Use District (binary)	Mat-Su Borough	0.071	0.256
Restrictive covenant (binary)	Mat-Su Borough	0.612	0.487
Percent of subdivision parcels with structures	Mat-Su Borough	0.620	0.336
Total parcels in the subdivision	Mat-Su Borough	92.69	200.77

[a]Property boundary less than 10 meters from an area with Conservation Management Status 3 or less (Smith et al. 2007)
[b]Area in Conservation Management Status 1 (Smith et al. 2007).
[c]Property boundary less than 10 meters from a stream listed in the Alaska Anadromous Waters Catalog (Alaska Department of Fish & Game, no date).
[d]Provided by Marcus Geist, The Nature Conservancy, April 9, 2012.
[e]Property boundary less than 10 meters from a lake greater than 10 acres in size.

Table 3. Hedonic Price Regression Results
Dependent variable: natural logarithm of property sales price
(Fixed effects for 34 election precincts not shown, z scores adjusted for variance clustering on election precinct)

	Fixed effects model			Fixed Effects with Spatial Error Correction		
Variable name	coefficient	z		coefficient	z	
Sold in 2009	-0.040	-1.60		-0.034	-1.39	
Protected open space frontage	0.152	3.38	**	0.159	3.72	**
Percent park within 5 miles	7.593	5.22	**	7.495	5.99	**
Percent park within 1 mile	73.053	5.59	**	72.605	6.13	**
Structure on parcel	-1.564	-4.70	**	-1.489	-4.68	**
Log structure square feet	0.188	3.31	**	0.169	3.11	**
Single-family home	-0.085	-0.35		-0.133	-0.60	
Home with accessory unit	1.269	0.61		0.841	0.42	
Mobile home	0.208	1.13		0.212	1.26	
Duplex	-1.095	-0.60		-1.173	-0.63	
Multifamily	1.148	4.50	**	1.196	4.77	**
Log sq. feet * home w acc. unit	0.118	2.31	**	0.131	2.97	**
Log sq. feet * mobile home	-0.146	-0.54		-0.084	-0.33	
Log sq. feet * multifamily	0.244	1.08		0.263	1.15	
Log sq. feet * water/sewer	-0.031	-0.94		-0.029	-0.96	
Log structure appraised value	0.099	5.04	**	0.098	5.07	**
Building age	-0.010	-6.27	**	-0.010	-6.21	**
New building	0.011	0.26		0.023	0.58	
Log parcel acres	0.181	7.02	**	0.177	6.74	**
Log drive time to anchorage	-0.321	-2.75	**	-0.303	-2.94	**
Miles to nearest road	-0.039	-5.05	**	-0.039	-5.71	**
Remote parcel, air access only	-2.216	-3.46	**	-1.939	-3.47	**
Log flight miles to anchorage	0.040	0.82		-0.009	-0.20	
Lake front property	0.141	1.76	*	0.141	1.84	*
Log meters to nearest lake	-0.065	-3.14	**	-0.064	-3.53	**
Frontage on salmon stream	0.067	0.85		0.076	0.95	
Km to nearest salmon stream	-0.042	-2.49	**	-0.045	-3.03	**
Matanuska River frontage	-0.947	-6.35	**	-1.052	-7.07	**
Home described as “cabin”	-0.144	-3.05	**	-0.152	-2.97	**
Condominium	0.824	2.73	**	0.828	3.13	**
Alaska State Land Sale	-0.534	-4.54	**	-0.549	-5.26	**
Special Planning Use District	-0.138	-1.63		-0.125	-1.70	*
Restrictive covenant	-0.111	-1.56		-0.102	-1.65	
% subdivision w structures	0.258	3.95	**	0.249	4.07	**
Total parcels subdivision	-0.001	-7.20	**	-0.001	-7.99	**
Parcels * % w structures	0.002	8.52	**	0.002	9.67	**
Intercept	11.974	24.54	**	11.906	28.07	**
Spatial error correlation				0.217	6.24	**
R Squared		0.819			0.826	
Observations		2,649			2,649	
Moran I test	actual-exp	0.2985		actual	0.0245	
	z	7.91	**	z	0.65	

* probability < 0.10
** probability < 0.05